

**D-13 Thematic Poster - Cardiac**

Thursday, June 2, 2016, 1:00 PM - 3:00 PM  
Room: 103

1765 **Chair:** Summer B. Cook, FACSM. *University of New Hampshire, Durham, NH.*  
(No relationships reported)

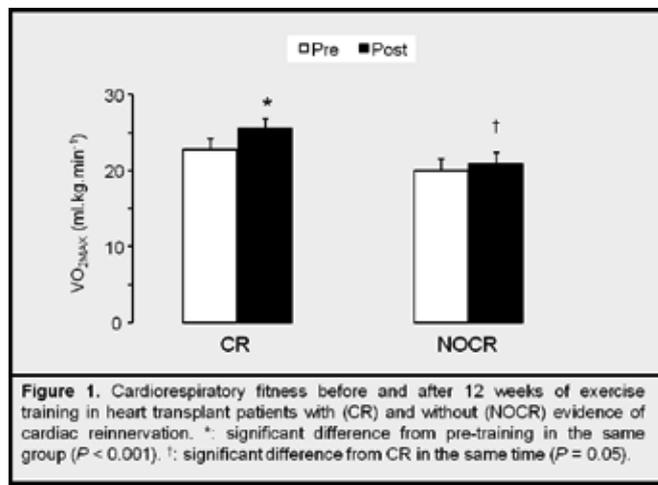
1766 Board #1 June 2, 1:00 PM - 3:00 PM  
**Cardiac Denervation Affects Exercise Training-Induced Improvements in Cardiorespiratory Fitness of Heart Transplant Patients**

Emmanuel G. Ciolac<sup>1</sup>, Rafael E. Castro<sup>1</sup>, José M. Rodrigues da Silva<sup>1</sup>, Edimar A. Bocchi<sup>2</sup>, Guilherme V. Guimarães<sup>2</sup>. <sup>1</sup>São Paulo State University - UNESP, Bauru, Brazil. <sup>2</sup>University of São Paulo, School of Medicine, Heart Institute, São Paulo, Brazil.  
Email: ciolac@fc.unesp.br  
(No relationships reported)

**PURPOSE:** Heart transplantation-induced cardiac denervation results in impaired heart rate control during exercise, and has been associated with a reduced cardiorespiratory fitness even years after surgery. Although there is some degree of cardiac reinnervation over time, it does not occur in all patients. Thus, our purpose was to analyze the effects of exercise training on the cardiorespiratory fitness of heart transplant patients with (CR) and without (NOCR) evidence of cardiac reinnervation. **METHODS:** 33 sedentary heart transplant patients (age = 45.5 ± 2.2 years; time since surgery = 6.7 ± 0.7 years), divided into CR (N = 16) and NOCR (N = 17) group, were submitted to a thrice-weekly aerobic (30 min) and resistance training program (5 exercises) for 12 weeks. Symptom limited cardiopulmonary exercise testing (CPX) was performed before and after exercise intervention to assess cardiorespiratory fitness and hemodynamic response to exercise.

**RESULTS:** Heart rate response to exercise (resting, submaximal, maximal and recovery heart during CPX) did not change in both groups after intervention. CR patients improved cardiorespiratory fitness (VO<sub>2</sub>MAX) and exercise tolerance improved (P < 0.001) 10.8 ± 1.8 % (VO<sub>2</sub> increase = 2.8 ± 0.5 ml/kg/min) and (13.4 ± 4.4%, Figure 1) after training, respectively. Although there was an increase in exercise tolerance (9.9 ± 3.5%; P = 0.02), cardiorespiratory fitness did not improve in NOCR patients after training (Figure 1).

**CONCLUSIONS:** Cardiorespiratory fitness improved in CR, but not in NOCR, after 12 weeks of exercise training. This result suggests that cardiac denervation affects exercise training-induced improvements in cardiorespiratory fitness of heart transplant patients.



1767 Board #2 June 2, 1:00 PM - 3:00 PM

**Cardiac Systolic And Diastolic Function During Incremental Exercise In Highly-trained Youth Soccer Players**

Vish Unnithan, FACSM<sup>1</sup>, Thomas Rowland<sup>2</sup>, Keith George, FACSM<sup>3</sup>, David Oxborough<sup>3</sup>. <sup>1</sup>Staffordshire University, Stoke-on-Trent, United Kingdom. <sup>2</sup>Baystate Medical Centre, Springfield, MA. <sup>3</sup>Liverpool John Moores University, Liverpool, United Kingdom.  
Email: v.unnithan@staffs.ac.uk  
(No relationships reported)

Superior peak VO<sub>2</sub> values have been noted in pre-pubertal soccer players compared to their recreationally active peers. It is unclear, what the underlying cardiovascular mechanisms are that give rise to this high level of aerobic fitness.

**PURPOSE:** The aim of the study was to evaluate global markers of systolic and diastolic function in a group of highly-trained, pre-pubertal soccer players during an incremental exercise test.

**METHODS:** Twenty-two, highly-trained male soccer players (SP) from two professional soccer clubs (age: 12.0 ± 0.3 years) volunteered for the study. Fifteen recreationally active boys (CON), of similar age (age: 11.7 ± 0.2 years) were also recruited. All boys underwent an incremental cycle ergometer test to exhaustion. Cardiac dimensions were determined using M-mode echocardiography. Doppler ultrasound techniques were used to derive SV. Tissue-Doppler imaging was used to quantify systolic (TDI-S<sub>adj</sub>) and diastolic function (TDI-E; TDI-E'adj and E/E'adj) at rest and maximal exercise intensities.

**RESULTS:**

|  | SP (n=22) | CON (n=15) |
|--|-----------|------------|
| <b>SV Index (mL·m<sup>-2</sup>)</b>                            |           |            |
| Rest   | 47±9*     | 42±4       |
| Maximum  | 56±9      | 52±7       |
| <b>Cardiac Index (L·min<sup>-1</sup>·m<sup>-2</sup>)</b>       |           |            |
| Rest   | 3.06±0.59 | 3.17±0.54  |
| Maximum  | 10.5±1.50 | 9.67±1.42  |
| <b>TDI-S<sub>adj</sub> (cm·s<sup>-1</sup>·mm<sup>-1</sup>)</b> |           |            |
| Rest   | 1.2±0.1   | 1.1±0.3    |
| Maximum  | 3.2±0.5*  | 2.9±0.3    |
| <b>TDI-E (cm·s<sup>-1</sup>)</b>                               |           |            |
| Rest   | 90±15.0*  | 82±7       |
| Maximum  | 177±16    | 172±13     |
| <b>TDI-E'adj (cm·s<sup>-1</sup>·mm<sup>-1</sup>)</b>           |           |            |
| Rest   | 1.92±0.38 | 1.70±0.48  |
| Maximum  | 3.31±0.43 | 3.14±0.38  |
| <b>E/E'adj</b>   |           |            |
| Rest   | 484±108   | 522±170    |
| Maximum  | 545±95    | 551±54     |

\*P<0.05

SP demonstrated significantly (p<0.05) greater peak VO<sub>2</sub> values than CON (SP:48.0±5.0 vs CON: 40.1±7.5 mL·kg<sup>-1</sup>·min<sup>-1</sup>). Some evidence of LV structural remodeling was seen in the SP; allometrically-scaled to body surface area left ventricular end-diastolic volume was larger (p<0.05) in the SP (51.3±9.0) compared to CON (44.6±5.8 mL·BSA<sup>1.5</sup>).

**CONCLUSION:** Factors that augment LV volume appear to be a contributory factor for the superior aerobic fitness of the soccer players. There appears to be no systematic evidence to support functional improvements in cardiac systolic and diastolic function in pre-pubertal soccer players.

1768 Board #3 June 2, 1:00 PM - 3:00 PM

**Effects of Endurance Exercise Training on Cardiac Autophagy Relationship Proteins in STZ-induced DM Rats**

Shiow-Chwen Tsai<sup>1</sup>, Chien-Chen Lu<sup>2</sup>, Uyn-An Chen<sup>1</sup>.  
<sup>1</sup>University of Taipei, Taipei, Taiwan. <sup>2</sup>Mackay Junior College of Medicine, Nursing, and Management., Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
Email: settsai6@gmail.com  
(No relationships reported)

Many studies have demonstrated that diabetes mellitus (DM) is associated with muscle autophagy. Exercise training may affect muscle autophagy. The aim of the present study was to evaluate effects of endurance exercise training (EX) on cardiac autophagy-related protein in DM rats. We also evaluated the levels of apoptosis proteins of the heart. Experimental methods: the Sprague-Dawley (SD) male rats were divided into 3 groups as two experimental groups and one control group. The first groups as a control group received adjuvant. The second and third groups were the DM groups, received 150 mg/kg STZ by intraperitoneal injection. After one week, EX

was carried out in the third group (DM-EX group) for four weeks. The animals were sacrificed; the blood were collected; the blood glucose was measured; the autophagy relationship proteins (i.e., Atg5, LC3-I, LC3-II, Atg12) and apoptosis proteins (i.e., Beclin1, caspase3, cleaved caspase3, Bcl2, P-Bcl2) were analysis by western blot. The results show that the level of blood glucose was higher in DM and DM-EX groups than in control group ( $p < 0.05$ ). EX decreased the level of blood glucose in DM group ( $p < 0.05$ ). The levels of LC3-I, LC3-II were higher in DM and DM-EX group than in control group ( $p < 0.05$ ). The ratio of LC3-II and LC3-I was highest in DM group than in other group ( $p < 0.05$ ). The Atg5, Atg12 and Bcl2 were highest in DM-EX group than in others ( $p < 0.05$ ). The Beclin1 and P-Bcl2 were higher in DM-EX group than in control group ( $p < 0.05$ ). Those results suggested that EX may affect muscle autophagy from DM damage through Bcl2, Atg5, and Atg12 increasing.

1769 Board #4 June 2, 1:00 PM - 3:00 PM  
**Effect of Exercise on Pulmonary Arterial Capacitance in Heart Failure**  
 Kirsten E. Coffman, Bryan J. Taylor, Courtney M. Wheatley, Alex R. Carlson, Caitlin C. Fermoyle, Briana L. Ziegler, Bruce D. Johnson. *Mayo Clinic, Rochester, MN.*  
 Email: coffman.kirsten@mayo.edu  
 (No relationships reported)

**PURPOSE:** Heart failure is often associated with abnormal pulmonary hemodynamics. Pulmonary arterial capacitance (PAC) is a measure of the distensibility of the pulmonary vasculature and is a determinant of right ventricular afterload. Previously it has been shown that, at rest, PAC demonstrates a hyperbolic relationship with pulmonary vascular resistance (PVR) in heart failure (HF) patients and is an independent predictor of mortality. Our aim was to determine how exercise affects PAC and its relationship with exercise capacity and indices of respiratory gas exchange.

**METHODS:** 39 HF patients undergoing right heart catheterization performed incremental exercise to exhaustion. Pulmonary arterial systolic pressure (PAPs), pulmonary arterial diastolic pressure (PAPd), mean pulmonary artery pressure (PAPm), and mean pulmonary wedge pressure (PWp) were measured invasively at rest and at peak exercise. Ventilation (VE), oxygen consumption (VO<sub>2</sub>), carbon dioxide production (VCO<sub>2</sub>), and heart rate (HR) were continuously collected at rest and during exercise. Arterial and mixed venous blood samples were collected for determination of cardiac output (Q) via direct Fick. The following variables were then calculated: stroke volume (SV)=Q/HR; PAC=SV/(PAPs-PAPd); PVR=(PAPm-PWp)/Q.

**RESULTS:** PAC significantly decreased from rest to peak exercise (2.6 vs. 1.6 ml/mmHg,  $p < 0.01$ ). At peak exercise, PAC was correlated with VO<sub>2</sub>max (PAC=0.29\*VO<sub>2</sub>max-0.87, R=0.74). PAC was negatively correlated to PVR at rest (R=0.85) and during exercise (R=0.82) according to a hyperbolic fit. PAC was negatively correlated to VE/VCO<sub>2</sub> at rest (R=0.53) and during exercise (R=0.52) according to a hyperbolic fit.

**CONCLUSIONS:** In patients with classic systolic HF, PAC is reduced and falls further with exercise. In addition, subjects with the greatest capacitance to accept increases in pulmonary blood volume have a better exercise capacity. This increased pulmonary vascular distensibility during exercise yields lower resistance to forward flow. The gas exchange measure ventilatory efficiency, a marker of disease severity and prognosis in HF patients, is also related to reduced PAC. Supported by NIH grant HL71478.

1770 Board #5 June 2, 1:00 PM - 3:00 PM  
**Differential Effects of Sarcopenic Obesity on Markers of Protein Synthesis in Hearts of C57BL/6J Mice**  
 Richard A. Perry, Jr., Lemuel Brown, David Lee, Jacob Brown, Megan Rosa, Nicholas Greene, Tyrone Washington. *University of Arkansas, Fayetteville, AR.*  
 (No relationships reported)

In 1990, 23.6% of the elderly population (60+ years old) was obese ( $\geq 30$  BMI). By 2010, it increased to 39.5%. Pathological, cardiac hypertrophy is highly associated with both age and obesity. As the prevalence of obesity in the elderly population continues to rise, a firmer understanding of how age and obesity interact to affect cardiac function is needed. **PURPOSE:** To examine how sarcopenic obesity affects markers of protein synthesis. **METHODS:** Twenty-four C57BL/6J mice were evenly distributed into either a normal chow (17% kcals from fat) or high-fat (60% kcals from fat) diet after weaning. Six mice from each diet were euthanized at 3-4 months of age (young) or 22-24 months of age (aged). The classification of the 4 groups is as follows: Young Lean (YL), Young Obese (YO), Aged Lean (AL), Aged Obese (AO). Hearts were excised, snap-frozen, and processed for protein expression via western blot. All protein targets are reported as a ratio of phosphorylated to total protein. **RESULTS:** There was an interaction of age and obesity on heart mass:tibia length. Heart mass:tibia length was 11 % higher in YO compared to YL and 37% greater in AO compared to AL ( $p < 0.05$ ). Also, AO heart mass:tibia length was 40% greater compared to YO ( $p < 0.05$ ). There was a main effect of age to increase both pAkt/Akt

( $p < 0.05$ ) and pmTOR/mTOR ( $p < 0.05$ ). There was an interaction of age and obesity on p4EBP-1/4EBP-1 expression. p4EBP-1/4EBP-1 was lower in YO compared to YL, AL, and AO ( $p < 0.05$ ). We detected an interaction of age and obesity on pp70S6K/p70S6K expression. pp70S6K/p70S6K was 47% higher in YO compared to YL ( $p < 0.05$ ); however, pp70S6K/p70S6K expression was not different between AL and AO mice. We observed an interaction of age and obesity on pAMPK/AMPK expression. pAMPK/AMPK expression was 329% higher ( $p < 0.05$ ) in YL compared to YO but 46% lower ( $p < 0.05$ ) in AO compared to AL. **CONCLUSION:** Sarcopenic obesity induced differential expression of protein synthesis markers. Obesity mediates cardiac hypertrophy through different pathways in the aging and young groups. Cardio protective processes may be downregulated in the sarcopenic obese group as represented by the loss of AMPK in that group.

This work was supported by a grant from the American Biosciences Institute and the animals were a kind gift from Rigel Pharmaceuticals.

1771 Board #6 June 2, 1:00 PM - 3:00 PM  
**LV Twist And Untwisting Rate During Exercise In Endurance Trained And Untrained Men**  
 Eric J. Stohr, Samuel Cooke, Jake Samuel. *Cardiff Metropolitan University, Cardiff, United Kingdom.*  
 Email: estohr@cardiffmet.ac.uk  
 (No relationships reported)

Left ventricular (LV) twist and untwisting rate ('LV twist mechanics') are indicative of the degree of systolic and diastolic myocardial deformation, respectively. Exercise training has been suggested to impact on resting LV twist mechanics, however, whether LV twist mechanics respond differently during exercise in trained and untrained individuals is currently not known. **Purpose:** To compare the response of LV twist and untwisting rate to exercise in endurance trained and untrained men. **Methods:** Nine endurance runners (25 ± 6 yrs; 77 ± 12 kg) and thirteen untrained men (22 ± 3 yrs; 76 ± 10 kg) were examined at rest and during supine cycling exercise at 30%, 40% and 50% of their peak power output. LV twist mechanics were assessed using speckle tracking echocardiography. Blood pressure and heart rate were determined from continuous photoplethysmography. Statistical difference were determined using 2-way RM ANOVA ( $\alpha \leq 0.05$ ), data are presented as mean and SD. **Results:** There were no significant differences between endurance trained and untrained men in blood pressure, heart rate or twist and untwisting rate (All  $P \geq 0.05$ ). However, the ratio of untwisting rate per twist ( $UT_{rate} / twist$ ) was significantly lower in untrained men at rest (-7.2 ± 3.0 vs. -10.1 ± 4.1 /s,  $P < 0.05$ ), but similar  $UT_{rate} / twist$  during exercise ( $P > 0.05$ , Fig 1). **Conclusion:** In endurance runners and untrained individuals, LV twist mechanics change similarly from rest to moderate exercise. However, the lower  $UT_{rate} / twist$  in untrained individuals at rest may suggest a reduced reliance on diastolic mechanics when the cardiovascular system is not challenged, possibly relating to smaller hearts.

Fig. 1. LV twist mechanics in trained and untrained men. \*;  $P < 0.05$ .



1772 Board #7 June 2, 1:00 PM - 3:00 PM  
**Identification and Prevalence of Atrial Fibrillation Associated ECG Markers in Collegiate Cross-Country Skiers**  
 Emily A. Larson, Summer B. Cook, FACSM, Timothy J. Quinn, FACSM. *University of New Hampshire, Durham, NH.* (Sponsor: Dain LaRoche, FACSM)  
 (No relationships reported)

Middle-aged and elderly cross-country skiers have an increased occurrence of atrial fibrillation (AF) than the general population and other endurance athlete populations. The increased AF occurrence in middle-aged and elderly cross-country skiers is thought to be associated with a few characteristic adaptations of the athletic heart

syndrome which can be quantified through the use of 12-lead electrocardiography (ECG). The identification and investigation of the prevalence of these AF associated ECG markers among collegiate cross-country skiers (CCCS) may offer insight into the development of AF in the lifespan of the endurance athlete. **PURPOSE:** This study used 12-lead ECG to identify and investigate the prevalence of these AF associated ECG markers, which include the continuous dependent variables of PR interval (PRI) duration, heart rate (HR), and P-wave height and the categorical dependent variables of bradycardia, left atrial enlargement (LAE), and P-wave peaking, in CCCS as compared with a matched inactive collegiate population (IC). **METHODS:** Supine resting 12-lead ECGs of ten Division I CCCS and ten IC were taken and subsequently analyzed. Subject height, weight, and blood pressure were recorded. Independent T-tests and Chi-square tests were used respectively to analyze continuous and categorical dependent variables. **RESULTS:** No significant differences in PRI duration or prevalence of LAE were found between the two groups, but CCCS had a greater prevalence of bradycardia than IC (HR:  $52 \pm 7$  bpm vs.  $66 \pm 7$  bpm) ( $P < 0.05$ ). The CCCS had a 58% taller mean P-wave height and a greater prevalence of P-wave peaking than the IC (60% vs. 0%) ( $P < 0.05$ ). **CONCLUSION:** The identification and prevalence of AF associated ECG markers in cross-country skiers is difficult to determine in CCCS, suggesting that it is affected by other factors such as cumulative training time or age. However, as the increases in vagal tone and atrial chamber modifications characteristic of the endurance athletic heart syndrome accumulate over a lifetime of endurance training, they may result in a higher prevalence of AF among cross-country skier athletes. Therefore, further research involving the potential progression of these ECG changes in the lifespan of the cross-country skier is warranted.

## D-14 Thematic Poster - Military Physiology

Thursday, June 2, 2016, 1:00 PM - 3:00 PM  
Room: 104

1773 **Chair:** Bradley Nindl, FACSM. *University of Pittsburgh, Pittsburgh, PA.*  
(No relationships reported)

1774 **Board #1** June 2, 1:00 PM - 3:00 PM  
**Reliability of Simulations of Common Soldiering Tasks**  
Stephen A. Foulis, Jan E. Redmond, Peter N. Frykman, Bradley J. Warr, Edward J. Zambraski, FACSM, Marilyn A. Sharp. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.* (Sponsor: Edward Zambraski, PhD, FACSM)  
Email: stephen.a.foulis.ctr@mail.mil  
(No relationships reported)

Understanding the physical demands of Soldiers is difficult. Many Soldiering tasks involve multiple people, require expensive equipment, or are difficult to carefully control. Simulations of these tasks may aid in answering specific research questions; however, the simulations must provide reliable results in order to be useful. **PURPOSE:** To determine the reliability of 5 simulations of common Soldiering tasks. **METHODS:** Three groups of ~50 Soldiers repeated simulations 4 times over 2 weeks. Group 1 (25 Male, 25 Female) performed 3 separate tasks: carrying 16 sandbags for 10m as fast as possible (SC), dragging a simulated 270-lb casualty 15m (CD), and completing an incremental heavy lift to simulate evacuating a casualty from a vehicle turret (CE). Group 2 (25 M, 25 F) completed 15 6.6m simulated combat rushes (CR), and Group 3 (29 M, 20 F) completed a simulated 4-mile foot march (FM). Repeated measures ANOVAs were used to test for improvements across consecutive trials. When there were no additional improvements between trials, relative reliability was assessed using Intraclass correlation (ICC). Absolute reliability was assessed with standard error of the measurement (SEM) and 95% limits of agreement (95% LOA) or 95% ratio LOA, as appropriate. **RESULTS:** The FM and CD did not improve across trials ( $p \geq 0.10$ ). Performance on the SC, CR, and CE improved between the first and second trials ( $p \leq 0.05$ ), but no improvements were seen on the third. Reliability estimates are shown below. **CONCLUSIONS:** These 5 simulations show high reliability and are suitable for studying the physical abilities of Soldiers. A practice session should be provided prior to testing the SC, CR, or CE.

|                     | ICC [95%CI]      | SEM (% Mean) | 95% LOA / 95% Ratio LOA |
|---------------------|------------------|--------------|-------------------------|
| Foot March          | 0.76 [0.61-0.86] | 7%           | 16.3 min                |
| Sandbag Carry       | 0.85 [0.75-0.91] | 12%          | 33%                     |
| Combat Rushes       | 0.93 [0.88-0.96] | 3%           | 0.16 min                |
| Casualty Drag       | 0.90 [0.83-0.94] | 11%          | 0.13 m/s                |
| Casualty Evacuation | 0.96 [0.94-0.98] | 6%           | 25.7 lbs                |

1775 **Board #2** June 2, 1:00 PM - 3:00 PM  
**The Physiological Demands Of A Task Simulation Varies Between Independent Groups Of Subject Matter Experts**  
Adam Hayes<sup>1</sup>, Kent Delbridge<sup>1</sup>, Jace Drain<sup>2</sup>, Herbert Groeller<sup>1</sup>, Joanne Caldwell<sup>1</sup>. <sup>1</sup>*University of Wollongong, Wollongong, Australia.* <sup>2</sup>*Defence Science and Technology Group, Melbourne, Australia.*  
Email: ach975@uowmail.edu.au  
(No relationships reported)

Task simulations are commonly developed by subject matter experts to enable quantification of the critical occupational physiological demands. However, it is unknown if the age, rank and experience of subject matter experts have an impact upon the resultant physiological demands of a task simulation.

**PURPOSE:** To compare the physiological demands of a task simulation developed by two independent groups of subject matter experts. **METHODS:** Two groups of Royal Australian Air Force personnel each designed a simulation for establishing a security control point (Group 1: 12 males, 3 females, age 32.8 SD 9.7 y, experience 8.2 SD 6.2 y; Group 2: 9 males, 1 female, age 26.4 SD 7.3 y, experience 5.2 SD 3.9 y). The task required a team of five personnel to construct a military tent (11 x 11 ft.) and insert star pickets to establish a perimeter around the tent. The specific task requirements, such as number of pickets, distance, individual job roles, and an acceptable work rate, were determined independently by each group of experts. Oxygen consumption (VO<sub>2</sub>, Metamax) and heart rate (Polar HR monitor) were measured to evaluate the physiological demands of the simulation task. An independent t test was used to determine significant differences ( $P < 0.05$ ). Similarly, there was no difference between Group 1 and Group 2 for average heart rate (125 SD 8.5 beats.min<sup>-1</sup> and 133 SD 16.4 beats.min<sup>-1</sup>, respectively;  $P > 0.05$ ) of the task simulation. However, there was a significant difference in the mean duration of the task simulation Group 1 (34 mins 26 s SD 10.01) and Group 2 (15 mins 30 s SD 3.41), and the % of maximal acceptable work duration (Group 1: 12.2 %, Group 2: 5.3%,  $P < 0.05$ ). **CONCLUSION:** The physiological demands of a task are significantly influenced by the group of subject matter experts used to develop the simulation. This effect primarily influenced task duration rather than the intensity of the simulation. These results indicate that physical employment standards should be developed with input from multiple groups of subject matter experts.

Supported by a UOW/DST Group Masters scholarship

1776 **Board #3** June 2, 1:00 PM - 3:00 PM  
**Predicting Performance On A Repeated Lift-and-Carry Task**  
Maria C. Canino, Jan Redmond, Stephen Foulis, Bradley Warr, Peter Frykman, Edward Zambraski, FACSM, Marilyn Sharp. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.* (Sponsor: Edward Zambraski, PhD, FACSM)  
Email: mcanino91@gmail.com  
(No relationships reported)

Repeated lifting and carrying (LAC) of heavy objects is a common job requirement for Soldiers. It is often safer and more practical to assess a Soldier's LAC capacity by administering physical fitness tests (PFTs) rather than performing the actual task. **PURPOSE:** To determine the effectiveness of PFTs to predict Soldiers' performance on a repeated LAC task. **METHODS:** 437 male and 187 female Soldiers performed a sandbag carry (SBC) task while wearing a fighting load without a weapon (approx. 71lbs). Soldiers lifted and carried 16 pre-filled sandbags (40lbs each) a distance of 10m to build a simulated fighting position (4 long x 2 wide x 2 high) as fast as possible for time (minutes). Soldiers also performed the following 14 PFTs while wearing shorts, t-shirts, and athletic shoes: dumbbell squat lift (SL), handgrip, upright pull, Illinois agility test (IA), arm ergometer (AE), 9kg powerball throw, isometric biceps curl, 2kg medicine ball put (MBP), 20m sled drag, standing long jump (SLJ), 300m sprint, beep test (BT), push-ups, and sit-ups (SU). Stepwise multiple linear regression was

used to predict SBC performance. **RESULTS:** The average SBC completion time was  $2.1 \pm 0.9$  minutes. The model obtained using all possible predictors was:  $SBC(\text{min}) = 4.286 - 0.009(\text{SL kg}) - 0.005(\text{SLJ cm}) - 0.004(\text{AE rev/sec}) + 4.351(\text{IA sec}) + 0.011(\text{SU \#}) - 0.001(\text{MBP cm})$ ,  $R^2 = 0.64$  ( $p < 0.001$ ),  $SEE = 0.53$  minutes. The percentage of the variability in the prediction equation explained by each of the variables was:  $SL = 49\%$ ,  $SLJ = 9\%$ ,  $AE = 4\%$ ,  $IA = 1\%$ ,  $SU = 1\%$ , and  $MBP = 1\%$ . Measuring 6 tests to predict one task may not be practical, but use of the first 3 tests (SL, SLJ, and AE) achieved an  $R^2$  of 0.62. **CONCLUSIONS:** Three simple PFTs can be used to predict individual LAC capacity. These data demonstrate that when assessing only one task it may be advantageous to actually administer the task in question. However, the same PFTs could potentially be used to assess performance on multiple job tasks, thus saving time and resources. Variables such as time, required equipment, participant safety, and available testing personnel must be considered when designing occupational testing procedures.

1777 Board #4 June 2, 1:00 PM - 3:00 PM  
**Simulated Military Dismounted Assault Task: Metabolic demands and Relationship to Field Expedient Physical Tests**

Stephen D. Myers, Stephen J. McGuire, Sam D. Blacker, David M. Wilkinson. *University of Chichester, Chichester, United Kingdom.*  
 Email: s.myers@chi.ac.uk  
 (No relationships reported)

The ability to perform high intensity intermittent exercise whilst carrying load is an important component of dismounted military assault tasks. The Australian Defence Force has recently devised a dismounted assault simulation (DAS) based on observed approach distances (Silk & Billings 2013). However, the metabolic demand of neither the simulation, nor its relationship to field expedient tests has been assessed. **PURPOSE:** Measure DAS metabolic demands and assess relationships with field expedient tests. **METHOD:** Fourteen non-military trained men (mean±SD, age: 30±9 years, height: 181±6 cm, body mass: 81±9 kg, BMI: 25±3 kg/m<sup>2</sup>,  $\dot{V}O_{2\text{max}}$ : 52±4 ml·kg<sup>-1</sup>·min<sup>-1</sup>) completed a DAS comprising 16 x 6 m bounds each performed in 20 s (5 s to complete, 15 s rest) followed by an 18 m leopard crawl (LC) 35 s time limit, wearing a weighted vest and carrying a rifle (24 kg). Oxygen cost (Douglas bag technique) and heart rate (HR) were measured during the DAS. Participants completed in separate sessions a  $\dot{V}O_{2\text{max}}$  test and a field expedient test battery (back and leg dynamometer pull, one repetition maximum, vertical jump, 40 m sprint, two minute push-up and two minute sit-up tests). Pearson's correlations were conducted to examine relationship between DAS performance (bound speed, LC time),  $\dot{V}O_{2\text{max}}$  and the field tests. **RESULTS:** Bounds were completed at a mean speed of  $1.6 \pm 0.23 \text{ m} \cdot \text{s}^{-1}$  at  $78 \pm 8\% \text{HR}_{\text{max}}$ ,  $55 \pm 5\% \dot{V}O_{2\text{max}}$ , metabolic rate:  $386 \pm 42 \text{ W} \cdot \text{m}^{-2}$ , with performance moderately correlated with speed at 20-40 m during 40 m sprint ( $r = 0.48$ ,  $p = 0.08$ ). The LC took  $26.1 \pm 2.2$  s to complete at an intensity higher than the bounds ( $87 \pm 7\% \text{HR}_{\text{max}}$ ,  $78 \pm 12\% \dot{V}O_{2\text{max}}$ , metabolic rate:  $557 \pm 84 \text{ W} \cdot \text{m}^{-2}$ ,  $p < 0.01$ ). Twelve of 14 participants completed the LC within the time limit. Completion time was significantly correlated with maximal jump power ( $r = 0.67$ ,  $p < 0.01$ ) with the best predictor for time to complete the LC a linear regression containing maximal vertical jump power and 20-40 m sprint speed ( $R^2 = 0.50$ ,  $p = 0.01$ ,  $SEE = 5.7$  s). **CONCLUSION:** Results are consistent with previous research suggesting high intensity intermittent tasks under load are related to lower body power. The two field tests measuring lower body power accounted for 50% of DAS performance, suggesting further work is warranted to develop methods to test other contributory factors to DAS performance.

1778 Board #5 June 2, 1:00 PM - 3:00 PM  
**USAF Battlefield Airmen Occupationally Specific, Operationally Relevant Physical Fitness Tests and Standards: Prototype vs Incumbent**

Neal Baumgartner, Ryan W. Logan, Matthew F. Gruse, Erin M. Flerlage, Kimberly N. Hale, Katherine A. Batterton. *US Air Force, San Antonio, TX.*  
 Email: neal.baumgartner@us.af.mil  
 (No relationships reported)

The US Air Force officially implemented Tier 1 health and general physical fitness (PF) tests and standards in 2010 with aerobic and body composition component standards established on professionally recognized health science criteria. Scores reflect degrees of health and general fitness, but do not necessarily reflect task achievement for military occupations, e.g., Battlefield Airmen (BA). **PURPOSE:** We developed prototype Tier 2 occupationally-specific, operationally-relevant PF tests and standards for BA (PrT), and compared PrT to incumbent BA PF tests and standards (InT) for content, predictive, and consequential validity and gender neutrality. **METHODS:** An occupationally-based bona fide operational requirements physical demand analysis was conducted for six BA career fields. Analysis identified operationally-required critical physical tasks (CPTs), plus six PF components and 14

physical movement patterns necessary to perform CPTs. CPTs provided the basis for developing physical task simulations (PTSs). Subjects ( $n = 171$ , 62 female, mean ± SD; age,  $28.5 \pm 5.6$  yrs) completed 15 PTSs and 39 PF tests to determine the optimal PF test battery for predicting operational task success. Data were analyzed using SAS®.

**RESULTS:** We developed a ten component PrT that addresses all operationally-required PFCs and physical movement patterns whereas the five component InT addresses only two PFCs and eight movement patterns. PrT explained variance in subjects' PTS performance significantly better (adj  $R^2$  78% to 82%) than InT (adj  $R^2$  58% to 63%). PrT classification accuracy (PF test scores vs PTS success) was significantly better at 85% correct versus InT at 66% ( $p < .05$ ). Finally, PrT predicted operational performance equally well across genders; however, InT under predicted male performance by 17% and over predicted female performance by 24%.

**CONCLUSIONS:** The study approach proved efficacious for developing a viable prototype BA PF test. InT has limited validity and pronounced deficiencies in predicting operational task performance; PrT strengthens the validity and mitigates these deficiencies. In addition, PrT meets public law requirements that qualifying PF tests for military specialties be occupationally specific, operationally relevant, and gender neutral.

1779 Board #6 June 2, 1:00 PM - 3:00 PM  
**Determining Department of Defense Readiness via Soldier Performance Index & Army Physical Fitness Testing**

Todd A. Crowder, Michael N. Tiffany, William B. Kobbe, Alexander J. Bedard. *US Military Academy, West Point, NY.*  
 Email: todd.crowder@usma.edu  
 (No relationships reported)

**PURPOSE:** Investigate physical performance utilizing Soldier Performance Index (SPI) & Army Physical Fitness Test (APFT) using 3 unique composite scores. **METHODS:** 321 subjects; 280 men: 223 United States Service Academy male cadets (MC); 57 USA soldiers (AS); 41 female cadets (FC) tested on the SPI: Cadence Pull-ups {CPU}; 155-lb Bench Press {SBP}; 65-lb BP {65BP}; 45-lb Dumbbell Squat {45SQ}; 2 Mile Run {2MR}; 300-Meter Forward/Backward Run (300M). APFT included: (2-Min. Push-ups, Sit-ups & 2MR). Composite scores tabulated via SPI scoring. APFT age-gender scoring (APFT) & APFT 17-21 year old male scoring chart only (APFT-17). SPI, APFT & APFT-17 scoring was rank ordered respectively to find tertile group affiliations. **RESULTS:** Using SPI as true indicator of a robust fitness profile, group affiliations & mean performances revealed APFT "over scores" thus over estimating physical fitness, particularly in FC. A multitude of physical indices revealed FC to achieve 58.2% of MC ability & 67.8% of AS ability. AS achieved 87.8% MC ability.

| Group n = ( )                           | CPU Repts (SD) | SBP Repts  | 65BP Repts  | 45SQ Repts  | 2MR Secs     | 300M Secs  | SPI PTS      | APFT-17 PTS  | APFT PTS      |
|---|----------------|------------|-------------|-------------|--------------|------------|--------------|--------------|---------------|
| AS (57)                                 | 8.3 (3.7)      | 10.9 (6.4) | 62.5 (17.4) | 36.7 (18.6) | 841.9 (66.1) | 69.8 (6.7) | 175.1 (35.3) | 264.9 (35.8) | 265.39 (25.3) |
| MC (223)                                | 9.4 (3.5)      | 11.7 (8.9) | 70.5 (21.9) | 59.4 (16.6) | 828.8 (88.3) | 62.2 (4.0) | 209.3 (35.1) | 283.8 (35.4) | 279.4 (34.5)  |
| FC (41)                                 | 2.5 (2.7)      | 0 (0)      | 19.7 (11.1) | 41.6 (19.1) | 961.1 (86.4) | 72.6 (6.5) | 107.7 (28.1) | 222.3 (41.1) | 289.2 (37.9)  |
| SPI: Tertile 1 (AS-8; MC-99; FC-0)      | 11.4 (2.6)     | 17.2 (7.6) | 84.1 (19.4) | 67.1 (17.8) | 814.9 (85.9) | 60.8 (3.3) | 240.2 (20.9) | 297.3 (31.9) | 291.5 (33.1)  |
| APFT-17: Tertile 1 (AS-15; MC-91; FC-1) | 11.1 (2.8)     | 12.5 (8.3) | 71.6 (19.6) | 61.1 (19.8) | 768.1 (44.4) | 61.1 (4.0) | 223.7 (32.0) | 314.1 (23.2) | 306.7 (23.2)  |
| APFT: Tertile 1 (AS-10; MC-77; FC-10)   | 9.7 (4.4)      | 10.6 (8.8) | 62.9 (25.7) | 59.4 (20.1) | 786 (66.4)   | 62.6 (5.8) | 207.2 (51.5) | 306.0 (29.9) | 313.2 (22.3)  |
| USSA FC to USSA MC; % Men Output        | 25.5           | 0          | 27.9        | 70.0        | 84.0         | 83.3       | 51.4         | 78.3         | 103.5         |
| USSA FC to AS; % AS Output              | 28.9           | 0          | 31.5        | 113.4       | 85.8         | 95.9       | 61.5         | 83.9         | 109.0         |
| AS to USSA MC; % USSA MC Output         | 88.3           | 93.2       | 88.7        | 61.8        | 98.4         | 87.7       | 83.7         | 93.3         | 94.9          |

**DISCUSSION:** Previously SPI demonstrated to be a better assessment of overall physical abilities, central to DOD readiness. Using only APFT or APFT-17 metrics will

limit identifying individuals who possess key physical performance attributes, most notably upper body strength. **CONCLUSIONS:** To assess physical performance, one can score the APFT via APFT 17-21 year old male scale only, however upper body strength will be compromised by at least 27%. For a more accurate assessment of physical ability & perhaps DOD readiness, assessing physical performance via SPI, leads to higher refinement & better identification of a higher physical performance profile related to strength, endurance, & mobility parameters.

## D-15 Thematic Poster - Nutrition, Physical Activity, and Chronic Disease

Thursday, June 2, 2016, 1:00 PM - 3:00 PM  
Room: 101

1780 **Chair:** Kathleen Woolf. *New York University, New York, NY.*  
(No relationships reported)

### 1781 Board #1 June 2, 1:00 PM - 3:00 PM High-Fructose Consumption During Weight Loss Delays Hepatic Lipid Clearance and Promotes Hepatic Inflammation

Joshua S. Wooten, Kelsey B. Stout, Tayler N. Nick, Matthew P. Harris, Andrew Seija. *Southern Illinois University Edwardsville, Edwardsville, IL.*  
Email: jwooten@siue.edu  
(No relationships reported)

The incidence of non-alcoholic steatohepatitis (NASH) has increased and has become more commonly observed in patients with metabolic syndrome. NASH is characterized by increased hepatic lipid storage and chronic low-grade inflammation resulting from physical inactivity and overnutrition of diets high in both fat and fructose. Weight loss is a common therapeutic strategy; however, the continued high consumption of fructose may attenuate the beneficial effects of weight loss on NASH. **PURPOSE:** To determine the lipogenic and inflammatory effects of high-fructose consumption on hepatic steatosis and the expression of hepatic lipogenic and inflammatory genes during weight loss in obese mice.

**METHODS:** To induce obesity, male C57BL/6 mice were fed a 60% fat diet with a 20% fructose solution (HF+Fr) for 8 wks. Age-matched lean mice were fed a 10% fat diet (LF). To produce weight loss, HF+Fr mice were randomly assigned to a LF diet either with (WL+Fr) or without (WL-Fru) access to a 20% fructose solution for 6 wks. Significant differences ( $P < 0.05$ ) were identified by one-way ANOVA.

**RESULTS:** Following 6 wks of weight loss, WL-Fru remained 12.7% and 17.6% heavier than LF and WL+Fr, respectively. Despite the lower body mass, WL+Fr showed greater hepatic triglyceride than LF (10.5 v. 30.9 ug/mg tissue), but lower than HF+Fr (30.9 v. 69.4 ug/mg tissue). The elevated hepatic lipid in WL+Fr when compared to LF was associated with increased expression of lipogenic genes *Fasn* and *Acc1* by 1.5 and 1.1 fold, respectively. The increased expression of these genes in WL+Fr may be due to a 2.9 fold increased expression of the regulatory transcription factor *Chrebp* when compared to LF. Despite weight loss, the continued fructose consumption was associated with a 1.5-2.0 fold increased expression of pro-inflammatory *Tnfa* and *Ifnγ* when compared to both LF and WL-Fru. Conversely, WL+Fr demonstrated an increased expression of the immunoregulatory *Il10* (1.3 fold) and *Il6* (2.8 fold) when compared to LF.

**CONCLUSIONS:** These data suggest that the continued consumption of high-fructose during weight loss reciprocally increased hepatic lipid storage and mRNA markers of *de novo* lipogenesis, as well as mRNA markers of inflammation. Overall, delayed clearance of hepatic lipids by fructose consumption during weight loss may promote early signs of NASH.

### 1782 Board #2 June 2, 1:00 PM - 3:00 PM Association of Physical Activity and Sedentary Behavior with Psychological and Physiological Outcomes in Patients with Type II Diabetes.

David J. Rice<sup>1</sup>, Jeanette M. Garcia<sup>2</sup>, Daniel J. Cox<sup>3</sup>, Anthony McCall<sup>3</sup>, Anne Taylor<sup>3</sup>. <sup>1</sup>*Fitchburg State University, Fitchburg, MA.* <sup>2</sup>*Harvard University, Boston, MA.* <sup>3</sup>*University of Virginia, Charlottesville, VA.*  
Email: drice9@fitchburgstate.edu  
(No relationships reported)

**Objective:** To quantify the association of changes in moderate-to-vigorous physical activity (MVPA) and sedentary behavior (SB) with changes in physiological and psychological factors over a 6 month period in adults with type 2 diabetes. **Methods:** 24 adults (mean age: 57.4 yrs., 54% male) with type 2 diabetes participated. At times 0 and 6-months, eating behavior (consumption of high and low glycemic foods), and

psychological functioning (quality of life, depressive symptoms, diabetes emotional distress), were assessed via self-report questionnaires, along with physiological variables (heart rate, BMI, blood pressure, cholesterol, high sensitive C-reactive protein (HS-CRP), insulin, and glycosylated hemoglobin (HbA1c). Minutes per day of MVPA and SB were assessed with an accelerometer worn over 7 days at the same two times. Correlations were conducted to assess the association of change in MVPA and SB with changes in health outcomes. **Results:** MVPA min/day increased from 21.48 ± 18.49 at baseline to 28.96 ± 22.26, while SB minutes slightly increased from 565.18 ± 84.2 to 570.26 ± 105.32. An increase in MVPA was associated with decreases in heart rate ( $r = -.48, p < .05$ ), BMI ( $r = -.45, p < .05$ ), systolic blood pressure ( $r = -.39, p < .05$ ), HbA1c levels ( $r = -.42, p < .05$ ), and decreased HS-CRP ( $r = -.33, p = .09$ ). An increase in MVPA was associated with an increase in consumption of low glycemic load foods ( $r = .49, p < .05$ ), and an increase in quality of life ( $r = .4, p = .05$ ). An increase in SB minutes per day was correlated with greater diabetes distress ( $r = -.43, p < .05$ ) and an increase in depressive symptoms ( $r = .56, p < .01$ ). Interestingly, change in MVPA was not correlated with changes in SB ( $r = .23, p = .3$ ). **Conclusions:** Despite the small sample, significant associations existed between MVPA and improvement in both psychological and physiological health factors, while SB was associated with worse psychological outcomes in participants. Changes in MVPA and SB independently affect psychological and physiological outcomes in participants with type 2 diabetes, suggesting interventions should focus separately on increasing MVPA and decreasing SB for optimal health benefits.

1783 Board #3 June 2, 1:00 PM - 3:00 PM

### Exercise Training As A Mitigator Of Liver Fibrosis In Western Diet Fed OLETF Rats

Melissa A. Linden<sup>1</sup>, Ryan D. Sheldon<sup>1</sup>, Grace M. Meers<sup>1</sup>, Laura C. Ortinau<sup>1</sup>, E Matthew Morris<sup>1</sup>, Victoria J. Vieira-Potter<sup>1</sup>, Jill A. Kanaley, FACSM<sup>1</sup>, Frank W. Booth, FACSM<sup>1</sup>, James R. Sowers<sup>1</sup>, Jamal A. Ibdah<sup>1</sup>, John P. Thyfault, FACSM<sup>2</sup>, M Harold Laughlin, FACSM<sup>1</sup>, R. Scott Rector<sup>3</sup>. <sup>1</sup>*University of Missouri, Columbia, MO.* <sup>2</sup>*University of Kansas Medical Center and Kansas City VA, Kansas City, MO.* <sup>3</sup>*University of Missouri and Truman VA, Columbia, MO.* (Sponsor: M Harold Laughlin, FACSM)  
Email: Melissa.Linden@pfizer.com  
(No relationships reported)

Nonalcoholic fatty liver disease (NAFLD) is a progressive disorder ranging from simple steatosis to nonalcoholic steatohepatitis (NASH), fibrosis, and cirrhosis. Exercise training is recommended to patients with NAFLD, yet it is unclear if exercise can effectively treat advanced liver disease, including fibrosis. **PURPOSE:** To determine whether 12 weeks of exercise training can attenuate the NASH+ fibrosis phenotype induced by a western diet (WD) high in fat, sucrose, and cholesterol in Otsuka Long-Evans Tokushima Fatty (OLETF) rats. **METHODS:** Eight week old Long-Evans Tokushima Otsuka rats (L) and hyperphagic OLETF (O) rats were provided with WD (45% kcal fat, 17% sucrose, and 1% wt/wt cholesterol). At 20 wks of age, OLETF rats were randomized to the following groups for 12 weeks: sedentary (O-SED), treadmill exercise training (O-EX; 20 m/min, 15% grade, 60 min/d, 5d/wk) or food restriction (O-FR; ~25% kcal restriction vs. O-SED). L-SED served as the control group. **RESULTS:** While liver triglyceride content did not differ among groups, FR lowered hepatic inflammatory status (50-75% reductions in IL-1β protein content and TNFα mRNA expression vs. O-SED). Attenuation of liver fibrosis with FR and EX corresponded with lower liver hydroxyproline content with FR and lower collagen 1α1 mRNA expression with EX ( $p < 0.05$  vs O-SED for each). FR reduced markers of hepatic stellate cell activation (reduced hepatic TGF-β protein and αSMA mRNA vs O-SED), while EX increased protein content of the hepatic stellate cell senescence marker CCN1 ( $p < 0.01$  vs. O-SED). Additionally, both FR and EX normalized markers of extracellular matrix remodeling to levels similar to L-SED ( $p > 0.05$ ). **CONCLUSION:** Both food restriction and moderate intensity exercise training modestly attenuate WD-induced NASH and fibrosis in OLETF rats likely through independent mechanisms. However, neither treatment strategy completely resolves the liver-related injury induced by this western diet. Supported by NIH DK088940 (JPT), HL036088 (MHL), HL107910-03 (JRS), VA-Merit 0018 (JRS), and VA-CDA2 IK2BX001299 (RSR) grants.

1784 Board #4 June 2, 1:00 PM - 3:00 PM  
**Short-term Sedentary Behavior Increases Post-meal Insulin Concentrations By Decreasing Hepatic Insulin Extraction**  
 Richard Viskochil<sup>1</sup>, Kate Lyden<sup>2</sup>, Barry Braun, FACSM<sup>3</sup>, Patty S. Freedson, FACSM<sup>1</sup>. <sup>1</sup>University of Massachusetts, Amherst, MA. <sup>2</sup>Misfit, Inc., Burlingame, CA. <sup>3</sup>Colorado State University, Fort Collins, CO. (Sponsor: Barry Braun, FACSM)  
 Email: rviskoch@kin.umass.edu  
 (No relationships reported)

**Introduction:** We recently demonstrated that 7 days of increased sedentary time significantly increases post-meal insulin concentrations in healthy adults (Lyden et al. *Med Sci Sport Exerc.* 2015). It is unclear whether higher insulin concentrations are due to greater insulin secretion from the pancreas or lower hepatic extraction, i.e. the amount of insulin cleared by the liver after secretion but prior to reaching the circulation. **Purpose:** To quantify changes to insulin secretion, hepatic extraction and beta cell function following 7 days of increased free-living sedentary time. **Methods:** Physical activity and sedentary time were measured for 7 days in 10 healthy, recreationally active (>150 minutes of physical activity/week), men and women age 18-35 using the thigh-worn ActivPAL™ wearable sensor, with participants maintaining their habitual physical activity levels. Following this baseline condition participants were instructed to reduce their physical activity levels and increase their sedentary time for 7 consecutive days. Participants completed a 5-sample oral glucose tolerance test (OGTT) and glucose, insulin and C-Peptide concentrations were measured following each condition. Hepatic extraction was quantified at basal (HE<sub>0</sub>) and 2h time-points (HE<sub>2h</sub>) as well as area under the curve (AUC) for the OGTT (HE<sub>AUC</sub>). The insulinogenic index (IGI, C-Peptide (0-30)/Glucose (0-30)) and the disposition index (IGI (x) Insulin sensitivity) were calculated to determine insulin secretion and beta cell function, respectively. Paired t-tests were used to evaluate differences between baseline and sedentary conditions and Pearson product moment correlations were used to test for relationships between sedentary time and beta cell function. **Results:** HE<sub>2h</sub> and HE<sub>AUC</sub> were significantly lower (85.4 ± 7.2% vs. 74.6 ± 6.6%, p<0.05 and 73.6 ± 9.4% vs. 67.5 ± 11.3%, p<0.05) after 7 days of increased sedentary time. Additionally, changes in sedentary time were associated with changes in HE<sub>2h</sub> (r=-0.65, p=0.04). There were no significant differences in HE<sub>0</sub>, insulin secretion, or measures of beta cell function. **Conclusion:** Postprandial hyperinsulinemia following one week of sedentary behavior is primarily due to reductions in hepatic extraction rather than increases in insulin secretion.  
 Supported by NIH RC1HL099557

1785 Board #5 June 2, 1:00 PM - 3:00 PM  
**Effects of Neighborhood Walkability on Physical Activity and Sedentary Behavior in Long-Term Post-Bariatric Surgery Patients**  
 Ryan ER Reid<sup>1</sup>, Marie-Aude Picard-Turcot<sup>1</sup>, Tamara E. Carver<sup>1</sup>, Tyler GR Reid<sup>2</sup>, Kathleen M. Andersen<sup>1</sup>, Nicholas V. Christou<sup>1</sup>, Ross E. Andersen, FACSM<sup>1</sup>. <sup>1</sup>McGill University, Montreal, QC, Canada. <sup>2</sup>Stanford University, Palo Alto, CA. (Sponsor: Ross E Andersen, FACSM)  
 Email: ryan.reid@mail.mcgill.ca  
 (No relationships reported)

Chronic inactivity and weight re-gain are both serious health concerns following bariatric surgery. Neighborhood walkability is associated with physical activity in normal weight populations. **PURPOSE:** To explore the influence of neighborhood walkability on the daytime sedentary and physical activity habits of bariatric patients long-term post-surgery. **METHODS:** 71 adults aged 50.3 ± 9.4 yrs, weighing 97.3 ± 25.2 kg with a BMI of 35.6 ± 9.9 kg/m<sup>2</sup> having undergone bariatric surgery 8.87 ± 3.8 yrs earlier participated in this study. Participants were asked to wear an ActivPAL™ tri-axial accelerometer attached to their mid-thigh for seven consecutive days, 24 hours/day. All patients wore the device for ≥5 days and ≥22 hours/day. Self-reported nighttime sleeping facilitated distinguishing this from day sitting time. After data collection was complete, the data were analyzed and the sample was separated into those that live in Car Dependent (N = 28), Somewhat Walkable (N = 19), Very Walkable (N = 17), and Walker's Paradise (N = 7) neighborhoods as defined using Walkscore™. MANCOVA was performed comparing the four groups on their steps/day and sedentary time controlling for age and sex. **summary of RESULTS:** Neighborhood walkability did not influence either daily steps (F(3,65) = 1.43, p = .25) or sedentary time (F(3,65) = .65, p = .57): Car Dependent (6559 ± 2840 steps, 9.7 ± 2.3 hrs), Somewhat Walkable (6940 ± 2833 steps, 9.3 ± 2.4 hrs), Very Walkable (5246 ± 2184 steps, 9.9 ± 2.0 hrs), and Walker's Paradise (6847 ± 2500 steps, 10.6 ± 2.6 hrs). **CONCLUSION:** The walkability of a neighborhood does not appear to affect daily sedentary time or physical activity long-term post-bariatric surgery. More research is needed to enhance physical activity and reduce sedentarism in this important population.

1786 Board #6 June 2, 1:00 PM - 3:00 PM  
**Associations Between Dietary Intake And Frailty In Older Ethnically Diverse Migrant Women**  
 Janice L. Thompson, FACSM, Diana Castaneda-Gameros. University of Birmingham, Birmingham, United Kingdom.  
 Email: j.thompson.1@bham.ac.uk  
 (No relationships reported)

**PURPOSE:** Frailty syndrome is a wasting disorder with weight loss commonly used as a proxy measure of inadequate dietary intake in older adults. However, many older adults are overweight/obese, and the absence of weight loss may not be adequately sensitive to identify individuals consuming a poor quality diet and are frail. This is particularly problematic in older ethnically diverse migrant women due to their relatively high rates of overweight/obesity. Our aim was to investigate the association between dietary intake and frailty syndrome in older (>60y) ethnically diverse migrant women (n=60). **METHODS:** Frailty was defined as meeting two of the following criteria: feelings of exhaustion, low level of accelerometry-measured physical activity (PA), low walking speed, and weakness. 24hr dietary recall was used to estimate daily intakes of energy, protein, retinol, Vitamins D, C, E, folate, Ca, Fe, and Zn; low intake was defined as the lowest quintile of intake in this sample. **RESULTS:** Twenty-three percent of participants (mean age 70.8±8.0y) were classified as frail. Mean BMI was 29.4±4.8kg/m<sup>2</sup>; no participant had a BMI indicative of underweight. However, 57.1% reported low intake values of at least 3 nutrients. Weight loss (p=0.3, Fisher's exact test) and BMI (r= 0.05, p=0.7) were not associated with frailty. Logistic regression indicated that low energy intake was independently associated with frailty (OR:0.08, 95%CI:0.01-0.59). After controlling for low energy intake, low intakes of retinol (OR:0.06, 95%CI:0.006-0.64) and of >3 nutrients were associated with frailty (OR:0.008, 95%CI:0.001-0.41). Percentages of women with low levels of PA and slow walking speed increased with the number of nutrient intakes in the lowest quintile, with only slowness being independently related to frailty (OR:0.005, 95%CI:0.001-0.16). **CONCLUSIONS:** Low intakes of energy and selected nutrients were common in this sample and were associated with frailty. Due to the higher prevalence of overweight/obesity and related complications in older ethnic minority migrant women, dietary intake may be a better indicator of frailty rather than weight loss and BMI.  
 Funding: The National Council on Science and Technology, Mexico; University of Birmingham Institute for Research Into Superdiversity.

1787 Board #7 June 2, 1:00 PM - 3:00 PM  
**Exercise, Inflammation, and Sugar Consumption in Adults with Normal Versus Impaired Fasting or Glucose Tolerance**  
 Jay W. Porter, Andrea N. Steward, John T. Halvorson, John G. Seifert, Sarah Bronsky, Ashley E. Connors, Mary P. Miles, FACSM. Montana State University, Bozeman, MT.  
 (No relationships reported)

Exercise improves glucose tolerance and insulin sensitivity, but little is known about how consuming sugar sweetened beverages (SSB) during and post exercise influences the metabolic benefits of exercise. **PURPOSE:** Determine how the metabolic benefits of exercise are influenced by SSBs during and after exercise in overweight and obese adults of normal (NFG/NGT) and impaired fasting glucose (IFG) or glucose tolerance (IGT). **METHODS:** Male (n=9) and female (n=11) participants (18-52 y) completed two exercise and one control (CON+H2O) conditions. A standard, isocaloric diet to meet energy needs was given post exercise in EX+H2O and CON+H2O conditions, but SSB replaced 2 g per kg lean mass of calories from food in EX+SSB. Exercise was performed midday and consisted of an uphill walk at 65% predicted VO<sub>2</sub>max for 45 minutes on the first and matched on the second exercise condition. Participants completed a 75 g oral glucose tolerance test (OGTT) 18 h later with blood samples collected -5(0), 60, 120 minutes for analysis of soluble tumor necrosis factor receptor-1 (sTNFR1), TNF-alpha (TNFα), interleukin-6 (IL-6), and reactive oxygen and nitrogen species (RONS). Subjects were grouped into NFG/NGT (n=12) and IFG/IGT (n=8) for analysis. **RESULTS:** IL-6 at 0 and 60 min was lower (p=0.004) than 120 min. There was a trend (p=0.058) for IL-6 in CON+H2O (mean±SEM; 1.70±0.16 pg/ml-1) to be higher than EX+SSB (2.42±0.34 pg/ml-1) at 120 min. TNFα was lower (p=0.022) in EX+H2O compared to CON+H2O. The IFG/IGT group had higher (p<0.05) sTNFR1 with consumption of SSB regardless of exercise. There was a significant time by group interaction (p=0.009) for RONS to increase during the OGTT in IFG/IGT but not NFG/NGT. **CONCLUSIONS:** Inflammation responses to glucose ingestion were lower 18h after exercise compared to the non-exercise. This is the first study that we know of to demonstrate a prolonged anti-inflammatory effect of exercise. IFG/IGT had greater RONS responses during the OGTT, regardless of condition. Thus, metabolic benefits of exercise may partially be compromised by increases in some inflammatory markers when IFG/IGT adults consumed SSBs.

Supported by the Mountain West Clinical Translational Research - Infrastructure Network under a grant from NIGMS of the NIH under Award Number 1U54GM104944.

1788 Board #8 June 2, 1:00 PM - 3:00 PM  
**Impact of Dietary Composition and Exercise on Functional Capacity and Cardio-metabolic Health in Male Rats**

Sang-Rok Lee<sup>1</sup>, JohnHenry M. Schriefer<sup>2</sup>, Trint A. Gunnels<sup>2</sup>, Richard J. Bloomer<sup>2</sup>. <sup>1</sup>New Mexico State University, Las Cruces, NM. <sup>2</sup>University of Memphis, Memphis, TN. (Sponsor: Jeong-Su Kim, FACSM)  
 Email: srlee@nmsu.edu  
 (No relationships reported)

A purified vegan diet known as "Daniel Fast" (DF) has attracted great attention due to its health-enhancing properties. However, the effects of this vegan diet combined with exercise training on physical performance and cardio-metabolic health remains to be established. **PURPOSE:** To determine the effects of a 12-week DF with or without endurance exercise training on body composition, physical performance, cardio-metabolic profile, and oxidative stress in male rats. **METHODS:** Long-Evans male rats (N=28) were assigned to be exercise trained (+E) by running on a treadmill (3d/week) or to act as sedentary controls. After baseline functional capacity was evaluated by recording run time to exhaustion, animals were randomly allocated to the vegan DF or a Western Diet (WD) group. Food was provided *ad libitum* for 12 weeks. Once post-intervention physical performance and body composition assessments [dual X-ray absorptiometry (DXA)] were completed, blood was collected for evaluation of cardio-metabolic profile parameters (glucose, triglyceride, and cholesterol) and a selected biomarker of oxidative stress [advanced oxidation protein products (AOPP)]. Analysis of variance (ANOVA) was used with significance set at  $p \leq 0.05$ . **RESULTS:** Body mass and body fat were lower in the DF+E group compared to the WD+E group (body mass: 478.7±11.3 g vs. 516.8±10.7 g) (fat mass: 100.7±7.4 g vs. 161.6±8.0 g). Physical performance was higher compared to baseline for both exercise groups, with a greater percent increase in the DF+E group (+81%) compared to the WD+E group (+36%). Concentration of blood glucose, triglyceride, and cholesterol was lower in the DF (129±9; 74±13.1; 74.6±4.3 mg·dL<sup>-1</sup>) and DF+E (113±3; 65.5±7.5; 67.2±5.2 mg·dL<sup>-1</sup>) groups than the WD (182±7; 477±67.9; 191±21.2 mg·dL<sup>-1</sup>) and WD+E groups (158±10; 408±57.7; 135.8±9.9 mg·dL<sup>-1</sup>), respectively. Further, the AOPP concentration was lower in the DF (67±15 μmol·L<sup>-1</sup>) and DF+E (50±7 μmol·L<sup>-1</sup>) groups than in the WD (573±53 μmol·L<sup>-1</sup>) and WD+E (413±56 μmol·L<sup>-1</sup>) groups, respectively. **CONCLUSION:** The DF with *ad libitum* feeding resulted in lower body mass and body fat accumulation, enhanced physical performance, and improved cardio-metabolic parameters with lower oxidative stress regardless of amount of calories consumed.

**D-16 Thematic Poster - Physical Activity in Persons with Disabilities**

Thursday, June 2, 2016, 1:00 PM - 3:00 PM  
 Room: 109

1789 **Chair:** Thomas McKenzie, FACSM. San Diego State University, San Diego, CA.  
 (No relationships reported)

1790 Board #1 June 2, 1:00 PM - 3:00 PM  
**Cardiorespiratory Activity Participation and Strength Mediate the Association between Biomarkers and Functional Limitations**

Matthew J. Peterson, Miryoung Lee, Audrey Choh, Stefan Czerwinski. *Wright State University, Kettering, OH.*  
 Email: matthew.peterson@wright.edu  
 (No relationships reported)

Disablement models provide a conceptual framework to study aging-related systems dysregulation leading to impairment, functional limitations, and eventual disability. Studying biomarkers that signal dysregulation leading to functional limitations, and mediating lifestyle and physiologic factors, could lead to better targeted disability prevention programs.

**PURPOSE:** To determine associations between biomarkers and functional limitations representing a range of difficulty, and the degree to which these effects are mediated through cardiorespiratory activity participation (CAP) or strength.

**METHODS:** Data were from 778 participants (61.2 ± 12 years; 61% female; 67% white) in the Fels Longitudinal Study. Outcome measures included self-reported limitations in walking ¼ mile, walking a block, and bathing. Three biomarkers

included high sensitivity C-reactive protein (CRP), soluble vascular cell adhesion molecule-1 (VCAM), and tumor necrosis factor alpha (TNFα). CAP was measured via self-report and represented predominately sport activities of cardiorespiratory fitness such as golf, tennis, and rowing. Strength was measured using a handgrip dynamometer. Binary mediation analysis models estimated standardized direct and mediated effects and their precision.

**RESULTS:** 29%, 17%, and 9% of participants reported limitations in walking ¼ mile, walking a block, and bathing, respectively. CRP effects in all three models were significantly mediated through CAP [standardized coefficients (coeffs) 0.05-0.06; all  $P < 0.05$ ], and through strength in the ¼ mile walking model (coeff=0.03;  $P < 0.05$ ) and in walking a block model (coeff=0.03;  $P < 0.05$ ). VCAM effects were significantly mediated through strength in all three models (coeffs ~0.05; all  $P < 0.05$ ), whereas there were no significant mediating effects through CAP. All TNFα models were non-significant.

**CONCLUSIONS:** The association of biomarkers with functional limitations and the mediating role of CAP or strength is biomarker-specific. It is plausible that these biomarkers represent systems (e.g. inflammatory and endothelial function) that differentially impact system impairments (e.g. cardiorespiratory vs. musculoskeletal) and subsequent functional limitations. Early detection of system dysregulation may aid in targeted interventions.

1791 Board #2 June 2, 1:00 PM - 3:00 PM  
**Relationships of Physical Activity, Muscular Strength, and BMI to General Health Among Children with Disabilities.**

Joonkoo Yun<sup>1</sup>, Jooyeon Jim<sup>2</sup>, Stamatis Agiovlasitis, FACSM<sup>3</sup>.  
<sup>1</sup>Oregon State University, Corvallis, OR. <sup>2</sup>University of Wisconsin-La Crosse, La Crosse, WI. <sup>3</sup>Mississippi State University, Mississippi State, MS. (Sponsor: Stamatis Agiovlasitis, FACSM)  
 Email: jk.yun@oregonstate.edu  
 (No relationships reported)

Positive health benefits of engaging in regular physical activity (PA) have been well documented. Current PA recommendations for children include engaging in 60 or more minutes of daily aerobic activity and at least 3 days per week participation in muscular-strengthening activities (USDHHS, 2008). However, the underlying mechanism of how muscular strength, BMI, and PA are related to overall health has not been fully investigated among children with disabilities. **PURPOSE:** This study examined the relationships between overall health, PA engagement, muscular strength, and BMI. The goal was to reveal the potential underlying mechanism of general health among children with disabilities using mediation analysis. **METHODS:** This study employed secondary data analysis using the 2012 National Youth Fitness Survey. Data from 218 surveys of children with disabilities (101 male and 117 female) aged 6 to 15 years ( $M = 10.93 \pm 2.72$ ) were extracted from the nationally representative sample. Children with disabilities were defined as having one of four criteria: (a) receiving special education services, (b) having long term health impairment, (c) having mobility limitations, or (d) needing special equipment. Frequency of participation in daily PA, BMI, grip strength, and general health condition were used for data analysis. A multiple mediator model was employed to examine the potential underlying mechanism using SPSS 22, process macro (Hayes, 2014). **RESULTS:** As expected, the general health of children with disabilities was influenced by PA engagement, BMI, and muscular strength. The mediation analysis revealed that daily PA engagement not only directly affects general health ( $b = .24, p < .01$ ), but also indirectly through muscular strength ( $b = -.032, 95\% \text{ CI: } -.081, -.006$ ) as a single mediator, and through BMI and muscular strength ( $b = -.013, 95\% \text{ CI: } -.037, -.001$ ) as multiple mediators. In addition, BMI affects general health through muscular strength ( $b = .033, 95\% \text{ CI: } .008, .064$ ). **CONCLUSION:** The study demonstrated the importance of not only PA engagement on general health, but also the role of BMI and muscular strength, as well as how they are directly and indirectly affecting general health among children with disabilities.

1792 Board #3 June 2, 1:00 PM - 3:00 PM  
**Concurrent And Prospective Associations Between Learning Disabilities And Concussion In Young Adults**

Robert D. Moore, Linda Pagani, Dave Elleberg. *University of Montreal, Montreal, QC, Canada.*  
 Email: robert.moore@umontreal.ca  
 (No relationships reported)

**Dr. R. Davis Moore, Dr. Linda S. Pagani & Dr. Dave Elleberg  
 The University of Montreal**

Concussive injuries are an increasing public health concern. Although considerable research efforts are dedicated towards understanding injury outcomes, less effort is devoted to understanding the risk factors. **Purpose:** To retrospectively and prospectively evaluate the relation between neurodevelopmental disorders and the risk of incurring concussive injuries. **Methods:** 148 University athletes completed baseline

testing, which included the assessment of learning disabilities and sport-related concussion. Odds ratios were calculated ( $(p_a/1-p_a)/(p_b/1-p_b)$ ) for the 148 athletes who completed the baseline assessment and for the 48 athletes who incurred a concussion during the study to assess the relation of learning disabilities and the incidence of concussion. **Results:** At baseline, 32 athletes had a history of one concussion and 59 athletes had a history of two or more concussions. Athletes with a learning disability were 2.06 times more likely to have a history of concussion and 1.63 times more likely to have a history of multiple concussions than those without a learning disability. Further, athletes with a learning disability were 2.62 times more likely to suffer a concussion during the course of the study than athletes without a learning disability. **Conclusion:** The current data suggest that having a learning disability may be a significant risk factor for incurring a concussive injury.

1793 Board #4 June 2, 1:00 PM - 3:00 PM  
**Motor Proficiency And Executive Function In Children Diagnosed With ASD And ADHD**

Wei-Ya Ma<sup>1</sup>, Ming-Chih Sung<sup>1</sup>, Chu-Yang Huang<sup>1</sup>, Po-Lin Chen<sup>1</sup>, Chien-Yu Pan<sup>1</sup>, Chia-Liang Tsai<sup>2</sup>. <sup>1</sup>National Kaohsiung Normal University, Kaohsiung, Taiwan. <sup>2</sup>National Cheng Kung University, Tainan, Taiwan.  
 Email: winnie2643@yahoo.com.tw  
 (No relationships reported)

Autism spectrum disorders (ASD) are a group of developmental disorders characterized by difficulties in social interaction and communication, as well as by repetitive, restricted interests, and behaviors. Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder identified through developmentally inappropriate symptoms of inattention, impulsiveness, and overactivity. These two disorders seem quite distinct in terms of their description; however, children with ASD and ADHD have been found to display a variety of motor skill and executive function deficits. There has been little research directly contrasting the profiles of these groups. **PURPOSE:** To compare the motor proficiency and executive function in children with ASD, ADHD, and typically developing (TD) children. **METHODS:** Eighty-three children (ASD, n = 21; ADHD, n = 31; TD, n = 31), ages 6-12 years, were of average IQ participated. The Bruininks-Oseretsky Test of Motor Proficiency-2 and the Stroop Color and Word Test were used to collect data. One-way multivariate analysis of covariance and one-way univariate analysis of covariance, controlling for age, were performed to evaluate the group differences for the BOT-2 and the Stroop test, respectively. **RESULTS:** Group differences were found in all BOT-2 measures (total motor composite, F=6.29, p<0.01; fine motor control, F=3.64, p<0.05; manual coordination, F=8.96, p<0.01; body coordination, F=8.41, p<0.01; strength and agility, F=4.87, p<0.05;) and Stroop Color-Word task (F=16.40, p<0.01). Post hoc tests showed that (a) the ASD group exhibited lower score than the TD group on total motor composite, manual coordination, and strength and agility, (b) the ADHD group showed lower score than the TD group on fine motor control and manual coordination, (c) both the ASD and ADHD groups demonstrated lower score than the TD group on body coordination, (d) the ASD group had lower score than the ADHD group on manual coordination, and (e) both the ASD and ADHD groups obtained a significantly lower score than the control on the Stroop Color-Word task. **CONCLUSION:** The current study highlights the motor proficiency and executive function observed in children with ASD and ADHD are worse than those without a disability. Supported by Taiwan MOST grant 103-2410-H-017-026-MY3.

1794 Board #5 June 2, 1:00 PM - 3:00 PM  
**Physical Activity of Children with Intellectual Disabilities in Diverse Structured Settings in Special Schools**

Thomas L. McKenzie, FACSM<sup>1</sup>, Cindy H. P. Sit<sup>2</sup>, Jane J. Yu<sup>2</sup>, Ester Cerin<sup>3</sup>, Wendy Y. J. Huang<sup>4</sup>, Bik C. Chow<sup>4</sup>. <sup>1</sup>San Diego State University, San Diego, CA. <sup>2</sup>Chinese University of Hong Kong, Hong Kong, Hong Kong. <sup>3</sup>Deakin University, Melbourne, Australia. <sup>4</sup>Hong Kong Baptist University, Hong Kong, Hong Kong.  
 Email: tmckenzie@sdsu.edu  
 (No relationships reported)

Children with intellectual disabilities (ID) are less active than typically developing peers and rely on others for physical activity (PA) support. School is an important environment for PA accrual, but there is little information on PA of children with ID in diverse settings at school. **PURPOSE:** To determine the lesson/session contexts and PA levels of children with ID in various PA settings (i.e., programs designed for PA promotion) in special schools. **METHODS:** Participants were 144 children with ID (60 girls, 84 boys; 88 primary level, 56 secondary level) in 5 Hong Kong special schools for children with ID. Trained observers used SOFIT (System for Observing Fitness Instruction Time) to document student PA and lesson context during 5 structured PA settings (before and after school, physical education [PE], lunch recess, and non-PE lessons). PA levels (i.e., lying down, sitting, standing, walking, vigorous) and

lesson contexts (management, knowledge, fitness, skill practice, game play, other) were coded. Moderate-to-Vigorous Physical Activity (MVPA) was calculated by summing walking and vigorous codes. MVPA and lesson context were summarized by minutes and proportion of observed intervals. Total session energy expenditure (TEE) and energy expenditure rate (EER) were calculated using standard formulae. Three-way (gender X grade X setting) ANOVAs were used to determine differences in MVPA and lesson contexts. **RESULTS:** Among the structured settings, after school programs provided the highest TEE (423.4±122.0 kcal/kg; F=27.1, p<.001). Primary students had significantly less TEE than secondary students during PE (178.5±88.7 vs. 281.0±83.2, p<.05). Both EER (9.0±2.0 kcal/kg/min) and MVPA (56.3%±22.8) were highest during lunch recess (all p<.05). Relative to lesson context, before-school sessions provided the highest percent of time spent on fitness (88.0%±14.8) and lunch recess provided the highest skill practice time (52.8%±41.8). **CONCLUSION:** All programs contributed to the PA accrual of children with ID. PA minutes and intensity, however, varied by school setting and were related to lesson/session context--thus providing information important for designing effective interventions for this special population.

Supported by GRF, University Grant Committee, Hong Kong (CUHK 752712)

1795 Board #6 June 2, 1:00 PM - 3:00 PM  
**Improving Accelerometry Derived Estimations of Energy Expenditure in Individuals with Locomotor Dysfunction**

James J. Laskin<sup>1</sup>, Tidaporn Tairattanasuwan<sup>2</sup>, Utit Rungsawat<sup>2</sup>, Nitinet Ketsuwan<sup>2</sup>, Marek Szczepkowski<sup>3</sup>, Jan Kochanowski<sup>4</sup>, Piotr Czyzewski<sup>3</sup>, Daniel Malzcewski<sup>3</sup>, Bartosz Molik<sup>4</sup>. <sup>1</sup>The University of Montana, Missoula, MT. <sup>2</sup>Chiang Mai University, Chiang Mai, Thailand. <sup>3</sup>Bielanski Hospital, Warsaw, Poland. <sup>4</sup>Józef Pilsudski University of Physical Education, Warsaw, Poland. (Sponsor: Charles Dumke, FACSM)  
 Email: james.laskin@umontana.edu  
 (No relationships reported)

Accelerometry has become widely used to determine energy expenditure (EE) and daily physical activity patterns in a variety of able-bodied populations. The reliability and validity of this device has been well documented in the able-bodied population, however the assumption has been that the prediction equations used are appropriate for use in those with locomotor dysfunction (LD).

**PURPOSE**

The purpose of this study was two fold: 1) to examine the validity of the able-bodied prediction equations in a heterogeneous group of individuals with LD and 2) determine the effectiveness of using clinical measures of locomotor function to improve the prediction of EE in this population.

**METHODS**

Actical™ accelerometers were placed bilaterally on the wrists and ankles of 90 individuals (18 to 91 yrs). Diagnoses included stroke, MS, brain injury, arthritis, congenital deformity, and other orthopedic/neurological conditions. An Oxycon Mobile metabolic system was used to collect and determine actual EE (AEE). Baseline AEE was determined with the participants supine for 5 min, followed by 5 min of quiet standing, 5 min of a sweeping/vacuuming task, 5 min walking at a self-determined comfortable pace and completing a 6 minute walk test (6MWT). The Timed Up and Go (TUG), 10 Meter Walk (10W), 30-second Chair Stand (30CS), and 4 stage standing balance (4SB) were used a determinants of ambulatory function.

**RESULTS**

The AEE was found to be significantly higher than the PEE (p<0.05) at both the wrist and ankle. The correlations between AEE and the 4 Actical™ sites were poor and not significant. The activity counts (AC) at the bilateral wrist and ankle sites were poorly correlated. Backwards regression, produced an R=0.718 and used the variables of gender, weight, age, 30CS, 4SB, the fast 10mW, and fast 10mW - slow 10mW.

**CONCLUSION**

We found the AEE was consistently under predicted in people with LD. In contrast to the able-bodied there is no correlation between measures of EE and AC regardless of the measurement site. This study demonstrates that with the addition of a few clinical indicators of locomotor function it is possible to improve the prediction of EE in individuals with LD.

1796 Board #7 June 2, 1:00 PM - 3:00 PM  
**Reliability Of Step Counts Measured By Activity Monitors In Patients With Abnormal Gait**  
 Tomohiro Oba<sup>1</sup>, Hiroaki Iwase<sup>2</sup>, Kojiro Ishii<sup>1</sup>. <sup>1</sup>*Doshisha University, Kyotanabe-shi, Kyoto-fu, Japan.* <sup>2</sup>*Kyoto Tachibana University, Kyoto, Japan.* (Sponsor: Susumu Sawada, FACSM)  
 Email: hrndn660@yahoo.co.jp  
 (No relationships reported)

Few studies reported reliability of step counts measured by activity monitors, low walking speed and differences of attachment side such as affected side (A/S) or unaffected side (U/S) for stroke survivors influence it. However, the conditions of that are yet unclear for the patients with abnormal gait. **PURPOSE:** To investigate the devices and conditions under which reliable step count measurements can be obtained in patients with abnormal gait using several activity monitors. **METHODS:** The subjects were 32 hospitalized patients (12 patients with femoral fracture; 8 patients with spomdylopathies; 5 patients with cerebrovascular disease; 7 patients with other conditions). Four types of activity monitors were used: monitors with triaxial accelerometers, biaxial accelerometers, uniaxial accelerometers, and spring-levered pedometers. Measurements were performed by attaching an activity monitor to the left and right sides (A/S, U/S) and then having a patient walk 25 m at their normal speed. This task was performed 4 times using all the activity monitors. For statistical analysis, the dependent variables were 2 groups with measurement error [(activity monitor step count - actual step count) / actual step count × 100] ± 3% (Japanese Industrial Standards of pedometer) as the dividing line and the independent variable was walking speed. The cut-off velocity (COV) and area under the curve (AUC) was determined from receiver operating characteristic (ROC) curves for each activity monitor attachment side. **RESULTS:** The mean walking speed was 0.78 ± 0.29 m/s. Based on the ROC curve results for the monitors with triaxial accelerometers (U/S; COV: 0.9 m/s, AUC: 0.99, p<.01, A/S; COV: 0.99 m/s, AUC: 0.85, p<.01), biaxial accelerometers (U/S; COV: 1.04 m/s, AUC: 0.81, p<.05, A/S; COV: 0.97 m/s, AUC: 0.80, p<.01), and spring-levered pedometers (A/S; COV: 1.00 m/s, AUC: 0.80, p<.05), it was easier to obtain a measurement error of less than 3% at a higher COV. Significant results were not obtained for the other combinations. **CONCLUSIONS:** This study suggests that the condition is walking speed higher than 0.9 to 1.0 m/s for measurement of step count of patients with abnormal gait. In addition, the better devices are triaxial and biaxial accelerometers. Spring-levered pedometers are also reliable, but only affected side.

1797 Board #8 June 2, 1:00 PM - 3:00 PM  
**Sedentary Time among Adults with Chronic Obstructive Respiratory Conditions**  
 Shilpa Dogra. *University of Ontario Institute of Technology, Oshawa, ON, Canada.*  
 Email: shilpa.dogra@uoit.ca  
 (No relationships reported)

Asthma and chronic obstructive pulmonary disease (COPD) are prevalent conditions that affect 1 in 12 and 1 in 6 Canadians, respectively. Asthma-COPD overlap syndrome (ACOS) has been shown to affect between 15-20% of those with COPD. However, little is known of sedentary time in any of these groups. Given the health consequences of sedentary time, reduction interventions may be an important avenue for improving health among those with chronic obstructive respiratory disease. **PURPOSE:** To describe self-reported weekly sedentary time, and to determine the association between sedentary time and health outcomes among adults with asthma, COPD or ACOS. **METHODS:** A sample of adults from the Canadian Community Health Survey (2011-2012) was used for analysis. Average weekly sedentary time in the past 3 months was categorized in 5 hour increments and dichotomized as >29 hours or <29 hours; this cut-point represents 4 hours of sedentary time per day. Self-reported physician diagnosed asthma and COPD were used to categorize respiratory conditions. Respondents with both COPD and asthma were classified as ACOS. Each category was exclusive of the other. Perceived health, mood disorder (depression) and high blood pressure were used as outcomes. **RESULTS:** Of those with ACOS (n=1,673), 29.4% were sedentary for 45 or more hours per week. Similarly, 27.6% of those with COPD (n=3,290) and 16.7% of those with asthma (n=6,151) were sedentary for 45 or more hours per week. In models adjusted for age, sex, physical activity levels and presence of cardiometabolic disease (diabetes, heart disease or stroke), adults with asthma, COPD and ACOS had a 21% (OR: 1.21, CI: 1.10-1.28), 70% (OR: 1.70, CI: 1.52-1.90) and 75% (OR: 1.75, CI: 1.50-2.04) higher odds of being sedentary for 29 or more hours per week compared to those with no respiratory conditions. Similarly, in fully adjusted models, individuals with asthma and COPD who were sedentary had higher odds of good perceived health, mood disorders and high blood pressure compared to those who were non-sedentary. Among those with ACOS, blood pressure was not associated with sedentary time (OR: 0.91, CI: 0.65-1.26). **CONCLUSION:** It appears that adults with chronic obstructive respiratory conditions are engaging in high volumes of sedentary time and that sedentary time is associated with worse health outcomes.

D-17 Thematic Poster - Women's Physiology - Skeletal Muscle, Connective Tissue, and Bone  
 Thursday, June 2, 2016, 1:00 PM - 3:00 PM  
 Room: 110

1798 **Chair:** Lisa Ferguson-Stegall. *Hamline University, Saint Paul, MN.*  
 (No relationships reported)

1799 Board #1 June 2, 1:00 PM - 3:00 PM  
**Physical Exercise Programs In A Young Female Rat Model: What Is Most Osteogenic?**  
 Priscilla Aveline<sup>1</sup>, Eric Lespessailles<sup>1</sup>, Marija Mazar<sup>1</sup>, Gaith Larguech<sup>1</sup>, Masensen Cherief<sup>1</sup>, Thomas M. Best, FACSM<sup>2</sup>, Hechmi Toumi<sup>3</sup>. <sup>1</sup>*Orleans University France, I3MTO, EA4708, Orléans IPROS CHR Orleans, France.* <sup>2</sup>*Ohio State USA, Division of Sports Medicine, Department of Family, OH.* <sup>3</sup>*Orleans University France, I3MTO, EA4708, Orléans IPROS CHR Orleans, France.* (Sponsor: Pr. Thomas Best, FACSM)  
 Email: hechmi.toumi@univ-orleans.fr  
 (No relationships reported)

The effects of physical activity on bone formation remain unclear. Herein, we compared running and jumping exercise and their effects on osteogenesis. Methods: Fifty female Wistar rats, 6 weeks-old, were divided into a control group (S) and 4 exercise groups: treadmill training (T), 3 Free-Fall (F) groups, rats dropped from height of 30cm (F30), 45cm (F45) and 60cm (F60), 5 days/week, for 8 weeks. We evaluated: BMD (by DXA), trabecular bone of the femur and vertebrae and cortical bone architecture of the femur (by  $\mu$ CT), mechanical strength of the femur (bending test), osteocalcin and NTX levels (by ELISA). Results: After 8 weeks, whole body BMD was significantly higher from baseline in all 4 exercise groups, with no difference between groups (p<0.04). Left femur BMC and BMD significantly increased in F45 and F60 groups compared to S and T groups (p<0.03). In the exercise groups, BV/TV, Tb.Th, Tb.N and Tb.Pf were significantly higher at W8 in the F45 and F60 compared to S, F30 and T groups (p<0.04). Biomechanical properties were modified only in the F30 and F45 groups. CSA of the left femur was significantly higher for F30 compared to S and F60 (p<0.05) while moment of inertia, yield point stress and Youngs modulus were significantly higher for F45 compared to S and F60 (p<0.03). Bone alkaline phosphatase (ALP) levels were higher in all three F groups compared to the control group (p<0.04). Osteocalcin was significantly increased in F45 compared to the other groups (p<0.02). NTX level was significantly decreased in F45 group compared to S and T groups (p<0.03). Conclusion: These data show free fall exercise exerts significant positive effects on bone formation marker and strength compared to running. Free fall from 45cm produced the highest benefit on osteogenic biomarkers.

1800 Board #2 June 2, 1:00 PM - 3:00 PM  
**Ibuprofen Before Exercise Does Not Alter Cortical Bone Adaptations to Treadmill Running in Female Rats**  
 Vanessa D. Sherk<sup>1</sup>, R. Dana Carpenter<sup>2</sup>, Erin D. Giles<sup>1</sup>, Robera Oljira<sup>1</sup>, Samuel Mills<sup>2</sup>, Ginger C. Johnson<sup>1</sup>, Janine A. Higgins<sup>1</sup>, Paul S. MacLean<sup>1</sup>. <sup>1</sup>*University of Colorado Anschutz Medical Campus, Aurora, CO.* <sup>2</sup>*University of Colorado Denver, Denver, CO.*  
 Email: Vanessa.sherk@ucdenver.edu  
 (No relationships reported)

Clinical studies indicate that taking ibuprofen before exercise prevents the expected increase in bone mineral density in women. However, it is unknown whether this translates to an attenuation of bone strength and structural adaptations to training. **PURPOSE:** To determine whether taking ibuprofen before exercise prevents changes in bone strength and structure due to treadmill running. **METHODS:** Adult female Wistar rats (n=43) were individually housed in metabolic caging designed to promote physical inactivity. Rats were randomized to Ibuprofen (IBU) or Vehicle (VEH) and Running (RUN) or Sedentary (SED) groups in a 2x2 (drug, activity) design. Ibuprofen drops (30 mg/kg BW) or vehicle (volume equivalent) were administered orally 1 hour before treadmill running or at a similar clock time. Treadmill running occurred 5 days/week for 60 min/day at 20 m/min with a 5° incline for 12 weeks. MicroCT, mechanical testing, and finite element modeling were used to quantify bone characteristics. ANCOVAs were covaried on body weight, and data are reported as mean±SE. **RESULTS:** There was a nonsignificant drug\*activity interaction for tibia failure load (p=0.08), where VEH-RUN had the highest bone strength. Other interactions were not

significant (all  $p > 0.14$ ). Exercise increased tibia cortical cross-sectional area (RUN:  $5.67 \pm 0.10$ ; SED:  $5.37 \pm 0.10$  mm<sup>2</sup>,  $p < 0.01$ ) and micro-CT based estimates of the bending resistance (Imax) and torsional strength (SecModPolar) of the tibia (Imax: RUN:  $5.16 \pm 0.18$ ; SED:  $4.70 \pm 0.18$  mm<sup>4</sup>,  $p < 0.01$ ; SecModPolar: RUN:  $4.01 \pm 0.11$ ; SED:  $3.74 \pm 0.10$  mm<sup>3</sup>,  $p < 0.01$ ). RUN had increased failure load (RUN:  $243 \pm 9$ ; SED:  $223 \pm 14$  N,  $p < 0.01$ ) and decreased distortion in response to a standardized load (200 N) (Von Mises Stress at Tibia-Fibula Junction: RUN:  $48.2 \pm 1.3$ ; SED:  $51.7 \pm 1.2$  MPa,  $p = 0.01$ ), but there was no effect of ibuprofen. Femur results revealed similar patterns. **CONCLUSIONS:** Our data do not support the hypothesis that taking ibuprofen before exercise prevents the skeletal benefits of exercise. However, an exercise paradigm that engenders higher bone strains may be required to detect an effect of ibuprofen.

**1801 Board #3 June 2, 1:00 PM - 3:00 PM**  
**Unique Effects of Energy versus Estrogen Deficiency on Components of Bone Strength in Exercising Women**

Emily Southmayd, Rebecca Mallinson, Nancy Williams, FACSM, Mary Jane De Souza, FACSM. *Penn State University, University Park, PA.*  
 Email: emily.southmayd@gmail.com  
 (No relationships reported)

Exercising women with menstrual disturbances are at risk for poor bone health due to hypoestrogenism. Energy deficiency often instigates menstrual dysfunction resulting in metabolic adaptations that independently threaten bone. Women experiencing both an energy and estrogen deficiency face an exacerbated risk to bone health. **PURPOSE:** To describe volumetric bone mineral density (vBMD), bone geometry, and estimated bone strength in exercising women ( $n = 50$ ) grouped by energy status (energy replete (EnR;  $n = 25$ ); energy deficient (EnD;  $n = 25$ )) and estrogen status (estrogen replete (E<sub>2</sub>R;  $n = 24$ ); estrogen deficient (E<sub>2</sub>D;  $n = 26$ )) resulting in four groups: EnR+E<sub>2</sub>R ( $n = 12$ ), EnR+E<sub>2</sub>D ( $n = 13$ ), EnD+E<sub>2</sub>R ( $n = 12$ ), EnD+E<sub>2</sub>D ( $n = 13$ ). **METHODS:** Energy status was defined by the ratio of measured to predicted resting energy expenditure (mREE/pREE). Estrogen status was defined by self-reported menstrual status and confirmed by assessment of urinary metabolites of reproductive hormones over one menstrual cycle or 28 day monitoring period. Peripheral quantitative computed tomography assessed vBMD, bone geometry, and estimated bone strength at the radius and tibia. **RESULTS:** The groups were similar in age ( $21 \pm 0.4$  years), gynecological age ( $8 \pm 0.5$  years), height ( $165.7 \pm 0.9$  cm), and weight ( $57.7 \pm 1.2$  kg). At the proximal tibia, EnD women exhibited significantly lower total vBMD, cortical area, and cortical thickness and greater endosteal circumference than EnR women ( $p \leq 0.020$ ). E<sub>2</sub>D women exhibited significantly lower total and cortical vBMD and bone strength index (BSI) and greater total and trabecular area ( $p \leq 0.040$ ) at the distal radius and lower cortical vBMD and thickness ( $p \leq 0.019$ ) at the proximal radius compared to E<sub>2</sub>R women. EnD+E<sub>2</sub>D women had significantly lower total and trabecular vBMD at the distal tibia and radius and total vBMD and cortical thickness at the proximal tibia compared to EnR+E<sub>2</sub>D women ( $p \leq 0.048$ ). **CONCLUSION:** Energy versus estrogen status affected bone differently and effects were site-specific. Women with both an energy and estrogen deficiency experienced the most adverse bone adaptations. Treating energy deficiency in exercising women may improve reproductive health, in turn addressing the unique contributions of energy status versus estrogen status to bone health. Supported by US DoD (PR054531).

**1802 Board #4 June 2, 1:00 PM - 3:00 PM**  
**Cumulative Menstrual Status is an Important Determinant of Femoral Neck Geometry in Exercising Women**

Rebecca J. Mallinson<sup>1</sup>, Nancy I. Williams, FACSM<sup>1</sup>, Jenna C. Gibbs<sup>2</sup>, Karsten Koehler<sup>3</sup>, Heather C.M. Allaway<sup>1</sup>, Emily A. Southmayd<sup>1</sup>, Mary Jane De Souza, FACSM<sup>1</sup>. <sup>1</sup>*Penn State University, University Park, PA.* <sup>2</sup>*University of Waterloo, Waterloo, ON, Canada.* <sup>3</sup>*University of Nebraska, Lincoln, NE.*  
 Email: mallinsonrj@gmail.com  
 (No relationships reported)

Menstrual status, both past and current, has been established as an important determinant of bone mineral density (BMD) in young exercising women. However, little is known about the association between the cumulative effect of menstrual status and bone geometry and strength. **Purpose:** To explore the association between cumulative menstrual status and estimated femoral neck (FN) geometry and strength assessed using dual-energy x-ray absorptiometry (DXA) in exercising women. **Methods:** 95 exercising women ( $22.2 \pm 0.4$  yr, BMI  $21.1 \pm 0.2$  kg/m<sup>2</sup>) participated in this cross-sectional study. Women were divided into three groups: 1) current and past regular menstrual cycles (C+P-R,  $n = 23$ ), 2) current and past irregular menstrual cycles (C+P-IR,  $n = 51$ ), and 3) current or past irregular cycles (C/P-RIR,  $n = 21$ ). Estimates of FN geometry and strength were obtained from hip strength analysis. Cross-sectional moment of inertia (CSMI), cross-sectional area (CSA), and strength index (SI) were calculated at the FN. Low CSMI, CSA, and SI were operationally defined

as values below the median. Chi-square tests and multivariable logistic regression were performed to compare the prevalence and determine the odds, respectively, of low CSMI, CSA, and SI among groups. **Results:** The groups did not differ in weight, height, BMI, or body composition ( $p > 0.05$ ); however, the C+P-IR group was younger than the C+P-R group ( $p = 0.023$ ). Cumulative menstrual status was a significant predictor of low FN CSMI and low FN CSA after controlling for confounding variables. When compared with the C+P-R group, the odds of C+P-IR women having low FN CSMI were 7.3 times greater (95% CI: 1.6-34.0,  $p = 0.011$ ) and the odds of C/P-RIR women having low FN CSA were 4.5 times greater (95% CI: 1.1-18.9,  $p = 0.039$ ). Chi square analysis revealed no significant association between menstrual group and low FN CSMI, CSA, or SI ( $p > 0.05$ ). **Conclusion:** In exercising women, the cumulative effect of current and past menstrual irregularity appears to be an important predictor of smaller estimates of FN geometry, which may serve as another means, beyond BMD, by which menstrual irregularity compromises bone strength. These findings support the recommendation that current and past menstrual status should be evaluated in female athletes when assessing bone health. Supported by US DoD (PR054531)

**1803 Board #5 June 2, 1:00 PM - 3:00 PM**  
**The Osteogenic Response was higher in Postmenopausal than in Premenopausal Women Following The Same Exercise Intervention**

Eva W. Helge<sup>1</sup>, Michael T. Lund<sup>1</sup>, Mogens T. Pedersen<sup>1</sup>, Sofie G. Dideriksen<sup>1</sup>, Carina V. Abildskov<sup>1</sup>, Simon Esrup<sup>1</sup>, Magnus Bendtsen<sup>1</sup>, Anders O. Madsen<sup>1</sup>, Anette Bundgaard<sup>1</sup>, Niklas R. Jørgensen<sup>2</sup>. <sup>1</sup>*University of Copenhagen, Copenhagen N, Denmark.* <sup>2</sup>*Research Center for Ageing and Osteoporosis, Glostrup, Denmark.*  
 Email: ewhelge@nexs.ku.dk  
 (No relationships reported)

Bone loading exercise is an important osteogenic stimulus, and multimodal exercise regimens associated with high bone strains are suggested to improve bone mass. However, it is discussed whether it is possible to induce improvements in bone mass after peak bone mass, especially after menopause. **PURPOSE:** To investigate the osteogenic impact of high-intensity, multimodal training in postmenopausal women (I-POM) compared to premenopausal women (I-PREM) and two matched control groups (C-POM and C-PREM). **METHODS:** The supervised intervention lasted 19 weeks, 3 x 30 min weekly. The varied training was of high musculoskeletal intensity aimed to elicit large and powerful forces on the skeleton. 49 healthy, sedentary women participated: I-POM ( $N = 21$ ;  $57.1 \pm 4.8$  yrs;  $64.5 \pm 8.1$  kg), C-POM ( $N = 12$ ;  $57.9 \pm 3.9$  yrs;  $63.9 \pm 10.6$  kg), I-PREM ( $N = 9$ ;  $43.6 \pm 4.7$  yrs;  $76.5 \pm 15.5$  kg), and C-PREM ( $N = 7$ ;  $42.9 \pm 5.9$  yrs;  $66.0 \pm 12.3$  kg). DXA-derived bone mineral density (BMD, g/cm<sup>3</sup>) in right (R) and left (L) proximal femur (PF) and lumbar spine (LS), plasma Osteocalcin (OC, µg/l), procollagen type 1 amino-terminal propeptide (PINP, µg/l) and C-terminal telopeptide of type 1 collagen (CTX-1, µg/l) were measured at baseline and post-intervention. OC, PINP and CTX-1 were also measured after 3 and 12 weeks. **RESULTS:** Post-intervention BMD was increased more ( $0.001 < P < 0.05$ ) in I-POM than in C-POM in PF (total R  $0.8 \pm 1.6\%$  vs.  $-1.0 \pm 1.1\%$ ; total L  $0.7 \pm 1.6\%$  vs.  $-0.5 \pm 1.1\%$ ; shaft R  $0.8 \pm 2.1\%$  vs.  $-0.8 \pm 1.6\%$ ; shaft L  $1.1 \pm 1.9\%$  vs.  $-0.3 \pm 1.0\%$ ; trochanter R  $1.2 \pm 2.4\%$  vs.  $-1.1 \pm 2.0\%$ ; trochanter L  $0.8 \pm 3.4\%$  vs.  $-0.3 \pm 1.9\%$ ) and in LS (L1-L4  $0.9 \pm 2.3\%$  vs.  $-1.1 \pm 2.8\%$ ; L2  $1.3 \pm 3.1\%$  vs.  $-1.3 \pm 3.2\%$ ). Plasma OC was increased more ( $0.0005 < P < 0.005$ ) in I-POM than in C-POM after 3 weeks ( $11.7 \pm 20.5\%$  vs.  $-9.3 \pm 19.4\%$ ), 12 weeks ( $23.7 \pm 17.6\%$  vs.  $-11.5 \pm 29.0\%$ ) and post-intervention ( $18.0 \pm 25.9\%$  vs.  $-14.8 \pm 28.6\%$ ), but plasma PINP and CTX-1 did not differ between the groups. The change scores in BMD, plasma OC, PINP and CTX-1 did not differ between I-PREM and C-PREM. **CONCLUSION:** The osteogenic effect of 19 weeks training was higher in postmenopausal than in premenopausal women following the same multimodal high-intensity exercise intervention. It was possible to improve bone mass after menopause and counteract the age-related reduction in BMD.

**1804 Board #6 June 2, 1:00 PM - 3:00 PM**  
**Relationships for MMG Amplitude and Frequency vs. Torque in Women With Higher vs. Lower Strength**

Colleen N. Gulick, Jared W. Coburn, FACSM, Andrew J. Galpin, Pablo B. Costa. *California State University, Fullerton, Fullerton, CA.* (Sponsor: Jared W Coburn, FACSM)  
 Email: cgulick11@gmail.com  
 (No relationships reported)

**PURPOSE:** To examine the MMG amplitude and mean power frequency (MPF) vs. torque relationships during isometric muscle actions in women who differ in muscular strength. **METHODS:** Twelve women volunteered to perform isometric leg extension muscle actions at 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100% of maximal voluntary contraction (MVC) on a HUMAC NORM isokinetic dynamometer. The women were classified into lower strength ( $n = 6$ ;  $23.2 \pm 1.7$  y,  $165.6 \pm 7.6$  cm,  $59.3 \pm 10.1$  kg) and

higher strength ( $n = 6$ ;  $22.8 \pm 2.0$  y,  $164.6 \pm 4.8$  cm,  $72.7 \pm 12.2$  kg) groups on the basis of their isometric MVC values (lower strength women MVC =  $98.0 \pm 20.6$  Nm, higher strength women MVC =  $169.2 \pm 27.5$  Nm). An accelerometer (EGAS S704 10 Rev C) was placed over the vastus lateralis to detect the MMG signal. The amplitude of the MMG signal was expressed as root mean square (RMS), while frequency data were expressed as mean power frequency (MPF). Torque (Nm) was recorded by the dynamometer.

**RESULTS:** Polynomial regression analyses indicated that the relationships for MMG amplitude versus isometric MVC were quadratic for both the lower strength ( $R^2 = 0.987$ ) and higher strength ( $R^2 = 0.964$ ) women. However, for the lower strength women, MMG amplitude increased most between 60 and 100% isometric MVC, while for the higher strength women, MMG amplitude increased most between 10 and 60% MVC, then began to plateau. For MMG MPF, the relationships were cubic for the lower strength women ( $R^2 = 0.861$ ) and linear for the higher strength women ( $R^2 = 0.902$ ).

**CONCLUSIONS:** The different torque-related responses for MMG amplitude and MPF may reflect differences in the motor control strategies that modulate torque production for lower vs. higher strength women. These results also suggest that isometric torque production is controlled by a combination of recruitment and firing rate, but that the reliance on each mechanism differed throughout the entire range of torque production between lower strength and higher strength women. Lastly, the torque-related patterns for MMG amplitude and frequency may also have been affected by differences in absolute torque, and thus muscle stiffness, between the lower strength and higher strength women.

1805 Board #7 June 2, 1:00 PM - 3:00 PM  
**Increased Fatigability Of Older Women Performing High-velocity Contractions Is Explained By Mechanisms Within The Muscle**

Christopher W. Sundberg, Hamidollah Hassanlouei, Andrew Kuplic, Sandra K. Hunter, FACSM. *Marquette University, Milwaukee, WI.* (Sponsor: Sandra K Hunter, FACSM)  
 Email: christopher.sundberg@marquette.edu  
 (No relationships reported)

Older adults are often more fatigable than young adults during high-velocity concentric contractions. This age-related difference in fatigability, however, has been studied primarily in men, and the contribution of supraspinal mechanisms are unknown.

**PURPOSE:** The purpose of this study was to quantify the changes in voluntary activation and contractile properties of the knee extensors in response to high-velocity dynamic contractions in 12 young ( $22.5 \pm 0.6$  [SE] yrs) and 18 old women ( $71.7 \pm 1.5$  yrs). **METHODS:** Subjects performed 80 maximal velocity concentric contractions (1 every 3 s) with a load set at 20% of the maximal voluntary isometric contraction (MVC). Transcranial magnetic stimulation (TMS) and peripheral nerve stimulation were used to measure voluntary activation and the contractile properties, respectively, before and immediately ( $<10$  s) following the fatiguing task. **RESULTS:** Old women generated 55% less power ( $P < 0.01$ ) and 43% lower isometric MVC torque ( $P < 0.01$ ) than the young women. At the end of the fatiguing task, power was reduced by  $35 \pm 4.7\%$  in the old compared to  $20 \pm 3.7\%$  in the young ( $P = 0.02$ ). The reduction in MVC torque, however, was similar for the old and young ( $25 \pm 2.5\%$  vs  $22 \pm 1.6\%$ , respectively,  $P = 0.28$ ). Voluntary activation was similar between the old and young ( $97 \pm 0.7\%$  vs  $97 \pm 0.6\%$ , respectively,  $P = 0.90$ ) before fatigue, but was reduced only in the old after the fatiguing task by  $3 \pm 1.1\%$  ( $P = 0.04$ ). Potentiated twitch amplitude was reduced by  $30 \pm 4.7\%$  in the old compared with  $13 \pm 5.4\%$  in the young ( $P = 0.02$ ). Similarly, twitch half-relaxation times increased more in the old compared with the young women ( $72 \pm 12.8\%$  vs  $32 \pm 9.4\%$ , respectively,  $P = 0.02$ ). **CONCLUSIONS:** Both a loss in voluntary activation from supraspinal centers and fatigue within the muscle are responsible for the greater loss in power during high-velocity dynamic contractions in old compared with young women. However, the large age-related reductions in the contractile properties indicate that muscular mechanisms are primarily responsible for the greater loss in power during knee extension in the old compared with the young women.

Supported by NIA (R21 AG045766) to SK Hunter.

1806 Board #8 June 2, 1:00 PM - 3:00 PM  
**Effects of Training on ACL Volume in Female Intercollegiate Soccer Athletes.**

Gene Kim, Bernadette Mele, Karen Myrick, Richard Feinn, Ramon Gonzales, Juan C. Garbalosa. *Quinnipiac University, Hamden, CT.*  
 Email: gene.kim@quinnipiac.edu  
 (No relationships reported)

Anterior cruciate ligament (ACL) injuries are one of the most common injuries that occur in competitive sports, affecting female athletes two to ten times more than males. While previous studies have correlated ACL volume with injury retrospectively, little information is available on how the ACL volume changes during periods of intense physical activity.

ACSM May 31 – June 4, 2016

**PURPOSE:** To characterize the volumetric changes that occur in the ACLs of female soccer athletes over the course of a competitive season.

**METHODS:** A sample of 16 Division I female collegiate soccer players were recruited for participation in this study. To be included in the study, subjects must have been members of the Quinnipiac University women's soccer team without previous history of ACL injury. All subjects underwent MRI scans of both knees, prior to the start and at the completion of the competitive season. Contours of the ACL were manually delineated in sagittal MR images and volumes were calculated. Mean volume comparisons were made using a paired t-test. ACLs were graded for the presence of edema by an orthopedic surgeon. Changes in the occurrence of edema were evaluated using the McNemar test.

**RESULTS:** Twenty-three of the 32 ACLs (72%) showed a greater volume post-season compared to pre-season. The mean difference in volume was statistically significant (pre-season  $1.43 \pm 0.29$  cc; post-season  $1.56 \pm 0.27$  cc;  $p = 0.006$ ). The presence of edema was noted in 33% of the ACLs at pre-season versus 47% at post-season, however this increase was nonsignificant ( $p = 0.17$ ).

**CONCLUSIONS:** The intense physical demand of a competitive soccer season in female collegiate athletes appears to cause an increase in volume of the ACL which may be associated with edema of the ligament. The clinical significance of this finding requires further research.

D-18 Free Communication/Slide - Loading and Unloading

Thursday, June 2, 2016, 1:00 PM - 3:00 PM  
 Room: 313

1807 **Chair:** Stephen P. Messier, FACSM. *Wake Forest University, Winston-Salem, NC.*  
 (No relationships reported)

1808 June 2, 1:00 PM - 1:15 PM  
**Cardiorespiratory Fitness, Adiposity Or Muscular Strength- The Best Predictor For Gait Biomechanics In Obese Children?**

Bhupinder Singh<sup>1</sup>, Megan G. Negatu<sup>1</sup>, Amber J. Hammons<sup>1</sup>, Shelby L. Francis<sup>2</sup>, Kathleen F. Janz, FACSM<sup>2</sup>, H. John Yack<sup>2</sup>.  
<sup>1</sup>California State University, Fresno, CA. <sup>2</sup>University of Iowa, Iowa City, IA.  
 Email: bhsingh@csufresno.edu  
 (No relationships reported)

Obese children may find it difficult to perform physical activity for a variety of reasons, including low cardiorespiratory fitness, decreased strength and increased joint moments but the relationships among these variables have not been previously investigated. **PURPOSE:** To explore the effect of including measures of cardiorespiratory fitness, adiposity and muscular strength in predicting gait biomechanics in obese children. **METHODS:** Twenty nine children, 14 girls and 15 boys, mean age  $9.8 \pm 0.9$  years, mean BMI  $27.06 \pm 3.2$  kg/m<sup>2</sup> and mean BMI percentile  $96.1 \pm 4.1$ , were recruited from University of Iowa Obesity Clinics. The 15 m Progressive Aerobic Cardiovascular Endurance Run (PACER) protocol was used to estimate cardiorespiratory fitness (VO<sub>2</sub>max). Adiposity measured as percent body fat, was estimated by air displacement plethysmography (Bod Pod). Right lower limb isometric strength was assessed using a custom leg press device. Intra-red emitting markers were applied to lower limbs, pelvis, and trunk segments to generate subject specific biomechanical anatomical models of walking gait on an 8 m walkway using a 3D motion analysis system (Optotrak, Kistler). Peak hip and knee moments normalized to body weight for the right side were analyzed for five walking gait cycles. Step wise regression model included moments as dependent variable and fitness, adiposity and right lower limb strength, as the three independent variables. P-value  $< 0.05$  was considered significant. **RESULTS:** Mean aerobic fitness as estimated by PACER was low ( $34.1 \pm 6.0$  mL·min<sup>-1</sup>·kg<sup>-1</sup>). Mean adiposity was  $32.2 \pm 7.6\%$  body fat and mean right lower limb strength, was  $7.54 \pm 2.29$  N/kg. The step-wise regression model for hip and knee adductor moments included adiposity as the only predictor variable (adjusted R<sup>2</sup> = 0.3 and 0.22 respectively). Knee extensor moments selected both strength and adiposity as the predictor variables (adjusted R<sup>2</sup> = 0.35) whereas hip extensor moments did not include any variable. None of the step-wise models included cardiorespiratory fitness. **CONCLUSION:** Adiposity was the main factor in models for adduction moments, whereas adiposity and knee strength correlated with knee extensor moments. The result suggests that level of adiposity and strength may be important factors in predicting gait biomechanics in obese children.

1809 June 2, 1:15 PM - 1:30 PM

**Obesity Increases Joint Moments Relative to Available Strength During Gait**

Michael Madigan<sup>1</sup>, Hoda Koushyar<sup>2</sup>, Dennis Anderson<sup>3</sup>, Maury Nussbaum<sup>2</sup>. <sup>1</sup>Texas A&M University, College Station, TX. <sup>2</sup>Virginia Tech, Blacksburg, VA. <sup>3</sup>Harvard Medical School, Boston, MA. (Sponsor: Kevin Davy, FACSM)  
Email: mlm@tamu.edu  
(No relationships reported)

Lower extremity joint moments during gait are higher among obese individuals compared to non-obese individuals. However, because obese individuals also exhibit greater lower extremity strength, it is unclear if these joint moments are higher relative to available strength. **PURPOSE:** To investigate the effects of obesity on lower extremity joint moments during gait, expressed relative to available strength. **METHODS:** Participants included 19 obese (body mass index, or BMI  $\geq 30.0$  kg/m<sup>2</sup>) adults and 20 normal-weight (19 kg/m<sup>2</sup> < BMI  $\leq 25$  kg/m<sup>2</sup>) adults. Sagittal plane, lower extremity joint moments were determined during gait at a self-selected speed using an inverse dynamics analysis. Maximum voluntary isometric capacity (MVIC) was assessed at the hip, knee, and ankle in flexion and extension. Joint moments were normalized to MVICs, and compared between groups using a two-way ANCOVA with gait speed and leisure-time activity level as covariates. **RESULTS:** Obese participants used 52% higher normalized knee extensor moments during weight acceptance ( $p < 0.05$ ), and 55% higher normalized ankle plantar flexor moments during push off ( $p < 0.05$ ). No other differences in normalized joint moments were found between obesity groups. **CONCLUSIONS:** The higher joint moments at the knee and ankle relative to available strength could help explain gait limitations present among obese individuals.

1810 June 2, 1:30 PM - 1:45 PM

**The Effect of Added Weight on Foot Anthropometry in Pregnant Women and Controls**

Jean L. McCrory, FACSM<sup>1</sup>, Kathryn D. Harrison<sup>2</sup>, Corrie A. Mancinelli<sup>1</sup>, Petra Meszaros<sup>1</sup>, Krystal Thomas<sup>1</sup>. <sup>1</sup>West Virginia University, Morgantown, WV. <sup>2</sup>Virginia Commonwealth University, Richmond, VA.  
Email: jlmccrory@hsc.wvu.edu  
(No relationships reported)

Foot anthropometry is altered by pregnancy, but it is not known if these changes are due to increased weight or hormonal effects of pregnancy on the body. **PURPOSE:** The purpose of this study was to examine the effect of added weight on foot anthropometry in pregnant women and never-pregnant controls. **METHODS:** Fifteen primigravid women and 13 nulliparous controls participated. Controls were matched to the pregnant women based on the pregnant women's self-reported pre-pregnancy weight. Informed consent was obtained. Data were collected on the pregnant subjects in each trimester and post-partum. Foot length, foot width, arch index, arch height index, arch rigidity index, and arch drop were assessed. To determine the effect of added weight on foot anthropometry, pregnant subjects in their first two trimesters donned a weighted pack on the anterior trunk such that total weight difference from pre-pregnancy weight was 124N, which was based on data from a previous study. Foot measurements were then repeated while the subjects wore this pack. Third trimester subjects did not wear a pack as they were at full-pregnancy weight. For post-partum subjects, their body weight plus the weight of the pack equaled their third trimester weight. For control subjects, their body weight plus the weight of the pack equaled the third trimester weight of the pregnant subject to whom they were matched. A MANOVA was performed with the independent variables of trimester (control, 1st, 2nd, 3rd, and post-partum) and weight condition (natural or weighted). Tukey post-hoc analyses were performed if appropriate ( $\alpha = 0.05$ ). **RESULTS:** Arch drop increased by 18% ( $p = 0.001$ ) and arch rigidity index decreased by 1% ( $p = 0.002$ ) in the weighted condition compared to the natural condition. Increase in foot length and width and decrease in AHI with added weight was greater in pregnant subjects vs controls, with the change increasing over the course of the pregnancy. ( $p < 0.05$ ). **CONCLUSIONS:** Adding weight produced significant changes in arch drop and arch rigidity index, although weight plus advancing pregnancy was related to further alterations in foot anthropometry, indicating that other factors, such as increased hormone concentrations, may play a role in foot anthropometry changes in pregnancy.

1811 June 2, 1:45 PM - 2:00 PM

**Pelvis and Trunk Kinematic Changes in Response to Carrying Heavy Loads**

Joseph F. Seay, Shane G. Sauer, Peter N. Frykman, Rebecca E. Fellin. U.S. Army Research Institute of Environmental Medicine, Natick, MA.  
Email: joseph.f.seay.civ@mail.mil  
(No relationships reported)

Low back injuries are prevalent in warfighters, and have been linked with carrying loads. Trunk mechanics change with load carriage, but trunk and pelvis motions have not been studied while carrying heavy loads. Research has studied loads up to 40% bodyweight; however, today's warfighter can carry loads in excess of 50 kg for extended periods. **PURPOSE:** To examine the effect of carrying heavy vest-borne loads on pelvis and trunk mechanics. **METHODS:** 23 active duty male volunteers ( $21 \pm 3$  yrs;  $176 \pm 7$  cm;  $82.9 \pm 12$  kg) walked on a treadmill at 1.34 m/s during four conditions. The first condition was body weight only (BW), and the participants also carried vest-borne loads of 15, 35 and 55 kg. Each load was carried for 10 min (randomized order) after BW. Pelvis and trunk motion data were collected. Volunteers rested between loads for 3 min once their heart rate was  $< 100$  beats/min. Three-dimensional pelvis and trunk segment ranges of motion (ROM) were compared among loads using a 1-way RM ANOVA. **RESULTS:** Trunk and pelvis rotational ROM (transverse plane) decreased significantly with added load relative to BW (both  $p \leq .001$ , Table 1). In the frontal plane, pelvis ROM increased significantly as load increased. There were no changes in the sagittal plane. **CONCLUSIONS:** Decreased pelvis and trunk rotation likely minimizes torque production while walking with load. Increased pelvic lateral sway with added load was necessary to maintain stride mechanics and walking speeds. These load-related changes in pelvis and trunk mechanics may provide mechanistic insight into the link between load carriage and risk of back pain. Disclaimer: authors' views, not DoD/DA.

**Table 1.** Pelvis and trunk range of motion (Mean  $\pm$  SD degrees) for sagittal (X), frontal (Y) and transverse (Z) planes.

|        |   | BW            | 15 kg           | 35 kg             | 55 kg             |
|--------|---|---------------|-----------------|-------------------|-------------------|
| Trunk  | X | 4.7 $\pm$ 2.5 | 3.8 $\pm$ 0.8   | 3.8 $\pm$ 0.9     | 3.9 $\pm$ 0.8     |
|        | Y | 5.2 $\pm$ 1.9 | 5.4 $\pm$ 1.9   | 5.5 $\pm$ 2.0     | 4.8 $\pm$ 1.6     |
|        | Z | 8.3 $\pm$ 2.2 | 7.6 $\pm$ 2.1 * | 6.9 $\pm$ 2.0 *   | 5.1 $\pm$ 1.6 *   |
| Pelvis | X | 5.7 $\pm$ 1.1 | 6.5 $\pm$ 2.8   | 6.8 $\pm$ 3.2     | 6.9 $\pm$ 2.5     |
|        | Y | 8.0 $\pm$ 1.6 | 9.7 $\pm$ 1.6 * | 10.7 $\pm$ 2.1 *+ | 11.5 $\pm$ 2.2 *+ |
|        | Z | 8.1 $\pm$ 3.2 | 6.6 $\pm$ 2.4 * | 6.6 $\pm$ 2.2 *   | 7.3 $\pm$ 2.2     |

BW = bodyweight only; \* sig different from BW; + sig different from 15 kg

1812 June 2, 2:00 PM - 2:15 PM

**Impact Of Torso-borne Load Redistribution On Soldier Biomechanics**

Clifford L. Hancock, Marina Carboni, Megan Coyne, Karen N. Gregorczyk. US Army NSRDEC, Natick, MA.  
Email: clifford.l.hancock4.civ@mail.mil  
(No relationships reported)

Shoulder and back pain, primarily due to torso-borne loads, are two commonly reported musculoskeletal complaints among military personnel. Redistribution of these loads from the shoulders to the pelvic region may decrease the frequency and severity of these complaints. Identifying the impact redistributed load has on performance and risk of injury is critical to understanding the value of this load modification. **PURPOSE:** To assess the impact of torso-borne load redistribution on load carrier biomechanics. **METHODS:** Kinematics and kinetics were recorded for sixteen volunteers while walking on a treadmill at both 0 and 9% grades with 29.7 kg of torso-borne load and a load distribution device. The level of redistribution, measured as a percentage of offloading of shoulder pressure, was set by pressure sensors on the shoulders. Volunteers completed 5 offloading conditions: high (70-90%), medium (40-60%), low (10-30%), no offloading (~0%, where the load distribution device was not engaged), and the control (0%, where the load distribution device was not worn). Data analysis for key variables were submitted to a repeated measures ANOVA to test the main effects of and possible interactions between offloading condition and grade. **RESULTS:** Varying the load's distribution about the torso did not alter biomechanics (Table 1). However, many significant differences existed between the two grades. For instance, the 9% grade resulted in a 4.10° increased peak ankle angle ( $p = 0.003$ ), a 20.82° increased peak hip angle ( $p < 0.001$ ), and a 6.18° increased peak trunk angle ( $p < 0.001$ ). **CONCLUSION:** The examined load distribution device successfully alleviated pressure from the shoulders without altering Soldier biomechanics.

THURSDAY, JUNE 2, 2016

Table 1: Sample Results

|                  | 0%           |              |              | 9%           |              |              |
|------------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                  | L            | M            | H            | L            | M            | H            |
| vGRF (BW)        | 1.14 ± 0.06  | 1.16 ± 0.06  | 1.15 ± 0.06  | 1.14 ± 0.08  | 1.16 ± 0.07  | 1.16 ± 0.05  |
| Ankle Angle (°)* | 13.96 ± 2.50 | 13.62 ± 3.15 | 13.75 ± 3.10 | 17.40 ± 4.68 | 18.10 ± 2.48 | 18.14 ± 3.40 |
| Knee Angle (°)   | 69.86 ± 4.73 | 69.37 ± 4.96 | 70.86 ± 6.42 | 68.76 ± 6.42 | 69.92 ± 5.07 | 68.91 ± 6.66 |
| Hip Angle (°)*   | 39.27 ± 5.85 | 39.57 ± 4.70 | 41.10 ± 5.68 | 60.33 ± 6.56 | 60.10 ± 5.87 | 61.96 ± 9.05 |
| Trunk Angle (°)* | 0.57 ± 4.13  | 0.03 ± 2.75  | 0.17 ± 2.83  | 5.87 ± 4.01  | 5.84 ± 4.30  | 7.62 ± 6.15  |

1813 June 2, 2:15 PM - 2:30 PM  
**Effect Of Unweighting Assistance On Sit-to-stand Mechanics**

Kelsey L. Piersol, George J. Davies, Bryan L. Riemann.  
 Armstrong State University, Savannah, GA.  
 Email: piersol.kelsey@gmail.com  
 (No relationships reported)

Being able to rise from a chair is an important activity of daily living and often a determinant for independence in older adults. Older adults who have difficulty rising from a chair may benefit from training devices that provide adjustable unweighting assistance. **PURPOSE:** To determine the effects of four levels of unweighting assistance on sit-to-stand (STS) mechanics. **METHODS:** Healthy men (n=5) and women (n=9) aged 18-35 years completed five repetitions of the stand-sit-stand cycle using a STS training device (Sit2Stand Trainer, Biodex Inc., Shirley, NY) with assistance comparable to 40%, 50%, 60%, and 70% of body weight. For the current analysis, only the motion from sitting to standing was investigated. Subjects performed the repetitions using a self-selected pace at 5 second intervals. Feet, shanks, thighs, pelvis, and trunk kinematic data and ground reaction forces under the right foot were collected and used to determine total rise time, timing of peak joint velocities, and phases of the STS movement. Inverse dynamics were then used to calculate ankle, knee, and hip net joint moment impulses (NJMI) during two phases: lift off to peak dorsiflexion and peak dorsiflexion to end of movement. **RESULTS:** Assistance level had no significant (P>.05) effect on total rise time and timing of peak joint velocities. Assistance level by joint by phase analysis revealed a significant three-way interaction (P=.005). Post hoc interaction contrasts by phase revealed a significant assistance level by joint interaction (P<.001) during lift off to peak dorsiflexion. Subsequent trend analysis demonstrated significant linear NJMI reduction for hip (P=.036, d=1.30) and increase for ankle (P=.017, d=1.51) with greater assistance. From peak dorsiflexion to end of movement, there was a significant linear decrease in NJMI across all three joints (P=.010, d=2.36). **CONCLUSIONS:** STS movement timing was similar across the four assistance levels, however, the effects on NJMI were different for the two phases. From lift off to peak dorsiflexion, with greater assistance, torques at the hip were decreased with a concurrent increase at the ankle. From peak dorsiflexion to end of movement, greater assistance produced similar decreases across all three joints. Future research will begin replicating this study using older adults.

1814 June 2, 2:30 PM - 2:45 PM  
**Biofeedback Gait Retraining Reduces Impact Loading During Walking**

Ivan P.H. Au<sup>1</sup>, Winko W. An<sup>1</sup>, K.H. Ting<sup>1</sup>, Irene S. Davis, FACSM<sup>2</sup>, Roy T.H. Cheung<sup>1</sup>. <sup>1</sup>The Hong Kong Polytechnic University, Hong Kong, Hong Kong. <sup>2</sup>Harvard Medical School, Cambridge, MA. (Sponsor: Prof. Irene Davis, FACSM)  
 Email: ivan.ph.au@polyu.edu.hk  
 (No relationships reported)

High impact loading during walking has been associated with knee osteoarthritis (OA). It has been suggested that individuals with painful knee OA walk slower in order to reduce their impacts and their symptoms. However, such modification compromises gait performance. Studies have shown that impact loading during running can be reduced with gait retraining. This has not been examined in walking. **Purpose:** To examine the effects of a walk retraining program aimed at reducing impacts during landing. **Methods:** 12 healthy adults (5 males, 26.1±8.1 years) walked normally on an instrumented treadmill at 1.25 m/s with an accelerometer attached to the heel counter of their right shoe. Accelerometry and force data were sampled at 1,000 Hz. Subjects then underwent 8 sessions of retraining over 2 weeks. They were provided with real-time feedback on their acceleration. They were asked to reduce peak values to below a target of 80% of their baseline peak accelerations by landing softer. Walk time increased from 10-30 minutes and feedback was gradually removed

over the last 4 sessions. Accelerometry and force data were again collected following the retraining. Speed was maintained for the training sessions, and the pre and post assessments. The peak positive acceleration (PPA), along with the vertical impact peak (VIP) of the ground reaction force data were extracted and averaged over the 3-minute assessment session before and after retraining. **Results:** PPA and the VIP were both significantly reduced following the retraining (Table 1). **Conclusion:** These findings suggest impact loading during walking can be lowered with gait retraining, without compromising gait speed. Future studies will involve individuals experiencing knee pain related to OA.

Table 1. Peak positive acceleration and vertical impact peak before and after gait retraining

|                                    | Pre-training Mean (SD) | Post-training Mean (SD) | Cohen's d | P-value |
|------------------------------------|------------------------|-------------------------|-----------|---------|
| Peak positive acceleration (g)     | 12.00 (3.80)           | 6.14 (2.55)             | 1.73      | 0.002   |
| Vertical impact peak (body weight) | 1.22 (0.07)            | 1.09 (0.10)             | 0.96      | 0.022   |

1815 June 2, 2:45 PM - 3:00 PM  
**Effects of Reduced Body Weight on Plantar Pressures During Running**

Brianne Borgia, Natalie Maltz, David Lee, Ralph Rozenek, James Becker. California State University, Long Beach, Long Beach, CA.  
 (No relationships reported)

Research has previously documented reduced ground reaction forces, cadences, and stride lengths when using lower body positive pressure (LBPP) treadmills. However, it remains unknown how running on LBPP treadmills alters plantar pressure distributions. **PURPOSE:** To examine differences in plantar pressure when running on a LBPP treadmill at different levels of body weight (BW) support. **METHODS:** 10 healthy, recreationally active individuals (sex: 4 M, 6 F; age: 21 ± 2.5 years) participated in this study. Participants ran for 10 minutes at 100% BW, 75% BW, and 50% BW at a moderate intensity (2.29 ± .33 ms<sup>-1</sup>). During the last 2 minutes at each condition, plantar pressures were recorded using a wireless in-shoe system. Peak pressures under 10 specific regions of the foot were determined. For each region, differences in peak pressure between BW conditions were analyzed using repeated measures ANOVA. **RESULTS:** For all regions except the hallux, peak pressure was lower in the 50% BW condition than the 100% BW condition (all ANOVAs p < .005). Comparing 100% and 75% BW conditions, the only regions where peak pressure was different was the 2nd, 3rd, and 4th metatarsals (Figure 1). Peak pressure under the hallux was not different between any BW conditions (Figure 1). **CONCLUSIONS:** While removing BW reduced peak pressures, the effects were region dependent. This has implications for rehabilitation of running injuries. For example, when using a LBPP treadmill for rehabilitation in patient with stress fractures of 2nd, 3rd, or 4th metatarsal, a reduction to 75% BW may be sufficient. However, for other injuries BW may need to be reduced to 50%. Further research is required to investigate how these changes in BW may influence kinematics while running on a LBPP treadmill.

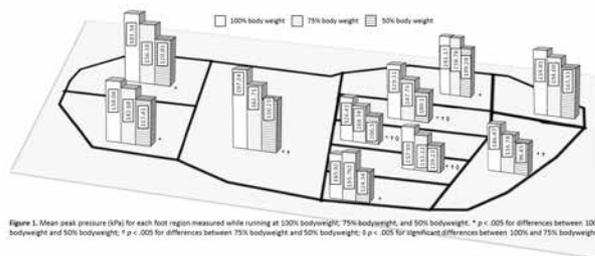


Figure 1. Mean peak pressure (kPa) for each foot region measured while running at 100% bodyweight, 75% bodyweight, and 50% bodyweight. \* p < .005 for differences between 100% bodyweight and 50% bodyweight; † p < .005 for differences between 75% bodyweight and 50% bodyweight; ‡ p < .005 for significant differences between 100% and 75% bodyweight

**D-19 Free Communication/Slide - Training Strategies**

Thursday, June 2, 2016, 1:00 PM - 3:00 PM  
Room: 102

1816 **Chair:** Kimberly Reich. *High Point University, Burlington, NC.*

(No relationships reported)

1817 June 2, 1:00 PM - 1:15 PM  
**Effect of Various Regimes of High Intensity Interval Training (HIIT) on Changes in Maximal Oxygen Uptake and Hemodynamic Function**

Todd A. Astorino<sup>1</sup>, Ross M. Edmunds<sup>2</sup>, Amy Clark<sup>1</sup>, Rachael M. Gallant<sup>1</sup>, Leesa King<sup>3</sup>, Samantha Namm<sup>1</sup>, Anthony Fischer<sup>1</sup>, Kimi A. Wood<sup>1</sup>. <sup>1</sup>California State University--San Marcos, San Marcos, CA. <sup>2</sup>SUNY-Stony Brook, Stony Brook, NY. <sup>3</sup>National College of Natural Medicine, Portland, OR.  
Email: astorino@csusm.edu

(No relationships reported)

Data (Burgomaster et al. 2008; Astorino et al. 2013) demonstrate improved maximal oxygen uptake ( $\dot{V}O_{2max}$ ) after 6 and 12 wk of high intensity interval training (HIIT) which enhances exercise performance and health status. A few studies (Daussin et al. 2008; MacPherson et al. 2011) document changes in cardiac output (CO) in response to HIIT in which increases in  $\dot{V}O_{2max}$  occurred, and their results are equivocal.

**PURPOSE:** To examine changes in  $\dot{V}O_{2max}$  and CO in response to various regimes of HIIT. **METHODS:** Fifty active men and women were randomized to control (CON, n = 24, age = 25.3 ± 4.7 yr) or one of three HIIT regimes, HIIT + sprint interval training (SIT) (n = 10, age = 22.8 ± 7.0 yr), HIIT + HIIT (n = 8, age = 21.8 ± 2.2 yr), or HIIT + periodized training (PER) (n = 8, age = 24.4 ± 6.8 yr). Training was performed 3 d/wk for 6 wk, with 10 sessions of HIIT (6–10 bouts of cycling for 60 s separated by 75 s recovery at 90–110% peak power output) completed followed by randomization to one of three regimes for the ensuing 3 wk of the study.  $\dot{V}O_{2max}$  was measured pre- and post-training during progressive exercise, during which pulmonary gas exchange data were obtained. Cardiac output, heart rate (HR), and stroke volume (SV) were continuously estimated using thoracic impedance (Physioflow Enduro). Participants maintained their habitual physical activity during the study, and prior to all assessments, they abstained from exercise for 48 h. **RESULTS:**  $\dot{V}O_{2max}$  was unchanged in CON, yet a significant groupXtime interaction ( $p < 0.01$ ) was demonstrated showing higher  $\dot{V}O_{2max}$  in HIIT + SIT (2.85 ± 0.47 L/min to 3.08 ± 0.34 L/min), HIIT + HIIT (2.81 ± 0.62 L/min to 3.02 ± 0.73 L/min), and HIIT + PER (2.64 ± 0.77 L/min to 2.92 ± 0.78 L/min). A significant groupXtime interaction ( $p = 0.038$ ) was revealed for HR in that it was higher through HIIT. Stroke volume differed across time ( $p = 0.009$ ) but no interaction occurred ( $p = 0.31$ ). Cardiac output differed across time ( $p = 0.006$ ) and a significant groupXtime interaction ( $p = 0.032$ ) was shown. Compared to CON (20.9 ± 3.3 L/min to 20.8 ± 3.2 L/min), CO was increased in HIIT + SIT (19.9 ± 2.5 L/min to 21.4 ± 1.0 L/min), HIIT + HIIT (21.1 ± 4.0 L/min to 22.2 ± 2.7 L/min), and HIIT + PER (20.0 ± 3.7 L/min to 21.6 ± 4.4 L/min). **CONCLUSION:** Similar increases in  $\dot{V}O_{2max}$  occur in response to various regimes of HIIT, with greater CO explaining this outcome.

1818 June 2, 1:15 PM - 1:30 PM  
**The Effect Of HIIT On Blood Lactate Indices And Performance In Well-trained Male Rowers**

Niamh J. Ni Chéilleachair<sup>1</sup>, Andrew J. Harrison<sup>2</sup>, Giles D. Warrington, FACSM<sup>2</sup>. <sup>1</sup>Athlone Institute of Technology, Athlone, Ireland. <sup>2</sup>University of Limerick, Limerick, Ireland.  
Email: nnicheilleachair@ait.ie

(No relationships reported)

Despite the fact that rowers compete close to maximum capacity, the majority of rowing training is typically performed at intensities below the lactate threshold. However, high intensity interval training (HIIT) may be effective at improving aerobic parameters and performance in rowers. **PURPOSE:** To compare the effects of HIIT with traditional, long, slow distance (LSD) training on submaximal blood lactate indices and performance in well-trained rowers.

**METHODS:** Fourteen well-trained male rowers participated in the study. Each participant completed an incremental step test to determine the power output at lactate threshold (WLT) and anaerobic threshold (WAT) and peak power output (PPO) and a 2000 m time trial (TT) on a rowing ergometer to determine performance pre and post an eight week training intervention. The incremental step test consisted of seven discontinuous bouts of four minutes at a fixed exercise intensity and stroke rate, with each bout followed by one minute recovery. The test began at a predetermined stroke rate, work load and increment based on each rower's best 2000 m TT from

the previous season, except for the final stage which was a maximum effort. A blood lactate sample was taken immediately after each bout. After the pre-test participants were randomly assigned to a HIIT or LSD group for the eight training intervention. The LSD group completed ten aerobic sessions per week while the HIIT group completed eight aerobic and two HIIT sessions. HIIT sessions involved 6-8 2.5 minute intervals performed at PPO with recovery based on heart rate returning to 70% maximum heart rate.

**RESULTS:** HIIT resulted in a significant improvement in WLT (17.8%,  $p = 0.022$  vs 0.9%,  $p = 0.984$ ) and this improvement was significantly greater than the change in WLT following LSD ( $p = 0.031$ ). The 2000 m TT performance also improved significantly following HIIT (396 to 389s, -1.8%,  $p = 0.044$ ) while there was no improvement following LSD (393 to 392s, -0.05%,  $p = 0.937$ ) However, this improvement was not significantly greater than that observed with LSD ( $p = 0.202$ ).

**CONCLUSIONS:** The results indicate that HIIT performed twice a week at 100% PPO, in addition to aerobic training, is an effective way to improve rowing performance and is more effective than LSD in eliciting improvements in associated aerobic physiological variables including WLT.

1819 June 2, 1:30 PM - 1:45 PM  
**Competition Day Strategies To Enhance Sprint Swimming Performance**

Courtney J. McGowan, Ms<sup>1</sup>, David B. Pyne, Prof, FACSM<sup>2</sup>, Kevin G. Thompson, Prof, FACSM<sup>1</sup>, John S. Raglin, Prof, FACSM<sup>3</sup>, Mark Osborne, Dr<sup>4</sup>, Ben Ratray, Dr<sup>1</sup>. <sup>1</sup>University of Canberra, Canberra, Australia. <sup>2</sup>Australian Institute of Sport, Canberra, Australia. <sup>3</sup>Indiana University Bloomington, Indianapolis, IN. <sup>4</sup>Swimming Australia Pty Limited, Brisbane, Australia.

Email: courtney.mcgowan@canberra.edu.au

(No relationships reported)

Competitive swimmers typically experience a delay (transition phase) between the pool warm-up and race start. Additional warm-ups may be required to optimize performance. Exercise completed several hours prior to an event may also elicit a priming effect on performance later that same day. **PURPOSE:** To determine the effect of additional warm-ups and same-day priming bouts upon sprint swimming performance.

**METHODS:** In study 1, 22 elite freestyle swimmers completed a standardized pool warm-up followed by a 30 min transition and a 100 m freestyle time-trial. During transition, swimmers wore a conventional tracksuit and remained seated (Control) or wore a tracksuit jacket with integrated heating elements and performed a 5 min dryland exercise routine (Combo). Elite breaststroke swimmers (n=10) repeated the study using tracksuit pants with integrated heat elements in Combo (study 2). In study 3, morning priming bouts consisting of no exercise (NoEx), swimming (SwimOnly) or swimming and dryland exercise (SwimDry) were investigated to ascertain the effect on afternoon sprint performance (6.5 hr later; n=13).

**RESULTS:** Freestyle swimmers yielded faster start (1.5% ± 1.0%, mean ± 90% confidence limits,  $p = 0.02$ ) and 100 m time-trial (0.8% ± 0.4%,  $p = 0.00$ ) performances with Combo compared to Control. Core temperature ( $T_{core}$ ) declined less during transition (-0.2°C ± 0.1°C vs -0.5°C ± 0.1°C,  $p = 0.02$ ) and total local haemoglobin concentration (tHb) was greater (36µM ± 25µM, mean ± SD;  $p = 0.00$ ) pre-time-trial in Combo compared to Control. Breaststroke performance was not faster ( $p = 0.55$ ) and  $T_{core}$  decline within transition similar in Combo compared to Control (-0.1 ± 0.2°C vs -0.3 ± 0.2°C;  $p = 0.36$ ). Afternoon time-trials were faster in SwimOnly (1.6% ± 0.6%,  $p = 0.00$ ) and SwimDry (1.7% ± 0.7%;  $p = 0.00$ ) and  $T_{core}$  was higher (0.2 ± 0.2°C;  $p = 0.04$ ) pre-afternoon session in SwimDry compared to NoEx.

**CONCLUSIONS:** Heated garments and dryland-based activation exercises employed within lengthy transitions can yield substantial benefits (~0.8%) to elite sprint freestyle 100 m time-trial performance but not in breaststroke. Attenuation in the decline of  $T_{core}$  and augmented tHb appear as likely mechanisms. Completion of a morning priming swim alone or in combination with dryland exercise can yield additional performance benefits.

1820 June 2, 1:45 PM - 2:00 PM  
**Effects of a Cool Vest Jacket on Skeletal Muscle Response using Tensiomyography**

Carles Lorente Gonzalez, Francisco Corbi Soler. *INEFC - University of Lleida, Lleida, Spain.*

Email: clorente@outlook.com

(No relationships reported)

EFFECTS OF THE COOL VEST JACKET ON SKELETAL MUSCLE CONTRACTILE RESPONSE USING TENSIOMYOGRAPHY

Carles Lorente, Francisco Corbi.

INEFC - University of Lleida (Spain)

Body cooling is a recovery method that benefits central and peripheral nervous system changing sensorial feedback of thermoregulation system. Fatigue reduces the

ability to perform high intensity action and produce peak force rates, weakening the defense mechanisms of the knee, exposing the ACL to an injury due to the lowered skeletal muscle contractile response capacity.

**PURPOSE:** To determine to effects of applying a cool vest jacket on biceps femoris contractile response after an induced fatigue protocol.

**METHODS:** Biceps femoris baseline contractile responses was obtained by means of tensiomyography, in which maximal displacement amplitude (Dm), contraction time (Tc) were measured, and velocity of contraction (Vc) was calculated after them. Afterwards the participants undertook a 45 induced fatigue soccer protocol, and a 15 minutes seated break, in which the cool vest was applied. After that tensiomyography was used again. Contractile responses were made using two-way ANOVA with repeated measures.

**RESULTS:** Tc was increased in both control (CG) and cool vest group (CV), resulting on 35.76±8.78 ms. to 37.14±2.18 ms. and 33.20±6.12 ms. to 37.45±2.63 respectively (p=0.359). Dm showed a different outcome, meanwhile CG reduced his maximal displacement, 6.52±2.27 mm to 5.88±2.12 mm, CV increased that displacement, 6.83±1.06 mm. to 7.00±1.37 mm (p=0.079). Vc was calculated in millimeters per second, having as a result a better performance for CV 211.47±46.80 mm/s to 194.40±45.13 mm/s, decreasing an 8.07% of velocity while CG contractile velocity was reduced a 12.62%, from 181.69±46.12 mm/s to a 158.75±45.22 mm/s (p=0.593).

**CONCLUSION:** The cool vest jacket contributes positively to nerve conduction velocity improving contractile response when fatigued in lab conditions.

1821 June 2, 2:00 PM - 2:15 PM

### Training Effects On A Lower Body Positive Pressure Treadmill At Different percentages of Body Weight

David Lee, Natalie Maltz, James Becker, Joshua Cotter, Ralph Rozenek. *California State University, Long Beach, Long Beach, CA.*

Email: davidlee020@gmail.com

(No relationships reported)

While training on a lower body positive pressure treadmill (LBPP) has become a tool for injury rehabilitation, these devices are now used for training in healthy individuals. While several acute studies have documented lower impact forces and differences in energy expenditure when body weight (BW) is reduced, to date there are no studies examining the longitudinal effect of training at reduced BW. **PURPOSE:** This study examined the physiological adaptations resulting from an 8-week training program on a LBPP treadmill at three different levels of BW. **METHODS:** Twenty-four healthy college aged students (age: 25 ± 7 years) participated in this study. Participants performed a graded exercise test (GXT) and were placed in one of three training groups: 100% BW, 75% BW, or 50% BW. Groups were balanced based upon the initial maximal oxygen uptake (VO<sub>2</sub>max). Each individual trained at ~70% of their peak effort achieved during the GXT. Following an 8-week progressive training program another GXT was performed to assess the effects of training. Primary outcome measures included relative and absolute VO<sub>2</sub>max, maximal heart rate (HRmax), and time of GXT. A one-way ANOVA was used to compare the absolute change among groups from pre-training to post-training. **RESULTS:** A difference in the change scores in relative VO<sub>2</sub>max was observed among the 3 training groups (F<sub>2,23</sub> = 4.99, p = 0.017). The 100% BW group improved their relative VO<sub>2</sub>max (1.71 ± 1.70 ml · min<sup>-1</sup> · kg<sup>-1</sup>) when compared to the 50% BW group (VO<sub>2</sub>max -1.41 ± 2.10 ml · min<sup>-1</sup> · kg<sup>-1</sup>) (p = 0.014). Relative VO<sub>2</sub>max for the 75% BW group (-0.20 ± 2.02 ml · min<sup>-1</sup> · kg<sup>-1</sup>) was not different than either the 100% BW group (p = 0.131) or 50% BW group (p = 0.443). No significant differences were observed for absolute VO<sub>2</sub> max (F<sub>2,23</sub> = 2.91, p = 0.076), HRmax (F<sub>2,20</sub> = 2.00, p = 0.164), or time of GXT (F<sub>2,22</sub> = 2.09, p = 0.150) among the 3 groups. **CONCLUSION:** Based on the results, it appears that running at 50% BW results in a slight reduction of aerobic capacity compared to running at 100% BW, while running at 75% BW does not result in any significant change. In order to maintain aerobic fitness, individuals should run with ~75% or more of their BW on LBPP treadmills at moderate intensities.

1822 June 2, 2:15 PM - 2:30 PM

### Relating Internal and External Loads in Collegiate Men's Soccer Players During Off-Season Training

David P. Looney, Chris A. West, Robert A. Huggins, Andrea Fortunati, Lindsay J. DiStefano, Samantha E. Scarneo, Douglas J. Casa, FACSM. *University of Connecticut, Storrs, CT.*

(Sponsor: Douglas J. Casa, FACSM)

Email: david.looney@uconn.edu

(No relationships reported)

Heart rate (HR) monitoring is considered to be the gold standard for assessing the internal load, or physiological training stress endured, in soccer athletes. Accelerometer-derived metrics have become an increasing popular means of quantifying the physical demands of training, known as the external load, in indoor environments where GPS signals are obstructed. Although internal and external

load measures have been previously related, few studies have accounted for training duration as a potential confounder. Even less is known regarding how the relationship between internal and external loads changes over long-term soccer training.

**PURPOSE:** To assess the relationship between external and internal load measures over an off-season soccer training program. **METHODS:** HR and accelerometer data collected over 40 off-season indoor sessions (session duration, 97 ± 20 min) were analyzed from 19 Division-1 Men's Soccer players (age, 20 ± 1 years; height, 180 ± 7 cm; resting HR, 49 ± 5 beats/min; max HR, 199 ± 7 beats/min). Mean HR Reserve (HRR, [Mean HR - Resting HR] / [Max HR - Resting HR]) and mean Player Load (PL), an accumulated measure of instantaneous tri-axial accelerations, were used to quantify the average internal and external loads per session respectively. All variables were rescaled to standard scores prior to analysis. Mean HRR was subsequently regressed on mean PL, session duration (min), and time (days from baseline) using a mixed effects model with random effects for player on each explanatory variable.

**RESULTS:** Mean HRR was significantly related to mean PL (0.674 ± 0.040, p < 0.001), session duration (0.247 ± 0.025, p < 0.001), and time (-0.216 ± 0.032, p < 0.001). **CONCLUSION:** The strong association between mean HRR and mean PL confirms that the relationship between these measures is not artificially induced by session duration. However, the positive association between mean HRR and session duration suggests that mean HRR may underestimate internal loads of brief, high-intensity training. The decrease in HRR over time demonstrates reduced physiological stress per given external load, possibly reflective of training-related improvements in fitness.

1823 June 2, 2:30 PM - 2:45 PM

### Acute Effects of Different Stretching Protocols Combined with Potentiating Exercise on Flexibility and Power Performance in Males

Hyun Chul Jung, Nan Hee Lee, Gina Ok, Soeun Jeon, Sukho Lee. *Texas A&M University-San Antonio, san antonio, TX.*

(Sponsor: Minsoo Kang, FACSM)

Email: hjung@tamusa.tamusa.edu

(No relationships reported)

The importance of stretching prior to exercise and sports events has been widely accepted for preventing injuries and maximizing their exercise performance. However, there are only a few studies investigating the acute effects of different stretching protocols combined with potentiating exercise on performance.

**PURPOSE:** The purpose of this study was to examine the acute effects of different stretching protocols combined with potentiating exercise on flexibility and power in males.

**METHODS:** This study was conducted in repeated and cross-over designed. Thirteen healthy males, aged 25.4±3.46 years, voluntarily participated in this study. Participants performed jogging on the treadmill for 5 min prior to stretching session. Then, four different stretching protocols (non stretching; NS, static stretching; SS, dynamic stretching; DS, and proprioceptive neuromuscular facilitation stretching; PNFS) specially targeted for lower limb muscles with potentiation exercise (3 sets x 5 times tuck jumps) were randomly applied at the same time of the day with 7 days interval. Straight leg raise, sit and reach, and vertical jump tests were measured at baseline, after jogging, stretching, and potentiating exercise. The percent changes of scores were calculated for all measures. Repeated measure ANOVAs were used to analyze the data, and significant level was set at p<.05.

**RESULTS:** Jogging improved straight leg raise (F=30.971, p<.001), sit and reach (F=30.213, p<.001) and vertical jump (F=46.759, p<.001) in all trials compared to baseline. After stretching session, greater improvement in straight leg raise was observed in SS (9.6%) and PNFS (11.1%) than NS (0.6%) and DS (5.0%) (F=6.914, p=0.001). However, vertical jump was significantly improved only in DS (1.8%) whereas it was reduced in NS (-2.6%), SS (-3.6%), PNFS (-4.4%) compared with previous score (F=8.44, p<.001). After potentiating exercise, greater improvement in vertical jump was observed in NS (2.2%), SS (3.2%) and PNFS (6.5%) than DS (-0.4%) compared with previous score (F=5.947, p=0.002).

**CONCLUSIONS:** Our study demonstrated that acute dynamic stretching appeared to be the most effective method for improving vertical jump. And potentiating exercise could act a beneficial role for preventing the loss of vertical jump ability caused by static and PNF stretching.

1824 June 2, 2:45 PM - 3:00 PM

**Is Remote Stretching Based On Myofascial Chains Equally Effective As Local Exercise? A Randomized Controlled Non-inferiority Study.**

Jan Wilke, Daniel Niederer, Nadine Welp, Lutz Vogt, Winfried Banzer. *Goethe University Frankfurt, Frankfurt am Main, Germany.*

Email: wilke@sport.uni-frankfurt.de

(No relationships reported)

Recent research suggests that fascial tissues directly connect the skeletal muscles forming a body-wide network of myofascial chains. Both cadaveric studies and in vivo experiments yield indications for force transmission along such muscle-fascia lines. In a previous pilot trial, we demonstrated that lower limb stretching increases cervical range of motion (cROM) in the sagittal plane. However, it remains unclear (1) whether other planes are also affected and (2) if remote stretching is inferior or superior to a local treatment. **PURPOSE:** To study the remote effects of lower limb stretching on cROM in comparison to local neck stretching. **METHODS:** The superficial back line (myofascial chain consisting of plantar fascia, gastrocnemius, hamstrings and erector spinae) was selected in order to investigate its significance as a myofascial pathway. Fifty-four healthy subjects (38±13 yrs.) were randomly allocated to three groups. One group (G1, n=18) bilaterally performed three consecutive 30 s bouts of static stretching for both the gastrocnemius muscle and the hamstrings, respectively. Another group (G2, n = 18) isometrically stretched the neck extensors for the same duration while a control group (G3, n=18) remained inactively seated. Prior (M1), immediately post (M2) and 5 min. following intervention (M3), maximal cROM was assessed in the sagittal (flexion-extension), frontal (lateral flexion) and transversal plane (rotation) using an ultrasonic 3D movement analysis system. Kruskal-Wallis tests and Sidak-Holm adjusted post hoc between-group comparisons were computed. **RESULTS:** Data analysis revealed significant differences between the three disposed conditions (p < .05): In comparison to the control group, G1 (flexion-extension +4.9%, lateral flexion +6.2%, rotation +5.5%) and G2 (flexion-extension +6.5%, lateral flexion +8.8%, rotation +5.0%) increased cROM in all movement planes and at all measurements (p < .05). No differences were found between G1 and G2 at any measurement (p > .05). **CONCLUSION:** Lower extremity stretching induces similar improvements in cervical range of motion as local neck stretching. Therapists might consequently consider using remote stretching exercises, in particular, if local treatments (e.g., manipulations of the cervical spine) are contraindicated.

**D-20 Clinical Case Slide - Cardiovascular Issues I**

Thursday, June 2, 2016, 1:00 PM - 2:40 PM  
Room: 206

1825 **Chair:** Aaron L. Baggish, FACS. *Massachusetts General Hospital, Boston, MA.*  
(No relationships reported)

1826 **Discussant:** Irfan Asif. *University of South Carolina, Greenville, SC.*  
(No relationships reported)

1827 **Discussant:** Philip F. Skiba. *Advocate Lutheran General Hospital, Park Ridge, IL.*  
(No relationships reported)

1828 June 2, 1:00 PM - 1:20 PM

**Heart Matters: A Rower Flourishes After Her Career Impacting Cardiac Diagnosis**

Sharon A. Chirban<sup>1</sup>, Aaron Baggish, FACS. <sup>1</sup>*Boston Children's Hospital, Boston, MA.* <sup>2</sup>*Massachusetts General Hospital, Boston, MA.*

Email: sharon.chirban@childrens.harvard.edu

(No relationships reported)

**Abstract**

History: A 19 year old female NCAA Division I scholarship rower was referred to a sport psychologist 10 months after being diagnosed with catecholaminergic polyventricular tachycardia (CPVT). Cardiac symptoms were stable and she had been exercising at or below prescribed threshold. She reported mood irritability and mild depression.

Psychiatric Evaluation: Athlete denied symptoms of clinical depression, anxiety or any significant mental health history. She is the older of two daughters, both of whom

row. She reported waves of sadness, inexplicable moments of teariness, fear about losing her competitive identity and transient concerns about weight gain and body transformation secondary to the adjustment to physical fitness limited to heart rate efforts at 120 or below.

Differential Diagnosis:

1. Mild Depression r/o
2. Adjustment disorder with mixed emotional features

Assessment:

1. Challenges to athletic identity
2. Assess Grief and Coping and overall adaptation
3. Assess level of acceptance of long-term implications of diagnosis

Final/Working Diagnosis:

Adjustment Disorder with mixed emotional features secondary to CPVT diagnosis

Treatment and Outcomes:

1. Educate patient about stages of sports grieving
2. Process shifts in athletic identity and understanding genetic component of diagnosis
3. Develop strategies to ritualize survival anniversaries
4. Provide support around team re-integration

1829 June 2, 1:20 PM - 1:40 PM

**Syncope And Palpitations In A Runner**

Colin Conner, Amy Svenson MD, Andrew Papez MD. *Phoenix Childrens Hospital, Phoenix, AZ.*

Email: kiddieheart@hotmail.com

(No relationships reported)

**HISTORY:** A 16 year old female was found by a passer-by unconscious on the street. She was arousable and fully conscious by the time EMS arrived. She was taken to a local hospital and later transferred to a pediatric hospital for evaluation. She was discharged home the same day with instructions to follow up with cardiology. Six days later, she presented to PMD for complaints of persistent chest pain. Cardiac enzymes were mildly elevated. She returned to the pediatric hospital for re-evaluation. She was admitted with an abnormal ECG.

Past medical history was notable for three episodes of sudden onset tachycardia. One episode occurred while walking down the stairs at home. The episode was sudden in onset lasting about 15 minutes with dizziness, lightheadedness and blurry vision during the episode. The other two episodes were similar but not as long.

**PHYSICAL EXAMINATION:**

HR 51 BPM; BP 105/67 mmHg

CV: nl S1, S2 no murmur, rub, gallop

Lungs: CTA

Abd: benign

**DIFFERENTIAL DX:**

- 1) Neurocardiogenic syncope
- 2) LQTS
- 3) SVT
- 4) CPVT
- 5) ARVD

**RESULTS:**

- 1) Echocardiogram; normal anatomy, normal function
- 2) ECG (initial): sinus rhythm, LAD, T-wave inversion anterior and mid-precordial leads. Flat T-waves lateral precordial leads
- 3) ECG (admission): monomorphic ventricular tachycardia
- 4) MRI: mild-mod RV dilation with mildly dec. function; thinning of RV myocardium; delayed gadolinium enhancement consistent with fibrofatty infiltration

**DIAGNOSIS:**

- 1) Arrhythmogenic right ventricular cardiomyopathy
- 2) Ventricular tachycardia

**OUTCOME:**

- 1) RFA of RVOT VT
- 2) Amiodarone 200 mg daily
- 3) Spironolactone 25 mg daily
- 4) LIFEVEST-awaiting release of MRI compatible AICD

1830 June 2, 1:40 PM - 2:00 PM

**Palpitations and Difficulty Breathing in a Collegiate Volleyball Player**

Jacklyn Lindsay Quade, Amy Miller. *University of Michigan Health System, Ann Arbor, MI.* (Sponsor: Bob Kiningham, FACS)

Email: lindsayquade@gmail.com

(No relationships reported)

**HISTORY:** A 20-year-old college volleyball player presented to an athletic medicine clinic with a complaint of difficulty breathing. This was often accompanied by palpitations, and it was unclear which happened first. Her symptoms seemed to consistently occur during shuttle runs. She used an inhaler in high school for exercise-

related breathing issues, but felt as though her symptoms had been progressively worsening over the past 6 months. There was no history of syncope, chest pain, or recent illness. Her mother passed away at a young age from an unknown etiology. **PHYSICAL EXAMINATION:** Examination revealed a well-appearing adult female. Her neck exam did not reveal thyromegaly. On cardiac exam, her blood pressure was low normal at 93/62 and her heart rate was bradycardic at 55 but regular. No murmur was auscultated. On lung exam, her work of breathing was non-labored and she had clear breath sounds bilaterally, without rales or wheezes. Her extremities were warm and without edema.

**DIFFERENTIAL DIAGNOSIS:**

1. Symptomatic palpitations/PVCs
2. Exercise-induced asthma/bronchospasm
3. Cardiac arrhythmia or structural abnormality
4. Hyperthyroidism

**TEST AND RESULTS:****EKG:**

- sinus bradycardia (ventricular rate of 49) with PACs with aberrant conduction
- normal PR, QRS, and QTc intervals, normal axis

**Labs:**

- TSH normal
- CBCP normal

**48 hour Holter monitor:**

- intermittent episodes of atrial fibrillation and atrial flutter
- very frequent multiform PVC's with episodes of couplets, triplets, bigeminy and runs of ventricular tachycardia

**FINAL/WORKING DIAGNOSIS:**

ARVC (Arrhythmogenic Right Ventricular Cardiomyopathy)

**TREATMENT AND OUTCOMES:**

1. Sent to the Emergency Department and admitted to General Medicine with a consult to Cardiology Electrophysiology
2. Initiated and maintained on sotalol for ventricular ectopy and atrial fibrillation/flutter
3. Diagnosis of ARVC made after completion of inpatient TTE, MRI, and additional EKGs; met 3 major criteria (Epsilon waves in V1/V2, arrhythmia LBBB superior axis, and MRI showing RV dysfunction and RV regional motion abnormalities) and 1 minor criteria (T wave inversion V1/V2)
4. Discharged with LifeVest and returned in 4 weeks for ICD placement
5. Genetic Counseling recommended
6. Restricted from future competitive athletics, with mild/light activity encouraged

1831 June 2, 2:00 PM - 2:20 PM

**Thanks For Listening. Cardiovascular-football.**

Karin VanBaak. *University of Minnesota, Minneapolis, MN.*

(Sponsor: Suzanne Hecht, FACSM)

Email: karin.vanbaak@gmail.com

(No relationships reported)

**HISTORY:**

A 22 year-old African American male NCAA D3 football player was referred to the team physicians' clinic by a nurse practitioner at student health.

2 weeks prior, he had presented for a routine check for sexually transmitted diseases check and the provider noticed a loud systolic murmur. He denied any symptoms including recent illnesses, chest pain, shortness of breath, cough, dizziness, decreased exercise tolerance or lower extremity swelling. He had undergone a complete cardiac workup 5 years earlier. He was cleared for athletic participation by a cardiologist at that time with an unremarkable EKG and transthoracic echocardiogram as well "no murmur" on exam.

He had no personal or family history of cardiac problems or sudden death.

**PHYSICAL EXAM:**

Vital signs were within normal limits. He was a fit young male in no acute distress. He did not have any jugular venous distention. His lungs were clear to auscultation bilaterally without wheezes or rhonchi. His heart rate was regular, with S1 and S2 appreciated. He had a 4/6 holosystolic murmur audible across the precordium, loudest at the apex radiating to the axilla, but not to the carotids. PMI was hyperdynamic but nondisplaced. The murmur did not change in intensity with valsalva or position changes. His lower extremities were warm and well perfused without edema.

**DIFFERENTIAL DIAGNOSIS:**

1. Mitral Valve Regurgitation
2. Ventricular Septal Defect
3. Hypertrophic Obstructive Cardiomyopathy
4. Aortic Valve Stenosis

**TESTS & RESULTS:**

EKG: sinus rhythm with normal axis, voltage criteria for left ventricular hypertrophy and repolarization abnormality

Transthoracic Echocardiogram:

- Left Ventricular (LV) dilation with mild concentric LV hypertrophy and normal LV systolic function (EF 60%-65%)
- Severe mitral valve insufficiency (3-4+), posterior leaflet pathology and a torn or redundant chordae tendineae
- Right Ventricle size, systolic function, and pulmonary pressures all normal

**FINAL DIAGNOSIS:**

Severe mitral valve regurgitation likely secondary to a ruptured chordae tendinae.

**TREATMENT & OUTCOMES:**

1. Withheld from all contact and noncontact exercise
2. Repeat exam at 6 weeks showed no evidence of volume overload
3. Plan for transesophageal echocardiogram
4. Referral to cardiovascular surgery for pre-operative workup and valve repair vs. replacement

1832 June 2, 2:20 PM - 2:40 PM

**Fatigue And Leg Heaviness**

Jeff Wang<sup>1</sup>, Greg Little<sup>2</sup>. <sup>1</sup>UMass, Worcester, MA. <sup>2</sup>UMass Amherst, Amherst, MA.

(No relationships reported)

**HISTORY:** 18 year old college freshman cross country runner presents with bilateral leg weakness/heaviness. In the past 6 years have had 10 separate incidences of bilateral leg weakness/heaviness few minutes into running. But since the symptoms always resolve after resting and the incidences are few and far in between, the patient never thought much about it. However, since starting college running, had the same symptoms on two consecutive days. During the episode, patient states he also has normal breathing, but can't seem to "utilize the oxygen". Denies any chest pain but just a twinge in his upper chest. No past medical history, no surgical history, not on any medications, no allergies. Family history of father and paternal grandfather with A-fib. **PHYSICAL EXAM:**

**VSS**

Gen: Well appearing, NAD

HEENT: NC/AT, EOMI

Resp: CTABL, no w/t/r

Card: S1, S2 appreciated, no additional heart sounds, no m/r/g, RRR

GI: BS+, no HSM

Neuro: CN 2-12 intact, sensation intact, 5/5 strength bilaterally to upper and lower extremity

Skin: intact, no rashes or signs of infection

**DIFFERENTIAL DIAGNOSIS:**

1. Over training
2. Iron deficiency
3. Anemia
4. Hypothyroid

**TESTS AND RESULTS:**

- In office EKG: ST segment elevation, T wave inversion, increased QRS voltage, Q waves

- In the ER the same night: normal blood work with 3 sets of negative troponins

- In office Echo in cardiology office one week later: thickened ventricles consistent of HCM

**FINAL/WORKING DIAGNOSIS:** Hypertrophic Cardiomyopathy

**TREATMENT AND OUTCOMES:**

1. Restriction from sports
2. Repeat echo in 6 months to rule out athletic heart

**D-21 Clinical Case Slide - Lower Extremity Issues I**

Thursday, June 2, 2016, 1:00 PM - 2:40 PM

Room: 202

1833 **Chair:** Peter Gerbino, FACSM. *Monterey Sports Medicine, Monterey, CA.*

(No relationships reported)

1834 **Discussant:** Steven D. Stovitz, FACSM. *University of Minnesota, Minneapolis, MN.*

(No relationships reported)

1835 **Discussant:** Kyle J. Cassas, FACSM. *Greenville Health System, Greenville, SC.*

(No relationships reported)

1836 June 2, 1:00 PM - 1:20 PM

**Bilateral Leg Pain in a 15 Year Old Runner**

Melissa Roscher, David Stone. *University of Pittsburgh Medical Center, Pittsburgh, PA.*  
 Email: rigginsms@upmc.edu  
 (No relationships reported)

**HISTORY**

A 15 year old female complained of bilateral posterior lower leg pain and paresthesias during running that resolved with rest. Symptoms occurred during track and soccer, but not between seasons. Her PCP suggested a stretching program and adding salt to her Gatorade. Work up showed an abnormal ankle-brachial index and mildly elevated ESR.

**PHYSICAL EXAM**

In our clinic, she had mild tenderness of the posterior tibiae and deep compartments of the lower legs, as well as pain with stretch of the anterior compartments bilaterally. Ankle musculature was diffusely weak with paresthesias in the feet during dorsiflexion and eversion testing. Tinel sign was negative at the fibular head, anterior tarsal tunnel, and the medial tarsal tunnel bilaterally.

**DIFFERENTIAL DIAGNOSIS**

Hamstring/Calf Strain, Exertional Compartment Syndrome, Popliteal Artery Entrapment, Medial Tibial Stress Reaction

**TESTS AND RESULTS**

Arterial Dopplers: No popliteal entrapment. Small thrombus at the left distal superficial femoral artery at the adductor canal

CTA Left leg: Occlusion of the distal superficial femoral artery with associated thrombus. Multiple collaterals. With plantar flexion, narrowing of the popliteal artery due to displacement of the popliteal artery from hypertrophy of the medial gastrocnemius

CTA Right leg: Normal vasculature at rest. With plantar flexion, narrowing of the infrageniculate popliteal artery between the gastrocnemius heads. Displacement of the suprageniculate popliteal artery due to hypertrophy of the medial gastrocnemius  
 CT Knees: Hypertrophy of both medial gastrocnemius displacing the popliteal arteries. Occlusion of the proximal Right peroneal artery

Factor V Leiden, antithrombin, fibrinogen, prothrombin, thrombin, factor VIII, protein C/S WNL

D-dimer elevated; hexagonal lipid neutralization (LAC), anticardiolipin IgG/IgM

**POSITIVE**

Pathology: Vascular tissue with organizing thrombus

**TREATMENT AND OUTCOMES**

Left superficial femoral to popliteal artery bypass with transection of the Left adductor hiatus by Vascular Surgery  
 Release of the Right superficial femoral artery by division of the Right adductor magnus

Treated with daily aspirin

Returned to competitive soccer in 4 months

**FINAL DIAGNOSIS**

Bilateral Exertional Compartment Syndrome due to Arterial Thrombus and Compression

1837 June 2, 1:20 PM - 1:40 PM

**Exertional Leg Pain In A Collegiate Basketball Player**

Prakash Jayabalan<sup>1</sup>, Kristin Abbott<sup>2</sup>, Monica Rho<sup>1</sup>.  
<sup>1</sup>Rehabilitation Institute of Chicago, Chicago, IL. <sup>2</sup>Northwestern University, Evanston, IL. (Sponsor: Joel Press, FACSM)  
 Email: pjayabalan@ric.edu  
 (No relationships reported)

**HISTORY:**

20 year-old female collegiate basketball player presented with right lower lateral leg pain. Three years previously she had a stress fracture of the right fibular head, and 12 months prior had a stress reaction of the same region. She now presented with 9-month history of pain radiating from her right lower lateral leg to the dorsum of her foot. Pain described as tightness, rated 3/10, and occurred intermittently primarily during exertion. She denied weakness in her lower extremities, but had intermittent low back pain.

**PHYSICAL EXAMINATION:**

No muscle bulk atrophy in the bilateral lower extremities. Strength testing - 5/5 bilateral hip flexion, knee extension, ankle dorsiflexion, eversion, plantar flexion and great toe extension. Lumbar spine exam - full ROM without pain; no pain with single leg hop and seated slump tests. Non-tender to palpation at the fibular head bilaterally. Tinel's behind the right fibular head did elicit pain down the right lower lateral leg. Sensation was intact to light touch throughout and reflexes were 2+ bilaterally.

**DIFFERENTIAL DIAGNOSIS:**

1. Common peroneal neuropathy
2. Stress reaction/fracture
3. L5 radiculitis
4. Chronic exertional compartment syndrome

**TESTS AND RESULTS:**

MRI right lower extremity: No stress fracture or reaction.

MRI lumbar spine: Mild disc bulging at L4/5 and L5/S1 without stenosis.

Compartment pressure test right lower extremity: No increase in pressures post-exertion.

Electrodiagnostics right lower extremity:

Nerve conduction - prolonged latency and decreased conduction velocity across fibular head. Needle EMG - increased insertional activity, polyphasic potentials in muscles innervated by branches of the common peroneal nerve.

Ultrasound right lower extremity with peroneal nerve block:

Hypomobile peroneal nerve at the fibular head with appearance of scar tissue at this region. Hydrodissection of the nerve and injection of lidocaine around the sheath caused improvement in pain (pain score changed from 3/10 to 0/10).

**FINAL WORKING DIAGNOSIS:**

1. Common peroneal neuropathy
2. L5 radiculitis

**TREATMENT AND OUTCOMES:**

1. Therapy regimen - lower extremity strengthening, back extension exercises and nerve glides with improvement in back symptoms and leg pain. 2. Compliance with further treatment is challenging and she currently is held from sports.

1838 June 2, 1:40 PM - 2:00 PM

**Lower Leg Pain- Basketball**

Jenna Neufeldt, Kyle Lennon, Bryan McCarty. *North Shore University Hospital, Manhasset, NY.*  
 (No relationships reported)

**Compartment Syndrome**

Jenna Neufeldt, MD North Shore University Hospital

Kyle Lennon, MD North Shore University Hospital

Bryan McCarty, MD North Shore University Hospital

Email: jneuf12@gmail.com

**HISTORY:** 15yoM no PMH presented with severe 10/10 right lower leg pain that started progressively 6 hours ago while playing basketball. Prior to the game, patient had no symptoms. He denies any trauma to the leg during the game. The pain is localized to the anterior and lateral aspects of the right lower leg with only mild pain noted posteriorly. Patient stated similar pains over the past year during exercise but today pain is much more severe and not improving with rest. Also c/o numbness in his foot and is having difficulty lifting his foot.

**PHYSICAL EXAM:**

No obvious deformities or signs of trauma. The anterior lower leg is extremely firm and tender to palpation with painful passive ROM and weakness and pain with active ROM. Decreased sensation of 1st dorsal webspace. Palpable DP pulse. No overlying skin changes or mottling.

**DDx:**

1. Medial tibial stress syndrome
2. Compartment syndrome
3. Tibial stress fracture
4. Acute arterial occlusion
5. Acute venous occlusion

**TESTS AND RESULTS**

xray tib/fib normal

compartment pressures: Anterior: 80, Lateral: 62, Post- 20, Deep post- 15

**FINAL DIAGNOSIS**

Acute on chronic exertional compartment syndrome

**TREATMENT AND OUTCOMES**

Patient went directly to the OR for fasciotomy

Outcome pending

1839 June 2, 2:00 PM - 2:20 PM

**Lower Extremity Injury --- Cross Country Pediatric Athlete**

Daniel Diaz. *William Beaumont Hospital, Sterling heights, MI.*  
 Email: daniel.diaz@beaumont.edu  
 (No relationships reported)

**HISTORY:** 16y/o cross-country runner who sustained a left lower extremity injury during a difficult workout. The athlete stated the pain started after a difficult training run Tuesday during practice. The following day, pain was worse and he noticed he had a slight limp while walking. That Thursday, he was able to continue running and completed practice however pain persisted. On Friday pt participated in a race and by the end of the meet he was in severe pain, had difficulty walking and noted an obvious limp. Since the race, pt had been unable to bear weight normally. Pain was localized to the lateral left leg and worse with dorsiflexion of his ankle. Pt presented the clinic the Monday following the injury for evaluation.

**PHYSICAL EXAMINATION:** Left lower extremity exam revealed swelling over the distal leg w/out erythema or ecchymosis. Tenderness to palpation noted over the

midshaft of the fibula. No point tenderness at the ankle. No pain to palpation over the midfoot or heel. Tibialis anterior, Achilles, peroneal and tibialis posterior tendons were normal by palpation. Dorsiflexion of the left foot intact but painful. No change in sensation of left foot.

**DIFFERENTIAL DIAGNOSIS:**

1. High ankle sprain
2. Lateral ankle sprain
3. Fibular fracture

**TESTS AND RESULTS:** Left Tib-Fib AP/lateral Xray: Midshaft Lt fibula fracture noted. Acceptable alignment. No severe shortening. Repeat Left Tib-Fib AP/Lateral Xray 6 weeks post immobilization: Fracture of the distal fibula. No change in alignment. Interval healing is noted.

**FINAL/WORKING DIAGNOSIS:**

Left midshaft fibular stress fracture

**TREATMENT AND OUTCOMES:** Pt initially placed in 6 weeks of short leg walking cast immobilization with crutch-assisted touch down weight-bearing. At 2 week follow-up athlete was tolerating cast and pain improving. Vit D levels were checked at this visit and returned normal. Discussed well cushioned shoes and correction of gait abnormalities once healing complete. At 4 week visit pain had resolved and he was able to bear weight in cast without issue. At 6 weeks pt remained pain free and was transitioned to Aircast walking boot with weight bearing as tolerated. DXA scan ordered at 6 week visit to rule-out low bone density. Plan for physical therapy and gait analysis once out of cast and prior to returning to running.

1840 June 2, 2:20 PM - 2:40 PM

**Calf Pain In A Young Runner**

Alexandra M. Rivera Vega, Melissa Learned, Guillermo Escobar, Roopa Ram. *University of Arkansas for Medical Sciences, Little Rock, AR.* (Sponsor: William F. Micheo, FACSMM)

(No relationships reported)

**History:** 23 year-old long distance runner with right calf pain starting 4 months after weighted calf presses. Pain was initially sharp but transitioned to achy/burning pain in the upper calf occurring with intensive exercise. Symptoms progressed and would occur when walking briskly with the development of blanching, numbness and coolness in his first 3 toes when power walking.

**Physical exam:** clinic exam revealed mild tenderness of right medial gastrocnemius and slightly diminished pulse when compared to contralateral foot with no leg discoloration, coolness or sensory deficits.

**Differential diagnosis:** 1. Popliteal artery entrapment syndrome 2. Chronic compartment syndrome 3. Deep Vein Thrombosis 4. Calf strain

**Results:** Right ankle brachial indices were normal at rest but decreased with both dorsiflexion and PF, with a great toe pressure of 0 mmHg upon PF. Of note, the left gastrocnemius had a fibrous band but no popliteal artery compression. MRI angiogram was ordered showing an anomalous course of the medial gastrocnemius with a fibrous band causing 2cm of high-grade popliteal artery stenosis which worsened with plantar flexion (PF). Post-exercise muscle edema was present suggestive of ischemic changes. **Final Diagnosis:** Popliteal artery entrapment syndrome

**Treatment and Outcomes:** Anticoagulation was started until fibrous band excision with right popliteal thromboendarterectomy and patch angioplasty was done. Six months post-op the patient remains symptom free.

**D-22 Clinical Case Slide - Spine I**

Thursday, June 2, 2016, 1:00 PM - 2:40 PM

Room: 203

1841 **Chair:** Monica Rho. *Rehabilitation Institute of Chicago, Chicago, IL.*

(No relationships reported)

1842 **Discussant:** Garrett S. Hyman, FACSMM. *Lake Washington Sports & Spine, Bellevue, WA.*

(No relationships reported)

1843 **Discussant:** Jason Pothast. *University of Florida, Gainesville, FL.*

(No relationships reported)

1844 June 2, 1:00 PM - 1:20 PM

**Lumbar Stress Injury or Not? - Cricket Player**

Dina C. Janse van Rensburg, FACSMM, Phathokuhle C. Zondi, Audrey Jansen van Rensburg, Catharina C. Grant. *University of Pretoria, Pretoria, South Africa.*

Email: christa.jansevanrensburg@up.ac.za

(No relationships reported)

**HISTORY:** An 18 year old male cricket player (fast bowler) presented with longstanding symptoms of stiff calves and hamstrings, and pain in the gluteal and lower back regions. He had been treated conservatively for a lumbar stress injury (including a full rehabilitation program) however his symptoms persisted. On further enquiry he had previous problems with his left Achilles tendon and a right-sided tennis elbow. His back pain felt better as he warmed up but did not respond to non-steroidal anti-inflammatory drugs. No further systemic complaints were elicited. He has a family history of an uncle diagnosed with Reiter's Syndrome.

**PHYSICAL EXAMINATION:** He had slight tenderness of the lower lumbar area to the left of the spinous process. Neurological examination was normal. The Schöber test and chest expansion were normal. The FABER test was positive on the right and left, and the sacroiliac joints were tender on palpation.

**DIFFERENTIAL DIAGNOSIS:**

1. Lumbar spondylolysis
2. Ankylosing spondylitis
3. Vertebral disc lesion

**TEST AND RESULTS:****Blood tests**

- Erythrocyte sedimentation rate: Normal
- C-reactive protein: Normal
- Human Leukocyte Antigen B27: Positive

**X-rays**

- Lumbar: No spondylolysis or spondylolisthesis. Slight narrowing noted of the L4/L5 intervertebral disc space. No vertebral body margin osteophytes or end plate changes identified.

- Pelvis: Normal

**MRI**

- Sclerosis of the lower lumbar facets, left (L4/L5 and L5/S1). Thought to be due to overuse.
- Slightly narrowed L4/L5 disc space, but no herniation or prolapse.
- Reactive changes of the right sacroiliac joint, but no bony edema.

**TREATMENT AND OUTCOME:**

1. Because of the clinical picture, inconclusive radiography and positive HLA B27, the athlete was treated for inflammatory arthritis. He was prescribed a course of prednisone to which he responded dramatically.
2. Following the significant improvement, a decision was made to treat for Ankylosing Spondylitis and include a stringent rehabilitation program for the other problems identified.
3. The athlete responded well, and after 20 weeks returned to full training. However this patient will need to be monitored frequently and remain on a rehabilitation program.

**FINAL DIAGNOSIS:**

Ankylosing spondylitis complicated by overuse of the lumbar facets possibly due to his sport.

1845 June 2, 1:20 PM - 1:40 PM

**Fitness Walker With Sciatica: Application Of Periodization Theory In Clinical Care**

William R. VanWye<sup>1</sup>, Donald L. Hoover<sup>1</sup>, Lawrence W. Judge<sup>2</sup>.  
<sup>1</sup>Western Kentucky University, Bowling Green, KY. <sup>2</sup>Ball State University, Muncie, IN. (Sponsor: Alan E. Mikesky, FACSM)  
Email: ray.vanwye@wku.edu  
(No relationships reported)

**HISTORY:** A 45 year old woman was referred by her primary care physician (PCP) to a physical therapist (PT) with a medical diagnosis of sciatica. Her chief complaint was difficulty walking. Her symptoms began insidiously 4 weeks prior to the PT evaluation. She described her initial symptoms as severe low back pain (LBP), rating it as 8/10, where 10 is the worst pain possible. Pain ratings at the time of initial evaluation were more manageable, yet the patient reported difficulty walking bouts longer than 5 minutes duration. She expressed a treatment goal of returning to recreational walking, including distances between 3.1 and 13.1 miles (5K and half-marathon).

**PHYSICAL EXAMINATION:** Clinical examination revealed limitation in spinal extension, significant weakness of the S1 myotome, positive neural tension via slump test, absent Achilles reflex, and paresthesia in the L5-S1 dermatome that was triggered by prolonged fitness walking.

**DIFFERENTIAL DIAGNOSIS:**

1. Low back pain
2. Radiculopathy
3. Neural tension
4. Loss of motor function

**TEST AND RESULTS:** The patient demonstrated abnormalities in the following clinical tests: 1) PPIVMs to the lumbar spine, 2) Positive neural tension/slump test, 3) Absent left Achilles reflex, and 4) frank weakness (2/5) of the left plantar flexors, as measured by the toe-raise test (Flynn, Cleland, & Whitman, 2008; Lunsford & Perry, 1995). The PT initiated a regimen of manual therapy, as well as progressive therapeutic exercise based upon periodization models regularly used in athletic preparation schemes.

**FINAL WORKING DIAGNOSIS:** Sciatica-based frank weakness of the plantarflexors in the involved lower extremity, affecting motor function and walking tolerance.

**TREATMENT AND OUTCOMES:** The attending PT treated this patient using a signs and symptoms-based clinical classification system, coupled with a periodization model commensurate with those used in athletic development programs to address the motor deficit of the plantarflexors. Through a combination of clinical and sport science models, the PT was able to eliminate all positive clinical signs, and the patient resumed previous level of function within 15 weeks of initiation of treatment.

1846 June 2, 1:40 PM - 2:00 PM

**Lumbar Back Pain in a Cheerleader**

Jill Sadoski. *Evergreen Sports Medicine, Winthrop, ME.*  
(Sponsor: James Dunlap, FACSM)  
(No relationships reported)

**HISTORY:** A 17 year old high school and competitive cheerleader presented with 10 month history of low back pain. The pain initially started during the start of her competitive cheerleading season 10 months prior to presentation. She denies trauma or injury. She describes her pain as sharp with radiation to her left calf. Her pain is aggravated by transitioning from a standing to sitting position, standing for long periods of time, and driving. Her only alleviating factor is ibuprofen. She completed a conservative treatment course that included two months of physical therapy and four months osteopathic manipulation. She denies any relief in her symptoms, and mentions that her radiating pain started after she had osteopathic manipulation performed. She is having nocturnal pain symptoms. She denies any bladder or bowel incontinence. She denies fever or chills.

**PHYSICAL EXAMINATION:** Alert, comfortable appearing female. Inspection revealed no swelling or gross deformity. No tenderness to palpation over the bony spine while supine, but tenderness along L5 while prone. Step deformity appreciated along the midline at L5. Spine forward flexion, extension, and lateral bending were pain free and normal. Negative log roll and straight leg raises B/L. Slump test on the left caused radicular symptoms in her left leg. Left Extensor hallucis longus 3/5 strength. Strength and sensation intact in the lower extremities B/L. Normal ambulation with toe and heel walking. Patellar reflexes +2 B/L. Achilles reflex + 1 on the left and +2 on the right. Dorsalis pedis pulses +2 B/L.

**DIFFERENTIAL DIAGNOSIS:**

1. Spondylolysis
2. Spondylolisthesis
3. Posterior Element Overuse Syndrome
4. Vertebral Body Apophyseal Avulsion Fracture
5. Sacroiliac Joint Dysfunction
6. Disc Herniation
7. Tumor

**TEST AND RESULTS:**

MRI Lumbar Spine:

- Grade 5 anterolisthesis at L5-S1 with severe spinal stenosis at the lumbosacral junction

CT Lumbar Spine:

- Grade 5 anterolisthesis of L5 relative to S1 with severe spinal stenosis at the lumbosacral junction

FINAL WORKING DIAGNOSIS: Grade 5 anterolisthesis at L5-S1 with radiculopathy

**TREATMENT AND OUTCOMES:**

1. Referral to Neurosurgery
2. PCP started her on gabapentin 300mg that was increased to a TID dosing for neuropathic pain.
3. Pain relief with alternating ibuprofen 400mg-800mg and Tylenol 500mg Q4 hours PRN for pain.

1847 June 2, 2:00 PM - 2:20 PM

**Chronic Musculoskeletal Pain Condition—Delayed-onset Lumbar Pain After Mastectomy**

Max Fitzgerald, Alex Behar. *Rush University Medical Center, Chicago, IL.* (Sponsor: Sheila Dugan, FACSM)  
(No relationships reported)

**HISTORY:** A 51-year-old woman presented to clinic with several year history of low back pain. No inciting event. Pain described as primarily aching in nature, localizing to right mid-low back and worse with overhead activity. Denied any numbness, tingling or weakness in LE's. No change in bowel or bladder. Has pertinent medical history of breast cancer status post mastectomy with reconstructive breast surgery using her right latissimus dorsi. This procedure was performed 18 years ago without complications. Her exercise habits included running on a treadmill once weekly, walking frequently and nightly stretching routine. Reported mild relief with weekly deep tissue massage. **PHYSICAL EXAMINATION:** Neurologic examination intact with normal strength, sensation and reflexes from L2-S1. Lumbar exam with full range of motion with flexion/extension, but reduced side-bending and rotation. She had marked levoscoliosis with forward flexion and prominent, tender paraspinal musculature on the right lower thoracic/upper lumbar region with some associated tenderness. She did not have any specific tenderness to palpation along the spinous processes. She denied pain with facet loading tests. Very poor activation of the right quadratus lumborum (QL) was appreciated with spinal extension muscle testing.

**DIFFERENTIAL DIAGNOSIS:**

1. Myofascial pain
2. Lumbar spondylolisthesis
3. Degenerative disc disease
4. Acquired scoliosis

**TESTS AND RESULTS:**

Lumbar Spine Radiographs anterior-posterior and lateral:

--No fractures  
--Mild scoliosis in lumbar spine (left rotated at L1-L3 and right rotated at L5)

Lumbar Spine MRI

--Mildly narrowed disc space at L4/5 with small left herniated nucleus pulposus

FINAL/WORKING DIAGNOSIS:

Quadratus lumborum dystonia with acquired scoliosis

TREATMENT/OUTCOMES:

1. Manual physical therapy with emphasis on stretching the QL/hip flexors, core stabilization, and re-educating QL. Also iliotibial band stretching, quadriceps/hip abductor strengthening.
2. Pregabalin to facilitate neuromuscular re-education.
3. Trigger point injections into right quadratus lumborum—possible future botulinum toxin injection.
4. Consideration of thoracic-lumbar-sacral orthosis following therapy.
5. Pain improving gradually with greater range of motion and functional status.

1848 June 2, 2:20 PM - 2:40 PM

**Back Pain In A Junior Olympian - Running**

Julia L. Iafrate, Karen L. Newcomer, FACSM. *Mayo Clinic, Rochester, MN.* (Sponsor: Karen Newcomer, MD, FACSM)  
Email: iafrate.julia@mayo.edu  
(No relationships reported)

**HISTORY:** 15 year old female member of the Uruguay Youth Olympic National Track Team with 1 year of back pain and 8 months of constant, worsening pain. Pain was located in the low lumbar region and worsened when she ran. Running hills and weighted exercises increased the intensity. Also worsened with prolonged sitting or standing. Improved with walking, stretching, and lying supine with knees in flexion. Outside MRI reported signs of degenerative disc pathology at L4-5 and Schmorl nodule of L5. MRI otherwise normal.

After the PanAm games she stopped running completely to try to allow for healing; however, pain remained. Gained no benefit from physical therapy at home. Grew 7 cm in the last year. Questionably regular menses. Resting pain a 6/10.

**PHYSICAL EXAMINATION:** Slender young female. Normal alignment of the pelvis. Tender from L3 to the sacrum in the midline and paraspinous region. Tenderness both SI joints. Pain with flexion and extension. Flexion slightly limited with a Schober's of 20 cm. Extension -1. Lateral bend normal bilaterally without pain. Hip ROM normal. Straight leg raise negative. Popliteal angle of 70 degrees on the right, 40 degrees on the left. Strength and reflexes of upper and lower extremities are normal.

**DIFFERENTIAL DIAGNOSIS:**

1. Sacroiliitis
2. Pars fracture/spondylolisthesis
3. Quadratus lumborum strain
4. Referred pain from hamstring strain
5. Pelvic/sacral stress fracture in the setting of possible female athlete triad
6. Discogenic low back pain
7. Facetogenic back pain

**TEST AND RESULTS:**

Sed Rate - 3

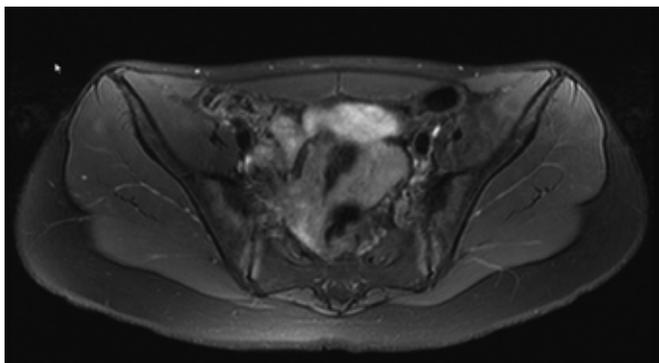
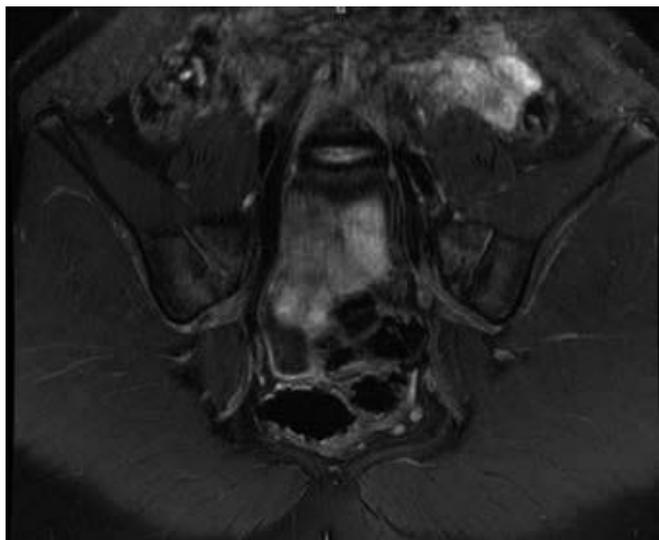
CRP - <3

MRI pelvis - Superior margins of both SI joints show significant subchondral marrow edema on both the sacral and iliac sides. Left greater than right subchondral fatty change. Mild disc degeneration at the L4-5 level. Normal gluteal and hamstring tendons.

**FINAL WORKING DIAGNOSIS:** Bilateral acute on chronic sacroiliitis - likely autoimmune.

**TREATMENT AND OUTCOMES:**

1. Core strengthening program. Encouraged to remain as active as possible.
2. Running evaluation.
3. Gradual return to run.
4. Decided not to get HLA-B27 because diagnosis already made.
5. Started on indomethacin 75mg BID. Consideration for TNF blockers in the future.
6. Rheumatology follow-up recommended. Expected to develop characteristic findings of spondyloarthritis as she gets older.
7. Consider nutrition evaluation.



## D-23 Free Communication/Poster - Age, Gender, and Special Populations

Thursday, June 2, 2016, 1:00 PM - 6:00 PM

Room: Exhibit Hall A/B

1849 Board #1 June 2, 2:00 PM - 3:30 PM

### No Significant Cognitive Changes Following Season Of High School Soccer

Margaret Dowling, Richelle M. Williams, Kathryn L. O'Connor, Steven P. Broglio, FACSM. *University of Michigan, Ann Arbor, MI.* (Sponsor: Steven Broglio, FACSM)  
Email: mmdowlin@umich.edu

(No relationships reported)

**BACKGROUND:** While concussions and repeated head impacts in football have received increased attention and scrutiny; soccer athletes are repeatedly exposed to head impacts during routine play. Limited research however, has been completed among this population, especially at the high school level. **PURPOSE:** A pilot investigation to evaluate the relationship between a season of soccer participation and cognitive function among male high school athletes. **METHODS:** Six male high school soccer players (ages  $15.8 \pm 0.8$  yrs, height  $178.0 \pm 7.8$  cm, and weight  $65.3 \pm 8.6$  kg) were assessed prior to and following the 2015 soccer season. Participants played in 18 games and 32 practices, including 2 scrimmages, over the season. Each participant signed an Institutional Review Board approved assent form and proper parental consent forms were obtained. Participants completed a 22-item Symptom checklist, Satisfaction with Life Scale (SWLS), Brief Symptom Inventory 18 (BSI-18), King-Devick, AXON computerized cognitive task, and Head Rehab virtual reality tasks assessing Balance, Spatial Memory, and Reaction Time. Paired t-tests were calculated. Significance was noted at  $p < 0.05$ . Head Rehab composite scores showed no significant difference pre to postseason for spatial memory or reaction time. Significant improvement in balance was observed for the roll condition ( $p = 0.03$ ), while no changes were observed for the stationary, pitch, or yaw conditions. **CONCLUSION:** This preliminary study found no significant cognitive declines following a season of high school soccer. Future research should address male and female athletes in a larger cohort where head impact exposure is directly monitored.

This research was supported by The National Institutes of Health: National Institute of Neurological Disorders and Stroke (3R15NS081691-01S1).

1850 Board #2 June 2, 2:00 PM - 3:30 PM

### Performance Validity And Post-concussive Symptoms In A Pediatric And Young Adult Sample

Subramani Seetharama<sup>1</sup>, Timothy Belliveau<sup>2</sup>, Jennifer Cromer<sup>2</sup>, Jason Cromer<sup>3</sup>, David Lovejoy<sup>1</sup>. <sup>1</sup>Hartford Hospital, Hartford, CT. <sup>2</sup>Hospital for Special Care, New Britain, CT. <sup>3</sup>Cogstate, New Haven, CT.

Email: subramani.seetharama@hhchealth.org

(No relationships reported)

Objective validity tests are commonly used to evaluate adult patients' symptom profile and effort during cognitive assessments, but there is less scientific research about methods to check on examinee effort during pediatric post-concussion evaluations.

**PURPOSE:** To investigate the relationships between self-reported post-concussive symptoms and cognitive test validity among pediatrics, adolescents, and young adults.

**METHODS:** Analysis of an archival dataset of 91 subjects consecutively evaluated at an outpatient clinic after a cerebral concussion. A validity index embedded in a brief, computerized cognitive assessment was used to classify test performance as fully acceptable (i.e., no atypical validity check scores,  $n=60$ ) or atypical (i.e., at least one atypical validity check score,  $n=31$ ).

**RESULTS:** Subjects with one or more atypical validity scores reported a broader profile of post-concussive symptoms than those with fully acceptable performance (Mean = 17.8, SD = 15.7 versus Mean = 28.3, SD = 21.4,  $t = -2.585$ ,  $p = 0.011$ ) and had worse performance on measures of information processing ( $t = 2.571$ ,  $p = 0.012$ ), response accuracy ( $t = 5.929$ ,  $p < 0.001$ ), learning ( $t = 3.209$ ,  $p = 0.002$ ), and impulse control ( $t = 2.01$ ,  $p = 0.049$ ). Higher atypical validity scores were positively correlated with responses to two self-reported postconcussive symptom surveys ( $r = 0.354$ ,  $p < 0.001$ ;  $r = 0.235$ ,  $p = 0.035$ ) and negatively correlated with measures of response accuracy ( $r = 0.665$ ;  $p < 0.001$ ), learning ( $r = 0.501$ ,  $p < 0.001$ ), impulse control ( $r = 0.339$ ,  $p = 0.002$ ), and verbal memory ( $r = 0.275$ ,  $p = 0.012$ ). Among subjects with fully valid test scores, post-concussive symptom severity was positively correlated with two measures of anxiety symptoms ( $r = 0.479$ ,  $p < 0.001$ ;  $r = .433$ ;  $p = 0.002$ ), and their subjectively experienced balance problems were not significantly associated with objectively measured balance performance.

**CONCLUSION:** Since post-injury test performance can be affected by non-neurological factors, embedded validity checks can guide test interpretation and case formulation. Elevations on validity indices combined with elevations on

psychological measures may suggest emotional stress and identify an opportunity for early intervention to prevent an atypical course of persistent symptoms after pediatric concussion.

**1851 Board #3 June 2, 2:00 PM - 3:30 PM**  
**Eye Tracking as a Biomarker for Concussion in Pediatric Patients**

Christina Lin Master<sup>1</sup>, Abdullah Bin Zahid<sup>2</sup>, Julia Lockyer<sup>1</sup>, Eileen Houseknecht<sup>1</sup>, Vikalpa Dammavalam<sup>2</sup>, Matthew Grady<sup>1</sup>, Michael Nance<sup>1</sup>, Uzma Samadani<sup>2</sup>. <sup>1</sup>The Children's Hospital of Philadelphia, Philadelphia, PA. <sup>2</sup>Hennepin County Medical Center, Minneapolis, MN.  
 Email: masterc@email.chop.edu  
 (No relationships reported)

Eye Tracking as a Biomarker for Concussion in Pediatric Patients  
 Christina Master MD<sup>1</sup>, Abdullah Bin Zahid MD<sup>3,4</sup>, Julia Lockyer BS<sup>1</sup>, Eileen Houseknecht<sup>2</sup>, Vikalpa Dammavalam BS<sup>3,4</sup>, Matthew Grady MD<sup>1</sup>, Michael Nance MD<sup>2</sup>, Uzma Samadani MD PhD<sup>3,4</sup>  
 Affiliations  
<sup>1</sup> Divisions of General Pediatrics and Pediatric Orthopedic Surgery, Center for Performance and Sports Medicine, The Children's Hospital of Philadelphia, Philadelphia, PA  
<sup>2</sup> Department of General Surgery, The Children's Hospital of Philadelphia, Philadelphia, PA  
<sup>3</sup> Department of Surgery, Hennepin County Medical Center, Minneapolis, MN  
<sup>4</sup> Department of Surgery, Minneapolis VA Health Care System, Minneapolis, MN  
**PURPOSE:** The diagnosis of concussion remains a challenge. Eye movements tracked at a very high frequency (~500Hz) can detect oculomotor abnormalities that last only a fraction of second. We mathematically converted abnormalities in eye movements related to concussion into a model that predicts the probability of being concussed in a pediatric patient population.  
**METHODS:** This cross-sectional case-control study examined concussed and healthy control children from a concussion referral center. Eye movements were recorded while children watched a 220 second video clip as it rotated clockwise around the periphery of a 17" viewing monitor. The pupils' raw coordinates were processed to obtain metrics that included measures from each eye separately and from both eyes together. Concussed patients were also evaluated clinically by measuring convergence on physical examination.  
**RESULTS:** There were 32 age and gender matched subjects in each group (ages 4-21; mean 13; p-value for age-matching=0.979). Eye tracking data was used to build an optimal model that predicts the probability of concussion as defined by the CDC. Accurate detection as demonstrated by an area under the curve of 0.85 (sensitivity of 72% and specificity of 84%) was achieved. Clinical identification of abnormal near point of convergence on physical examination also correlated with eye tracking (AUC=0.81)  
**CONCLUSION:** Objective measures of eye tracking correlate with convergence on physical examination in a pediatric concussion referral center population.

**1852 Board #4 June 2, 2:00 PM - 3:30 PM**  
**Descriptive Epidemiology of Pediatric and Adolescent Concussion Patients in the Primary Care Setting**

Johna K. Register-Mihalik<sup>1</sup>, Mackenzie M. Herzog<sup>1</sup>, O. Josh Bloom<sup>2</sup>, Janna Fonseca<sup>2</sup>, Valerie J. De Maio<sup>1</sup>. <sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>Carolina Family Practice & Sports Medicine, Cary, NC. (Sponsor: Kevin M. Guskiewicz, FACSM)  
 Email: johnakay@email.unc.edu  
 (No relationships reported)

Sport-related concussion (SRC) in the primary care setting is understudied.  
**PURPOSE:** This study describes the epidemiology and gender differences of young SRC patients presenting to the primary care setting.  
**METHODS:** This was a prospective cohort presenting to 3 clinics of a large urban/suburban practice group from December 19, 2015-October 10, 2015. Included were patients 8-18 years, presenting within 3 days of a SRC, who consented to participate. Certified athletic trainers completed data collection at the initial visit. Participants completed a standardized initial concussion visit, including a clinical exam, a symptom checklist, the Immediate Post-Concussion and Cognitive Test (ImPACT), and a visual-vestibular screening. T-tests and Chi-Square analyses were used to examine gender differences.  
**RESULTS:** A total of 131 patients were included: 75 (57.3%) were male, 101 (77.1%) Caucasian, 17 (13.1%) were injured in football, 16 (12.2%) had ADHD, 7 (5.4%) had a history of a psychological disorder, and 46 (35.1%) had a prior history of head trauma. Emergency department visits preceded the clinic visit for 19 (14.5%) patients and 10 (7.6%) patients had imaging for their SRC. There were 10 (7.6%) with loss of consciousness and 16 (12.2%) with amnesia post-injury. Mean age was

14.3±2.0 years. Mean symptom severity was 27.3±21.2. Mean ImPACT composites scores for patients clinically able and within the appropriate age range (n=123) were: Verbal Memory=81.8±12.4, Visual Memory=71.8±13.9, Reaction Time=1.0±3.6; and Processing Speed=33.7±8.1. Thirty-seven (28.2%) patients had abnormal near point convergence (>5cm). Females (Symptom Total=34.1, 95% CI: 27.4-40.8) reported a significantly greater symptom burden than males (Symptom Total=22.9, 95% CI: 19.2-26.7). Females also scored slightly lower on Verbal Memory (Female=78.7, 95% CI: 75.3-82.0; Male=83.2, 95% CI: 80.0-86.3) and Visual Memory (Female=68.8, 95% CI: 65.2-72.4; Male=73.8, 95% CI: 70.4-77.3). No other gender differences were observed (p>0.05).  
**CONCLUSIONS:** Clinicians face multiple presentations when evaluating SRC, and gender may drive some of this variability. Future studies should evaluate how initial presentation impacts treatment and outcomes.  
 Funded by the National Operating Committee on Standards for Athletic Equipment.

**1853 Board #5 June 2, 2:00 PM - 3:30 PM**  
**Effects of Sports Specialization on the Rates of Iliotibial Band Syndrome in Pediatric Athletes**

Sarah S. Jackson, Dai Sugimoto, David R. Howell, William P. Meehan, III, Andrea Straccioli, FACSM. Boston Children's Hospital, Boston, MA. (Sponsor: Pierre d'Hemecourt, FACSM)  
 Email: ss.jackson25@gmail.com  
 (No relationships reported)

Sports specialization has recently been defined as participation in year round intensive training in a single sport at the exclusion of all other sports. Studies suggest an increased risk of overuse injuries among athletes who are specialized to a single sport when compared to multisport athletes. The effect of sports specialization on rate of specific injuries such as iliotibial band (ITB) syndrome has not been reported.  
**PURPOSE:** To examine the effect of sports specialization on rates of ITB syndrome history in pediatric athletes.  
**METHODS:** In this cross-sectional study, participants completed electronic questionnaires describing their current sport participation and previous injury history (N=549). Participants were categorized into three groups: those athletes who participated in 1, 2, or 3 sports throughout the year. The proportions of athletes with a history of ITB syndrome were compared between the three groups using a chi-square analysis.  
**RESULTS:** 18 ITB cases were reported (mean age of athletes = 15.2±1.9 years). The mean age in which athletes reported beginning organized sport(s) participation was; 1 sport athletes: 5.5±2.3 years, 2 sport athletes: 5.7±2.5 years, and 3 sport athletes: 5.1±1.8 years. Thus, the athletes participated in organized sport(s) for approximately 10 years. A higher proportion of 1 sport athletes reported a history of ITB syndrome than 3 sport athletes (9% vs. 2%; p=0.045). No significant differences in the proportion of ITB cases were found between 1 and 2 sport athletes (p=0.294) or between 2 and 3 athletes (p=0.707).  
**CONCLUSION:** Pediatric athletes who participate in a single sport reported a higher proportion of history of ITB syndrome when compared to multiple sport athletes. The findings of this study support the notion that training in a single sport place pediatric athletes at an increased risk for overuse injuries. Future research is needed to evaluate effect of sports specialization on other musculoskeletal injuries in pediatric athletes.

**1854 Board #6 June 2, 2:00 PM - 3:30 PM**  
**Sport Comparison of Shoulder Adaptations in 8-10 Year Old Overhead Athletes**

Aaron H. Struminger<sup>1</sup>, Matthew M. Astolfi<sup>2</sup>, Charles B. Swanik<sup>1</sup>. <sup>1</sup>University of Delaware, Newark, DE. <sup>2</sup>Thomas Jefferson University, Philadelphia, PA.  
 Email: astrum@udel.edu  
 (No relationships reported)

Shoulder pain in adult, overhead athletes has been attributed to a loss of glenohumeral internal rotation. However, underlying soft tissue and bony changes that alter range of motion likely contribute to pain progression. Shoulder pain can begin as early as 8 years of age in overhead athletes, but little data exists on the adaptations that potentially occur at a young age. **PURPOSE:** To compare range of motion and tissue adaptations in the shoulders of swimmers, baseball players, and non-overhead athletic controls ages 8-10. **METHODS:** 55 youth athletes; 20 swimmers (years played=3.0±1.4), 15 baseball players (years played=4.9±1.7), and 20 non-overhead athletes participated. Glenohumeral internal (IR) and external rotation (ER) were measured with a digital inclinometer. Posterior capsule thickness (PCT) and humeral twisting (retrotorsion, HR) were examined using musculoskeletal ultrasound. All measures were taken bilaterally. The dominant arm was defined as the arm preferred to throw a ball for maximum distance. Age and years played were identified as potential co-variables, but neither significantly affected statistical models. Therefore, 3x2 ANOVAs and Tukey post-hoc testing were used to analyze group and arm dominance differences. **RESULTS:** Interaction effects were observed for IR (p=0.03), ER (p<0.01), PCT (p=0.02), and HR (p=0.01). Youth baseball players exhibited a

9.2±9.9° IR loss and 18±10.0° ER gain on the dominant arm compared to the non-dominant arm. These IR and ER differences did not exist in swimmers or controls. The dominant arms of baseball players manifested with greater PCT (1.29±0.24mm) than the dominant arms of all other populations. A significant main effect ( $p<0.01$ ) was also observed for PCT, with swimmers (1.11±0.14mm) and baseball players (1.21±0.19mm) presenting with greater PCT than control subjects (1.04±0.12mm). The non-dominant arms of baseball players demonstrated the least HR (-21.6±10.5) of all participants (swim=-11.3±6.9, non-overhead=-11.3±7.7). **CONCLUSIONS:** Tissue adaptation occurs in youth athletes after only 3 years of overhead sport participation and at an age earlier than previously documented. Sport selection affects the scope of these changes, with the dominant arm of baseball players undergoing the greatest adaptation.

Supported by NATA REF grant 13DGP016

1855 Board #7 June 2, 2:00 PM - 3:30 PM  
**Relationship between Intrinsic Foot Muscle Strength and Standing Broad Jump Performance Across Stages of Maturation**

Kaitlyn E. Wright, Emma F. Zuk, Kevin R. Ford, FACSM, Jeffrey B. Taylor, Anh-Dung Nguyen. *High Point University, High Point, NC.* (Sponsor: Kevin R. Ford, FACSM)  
*(No relationships reported)*

Foot muscle strength may influence physical performance in children, but has been limited to age based comparisons. Since strength varies with gender and physical maturation; and age does not accurately reflect maturational stage, accounting for these differences is necessary to accurately examine relationships in youth athletes. **PURPOSE:** To examine the difference in intrinsic foot muscle strength (IFS) and standing broad jump (SBJ), and their relationship, across maturation in youth athletes. **METHODS:** One hundred and fifty six youth soccer athletes (79M, 77F; 11.1±1.8 yrs, 145.4±16.1 cm, 39.3±10.9 kg) volunteered. The Pubertal Maturational Observational Scale classified participants into pre-pubertal (PRE: 39M, 33F), pubertal (30M, 27F), or post-pubertal (POST: 10M, 17F) maturational groups. IFS of both feet were measured with a pressure distribution platform during three standing trials of maximum isometric flexion of the hallux. SBJ distance was measured during two maximal trials. Maximum SBJ distance and average maximum force under the right and left hallux were used for analyses. Multivariate ANOVA and Pearson correlations examined IFS and SBJ differences and relationships, based on gender and maturational stage, respectively.

**RESULTS:** IFS in PRE (2.00±0.96 N/kg) was greater ( $p<0.001$ ) than PUBERTAL (1.57±0.89 N/kg), with both greater than POST (1.11±0.54 N/kg). There were no differences in IFS between gender ( $p=0.624$ ) or gender by maturational stage ( $p=0.982$ ). SBJ distance was greater ( $p<0.001$ ) in males (155.4±20.1 cm) compared to females (139.6±20.3 cm); and greater ( $p<0.001$ ) in POST (162.7±25.0 cm) compared to PUBERTAL (147.7±20.2 cm) and PRE (141.9±18.5 cm). There were no gender by maturation stage interaction for SBJ distance ( $p=0.883$ ). In both males and females, IFS was not significantly correlated to SBJ distance in PRE ( $p=0.111-0.643$ ), PUBERTAL ( $p=0.099-0.231$ ), or POST ( $p=0.523-0.618$ ).

**CONCLUSIONS:** IFS and SBJ distance are different in youth soccer players relative to maturation and gender. Research examining the influence of IFS on performance should account for maturational stage and gender. In contrast to previous literature, when accounting for maturational stage and gender, our findings do not support a relationship between IFS and SBJ distance in young soccer players.

1856 Board #8 June 2, 2:00 PM - 3:30 PM  
**Prevalence of FAI Type in Adolescent Female Athletes with FAI Presenting to Sports Medicine Clinic**

Joana Fraser, Dai Sugimoto, Emily Hanson, Yi-Meng Yen, Andrea Straccioli, FACSM. *Boston Children's Hospital, Boston, MA.* (Sponsor: Pierre D'Hemecourt, FACSM)  
 Email: joana.fraser@childrens.harvard.edu  
*(No relationships reported)*

**PURPOSE:** 1) To investigate FAI type prevalence in adolescent female athletes 2) To examine differences in cam versus pincer FAI type in adolescent female athletes by sport.

**METHODS:** Retrospective chart review of female athletes 10-25 years with FAI was performed (01/01/2003-08/31/2015). Age, BMI, sport, FAI type (cam, pincer or mixed) as diagnosed by treating physician, family history of hip pathology/early age total hip replacement and management (operative vs non-operative) was extracted. Descriptive and chi-square analyses were used. Chi-squared analysis was used to compare cam versus pincer FAI by sport. A priori statistical significance for the chi-square was set as 0.05

**RESULTS:** Four hundred and twenty two female athletes with FAI were identified with mean age 18.3±3.3 years and mean BMI 23.3±4.3. FAI types included 240 (56.9%) cam, 57 (13.5%) pincer, and 125 (29.6%) mixed. Within the largest five sports groups, the highest proportions of cam, pincer and mixed lesions were seen in softball

( $n=24/33, 72.7%$ ), dance ( $n=22/110, 20%$ ) and gymnastic athlete ( $n=13/40, 32.5%$ ) groups respectively. When comparing cam versus pincer FAI groups, female athletes with pincer FAI were more likely to have a family history of hip pathology (33.3% vs 16.0%,  $p=0.031$ ) and lower BMI (21.7 vs 22.7,  $p=0.019$ ) versus patients with cam FAI. A greater proportion (27.3%) of dancers ( $N=77$ ) with pincer FAI were identified when compared to non-dance athletes ( $N=219$ ) with FAI (16.4%;  $p=0.038$ ).

**CONCLUSIONS:** Cam impingement was the most common type of FAI in this cohort of adolescent female athletes. FAI type differed by sport with dancers showing more pincer type bony morphology versus non-dancing female athletes.

1857 Board #9 June 2, 2:00 PM - 3:30 PM  
**The Cleanse, Medicate, Moisture, and Protect (CoMMplete) Regimen in Adolescent Athletes With Acne Vulgaris**

Brian B. Adams<sup>1</sup>, Edward Lain<sup>2</sup>, JP York<sup>3</sup>, Marie-Jose Rueda<sup>3</sup>.  
<sup>1</sup>University of Cincinnati College of Medicine, Cincinnati, OH.  
<sup>2</sup>Austin Institute for Clinical Research, Austin, TX. <sup>3</sup>Galderma Laboratories, L.P., Fort Worth, TX. (Sponsor: Jon Divine, MD, FACSM)

**Reported Relationships:** B.B. Adams: Consulting Fee; Consultant for Galderma Laboratories, L.P.

**Background:** Cleansing, medicating, moisturizing, and photoprotection comprise a complete acne vulgaris (AV) management regimen. However, complete topical AV treatment regimen investigations in adolescent student athletes are scarce.

**Purpose:** Adapalene and benzoyl peroxide (A/BPO) Gel, 0.1%/2.5% is indicated for the topical treatment of acne vulgaris in patients 9 years of age and older. This open-label single center study evaluated a regimen comprised of A/BPO Gel, Cetaphil® DermaControl™ Foam Wash and Cetaphil® DermaControl™ Moisturizer SPF 30 in student athletes (referred to as the CoMMplete Regimen).

**Methods:** Adolescent student athletes 12 to 18 years of age with mild to moderate acne who were actively participating in 1 of 14 Texas University Interscholastic League (UIL) sanctioned athletic activities followed the CoMMplete Regimen for 8 weeks ( $N=28$ ). Lesion counts, satisfaction, cutaneous irritation, adverse events, and adherence were assessed.

**Results:** After 8 weeks, lesion counts were significantly reduced compared to baseline. Good tolerability and satisfaction were observed. Most subjects experienced no cutaneous irritation. All adverse events were mild or moderate, and the most common regimen related adverse events were dry skin, skin exfoliation, and erythema. One subject experienced treatment related skin burning sensation that resolved after discontinuation. Most subjects exhibited exceptionally high compliance and adherence.

**Conclusions:** The CoMMplete Regimen helps optimize AV treatment outcomes in young athletes.

Study funded

by Galderma Laboratories, L.P., Fort Worth, TX

1858 Board #10 June 2, 2:00 PM - 3:30 PM  
**Short and Long Term Outcomes in Acute versus Chronic Lumbar Spondylolysis in Adolescents Athletes**

Eric Welder<sup>1</sup>, Anastasia Fischer, FACSM<sup>2</sup>, Kristine Graft<sup>2</sup>, Reno Ravindran<sup>2</sup>, Eric Peters<sup>2</sup>, Richard Rodenberg<sup>2</sup>, James MacDonald, FACSM<sup>2</sup>, Mitchell Selhorst<sup>2</sup>. <sup>1</sup>The Ohio State University College of Medicine, Columbus, OH. <sup>2</sup>Nationwide Children's Hospital, Columbus, OH.  
 Email: eric.welder@osumc.edu  
*(No relationships reported)*

Spondylolysis, a stress fracture of the pars interarticularis, is a significant cause of morbidity in young athletes and can present in different phases of bony healing. While there is some evidence to guide treatment based on the injury acuity, the short-term and long-term outcomes of these treatments are not well studied.

**PURPOSE:** To assess ability to return to activity, time to return to activity, and long term functional outcomes for patients with acute versus chronic spondylolysis.

**METHODS:** A retrospective chart review was performed with a cross-sectional follow-up one to five years after initial diagnosis. Two hundred and seventy seven patients with spondylolytic injury met the inclusion criteria and were grouped by acuity of their injury (230 acute, mean age 14.3 ± 1.8 years vs. 47 chronic, mean age 14.9±2.1 years). Ability to return to sport, time to return to sport, and pain with return to sport were the primary variables of interest for the retrospective portion of this study. Long-term outcomes assessed in the survey included recurrence of injury and level of sports participation.

**RESULTS:** Median days of rest prior to return to sport for acute injury patients (138.9, IQR = 49.0) were statistically significantly higher ( $p = 0.001$ ) than for chronic injury patients (107.4, IQR = 60.8). Acute injuries successfully returned to sport at a higher rate (90.9% vs. 80.9%,  $p = 0.044$ ). The percentage of patients with recurrent symptoms during care did not differ between the groups (25.2% vs. 14.9%,  $p = 0.128$ ).

To date, 111 patients (40.1%) participated in the follow-up phone survey (96 acute, 15 chronic). Fifty eight (60.4%) acute group respondents reported sports participation level as "same or higher" compared to eight (53.3%) from the chronic group. Recurrence of symptoms was similar (36.5% vs. 40.0%), but a higher percentage of acute injury patients experienced symptoms requiring medical treatment rate of symptoms requiring medical treatment (21.9% vs. 13.3%). Collection of follow up data is ongoing.

**CONCLUSIONS:** A smaller percentage of chronic injury patients returned to sport, but those who did return had shorter recovery times than the acute group. Preliminary follow up data suggest patients treated for acute injuries have more favorable long-term outcomes more likely to recover to their pre-injury functionality.

1859 Board #11 June 2, 2:00 PM - 3:30 PM  
**Are Specific Aspects Of Training Associated with the Development Of Atrial Fibrillation in Older Runners and Endurance Athletes?**

Martin E. Matsumura<sup>1</sup>, Yassir Khalil<sup>2</sup>. <sup>1</sup>Geisinger Health System, Wilkes Barre, PA. <sup>2</sup>Coordinated Health System, Allentown, PA.  
 Email: mmatsumura@geisinger.edu  
 (No relationships reported)

**Purpose:** Accumulating data support a relationship between chronic participation in endurance sports and the occurrence of atrial fibrillation (AF). However, the specific aspects of training which are related to the development of AF are not well characterized. In the present study we assessed in a population of older athletes whether specific training habits are related to the presence of AF, and whether these relationships are independent of traditional AF risk factors.

**Methods:** Data regarding medical history and training characteristics were assessed for 2819 participants in the MASTERS Athletic study, a web-based survey of runners ages 35 and older. Data were stratified by those who reported a diagnosis of AF vs. those who reported no diagnosis of AF.

**Results:** AF was reported by 69/2819 respondents (2.4%). Runners reporting AF were significantly older (59.8yrs vs 48.1yrs,  $p < 0.001$ ) and more likely to be male (85.3% vs 67.8% males,  $p = 0.003$ ) and report diabetes (7.3% vs. 1.3%,  $p < 0.001$ ) and hypertension (47.1% vs. 20.3%,  $p < 0.001$ ). Of specific running/training characteristics only accumulated years of running were associated with AF ( $X^2 = 37.0$ ,  $p < 0.001$ ); in contrast, average training pace, weekly mileage, average training days/week, the use of speedwork for conditioning, and participation in triathlons were not associated with the report of AF. In a multivariable logistic regression model chronologic age (OR 1.076, 95% CI 1.041-1.113,  $p < 0.001$ ), hypertension (OR 1.972, 95% CI 1.029-3.779,  $p = 0.041$ ), and years of accumulated running (OR 1.162, 95% CI 1.002-1.348,  $p = 0.047$ ) remained independent predictors of AF. In contrast, male sex and diabetes did not independently predict AF.

**Conclusions:** In older runners accumulated years of running was the only training variable that appeared to relate to the risk of AF. Importantly, the relationship of years of running with AF appears to be independent of traditional AF risk factors and not simply related to chronologic age. Physicians should consider the risk of AF in patients who long-term participants in endurance sports regardless of athlete age and traditional AF risk factors.

1860 Board #12 June 2, 2:00 PM - 3:30 PM  
**Changes in Neuromuscular Performance throughout the Menstrual Cycle in Physically Active Females**

Lee A. Weidauer, Joe Albert, Mary Beth Zwart, Jeffrey Clapper, Bonny Specker, Matthew Vukovich, FACSM. *South Dakota State University, Brookings, SD.*  
 (No relationships reported)

**Purpose** The purpose of this study was to determine the change in neuromuscular performance throughout the menstrual cycle in college-aged females and the effect of hormonal contraception on these changes. **Methods:** Fifty physically active college females (25 on oral contraceptives (OC)) were recruited to participate in three visits throughout one menstrual cycle. Visits coincided with the follicular (Fp), ovulatory (Op), and the luteal (Lp) phases. Blood was drawn at each visit to determine circulating concentrations of estradiol (E2), progesterone (P4), and relaxin (R2). Grip strength, knee joint laxity, q-angle, and isokinetic quadriceps strength at 60°/sec, 180°/sec, and 300°/sec were measured. Data were analyzed using linear mixed effect models taking into account repeated measures. **Results:** Grip strength was lower during Fp (30.1 ± 0.7 kg/m<sup>2</sup>) than during Op (31.5 ± 0.7 kg/m<sup>2</sup>,  $p = 0.003$ ) and Lp (32.6 ± 0.7 kg/m<sup>2</sup>,  $p < 0.001$ ). Isokinetic peak torque (IPT) at 60°/sec was lower during Fp (112 ± 3 ft-lbs) than during the Op (116 ± 3 ft-lbs,  $p = 0.009$ ). IPT at 180°/sec was lower during the Fp (73 ± 2.0 ft-lbs) than the Op (79 ± 2 ft-lbs,  $p < 0.001$ ) and Lp (82 ± 2

ft-lbs,  $p < 0.001$ ). Results were similar for the 300°/sec isokinetic testing with lower peak torque during Fp (58 ± 2 ft-lbs) than the Op (63 ± 2 ft-lbs,  $p < 0.001$ ) or Lp (63 ± 2 ft-lbs,  $p < 0.001$ ). No differences were observed among any of the visits for knee joint laxity, or quadriceps angle. The OC-by-phase interaction was not significant for any of the outcomes or R2 concentration, but was significant for E2 and P4 with the concentrations of E2 and P4 being lower during the ovulatory and luteal phases in the OC group. Inclusion of E2, P4 or R2 in statistical models did not affect any of the outcomes for either group. **Conclusion:** Results indicate that muscular performance is diminished during follicular phase (menstruation) and the lack of significant OC-by-phase interaction indicates that this effect is not related to OC use, E2 concentrations, or P4 concentrations. Based on these data we postulate that female athletes may be at a greater risk of injury due to decreased strength during Fp than other phases of their cycle; future studies should focus on attenuating the strength decrease observed during menstruation.

1861 Board #13 June 2, 2:00 PM - 3:30 PM  
**Paralympic Athletes' Perceptions Of Their Experiences Of Sports-related Injuries: A Qualitative Study**

Jan Lexell<sup>1</sup>, Kristina Fagher<sup>1</sup>, Anna Forsberg<sup>1</sup>, Jenny Jacobsson<sup>2</sup>, Örjan Dahlström<sup>2</sup>, Toomas Timpka<sup>2</sup>. <sup>1</sup>Lund University, Lund, Sweden. <sup>2</sup>Linköping University, Linköping, Sweden. (Sponsor: Prof Nick Webborn, UK, FACSM)  
 Email: jan.lexell@med.lu.se  
 (No relationships reported)

Knowledge of sports-related injuries in Paralympic athletes is limited, and there are no data on how they perceive an injury. **PURPOSE:** To explore Paralympic athletes' perceptions of their experiences of sports-related injuries. **METHODS:** Eighteen elite athletes from the Swedish Paralympic program interviewed and a qualitative phenomenographic design was used for the detection and interpretation of their perceptions of their experiences. **RESULTS:** The athletes perceived that the disability itself influences the cause and consequences of an injury, and that they have more problems with injuries than a non-disabled body. Another perception was that the impact of elite training was seen as a cause of injury. Also, a majority of the athletes perceived that injuries could be self-inflicted. Other categories identified and described were: the normalized pain, the impact of injury, individual possibilities to prevent injuries, the dangerous elite sports and the in equal prerequisites. **CONCLUSIONS:** The results from this study indicate that Paralympic athletes' perceptions of their experiences of sport-related injuries are complex and multifactorial. This needs to be considered in the design of future injury surveillance systems, prevention programs and rehabilitation strategies.

Supported by the Swedish National Centre for Research in Sports and The Swedish Paralympic Committee.

1862 Board #14 June 2, 2:00 PM - 3:30 PM  
**Energy Expenditure during Power Wheelchair Soccer**

JP Barfield<sup>1</sup>, Laura Newsome<sup>1</sup>, Laurie A. Malone<sup>2</sup>. <sup>1</sup>Radford University, Radford, VA. <sup>2</sup>UAB/Lakeshore Foundation Research Collaborative, Birmingham, AL. (Sponsor: Hank Williford, FACSM)  
 Email: abarfield@radford.edu  
 (No relationships reported)

**Purpose.** The purpose of this study was to determine energy expenditure during power wheelchair soccer (PWS) among persons with physical disabilities. **Methods.** Sixteen participants with severe physical disabilities ( $M_{Age} = 33.88 \pm 17.12$  yrs,  $M_{BMI} = 22.82 \pm 6.82$ ,  $M_{Power\ Soccer\ Experience} = 7.58 \pm 4.09$  yrs,  $M_{Disability\ Sport\ Experience} = 11.58 \pm 10.02$  yrs) were recruited from multiple PWS teams. Portable metabolic carts were used to collect oxygen consumption data (expressed in METs) during the following conditions: resting (REST), practice (DRILL), and gameplay (SCRIMMAGE). A subsample of participants was assessed on a second day for reliability analysis. **Results.** Players sustained light-intensity exercise during both DRILL and SCRIMMAGE conditions, approaching 2.0 METs. These intensities demonstrate a 27% and a 41% increase in energy expenditure from REST to DRILL and REST to SCRIMMAGE, respectively. These scores were stable, as demonstrated by ICC values of .88, .89, and .90 for REST, DRILL, and SCRIMMAGE, respectively. **Conclusion.** Although this intensity does not meet the threshold recommended to reduce chronic disease risk, the ability to demonstrate an exercise stress during PWS is a meaningful outcome. Specifically, the documented energy expenditure in the current study was consistent with thresholds sufficient to enhance functional capacity and performance of daily living activities.

1863 Board #15 June 2, 2:00 PM - 3:30 PM  
**Evaluation Of Glenohumeral Joint Laxity in Physically Disabled Athlete**

aynur demirel, Nevin Ergun, FACSM. *hacettepe university, ankara, Turkey.* (Sponsor: Nevin ERGUN, FACSM)  
 Email: aynurdemirel629@hotmail.com  
 (No relationships reported)

**Evaluation Of Glenohumeral Joint Laxity In Physically Disabled Athlete**  
 Aynur Demirel, Nevin Ergun, Hacettepe University, Ankara, Turkey  
 aynurdemirel@hacettepe.edu.tr  
 (Sponsor: Nevin ERGUN, FACSM)

Alteration of glenohumeral joint external and internal range of motion is seen in athletes performing most of sport branches. Glenohumeral joint Repetitive motions causes microtrauma at glenohumeral joint. Altered shoulder laxity can cause instability and functional imbalance. Purpose: the aim of the study was to determine glenohumeral joint laxity and upper extremity musculoskeletal disorders in athletes with physical disabilities. Methods: 49 disabled athlete playing sport with wheelchair at least two years were participated to the study (20 F, 29 M; mean age: 28±8.2). The athletes were categorized as 28 para archery, para table tennis, shooting players in group 1 and 21 wheelchair basketball, tennis players in group 2. Glenohumeral Joint laxity (GJL) was assessed in the athlete's scapula maximally retracted, laterally fixed position. In this position athlete's arm was horizontally adducted without any rotation. The angle between the humerus shaft and the horizontal plane was measured with goniometer. All measurements were applied three times bilaterally and the best score was recorded. SF-36 Life Quality scale, The Disability of Hand Arm and Shoulder (DASH) was applied all athletes. Due to the non-normal distributions of the test values, Mann Whitney U test was used for the differences between two groups in terms of glenohumeral joint laxity, SF-36 health survey and DASH scale. Results: There was no difference between two groups regarding SF-36 Health Survey, DASH Questionnaire (p>0.05). GJL for dominant shoulder was significantly higher in group 2. (105.2°±1.64°, 100.7°±1.48°, p<0.001; group 1 and 2, respectively). GJL for non-dominant shoulders was higher in group 2 (103.1°±1.2°, 100.7°±1.3° p<0.001; group 1 and 2, respectively). Conclusion: In this study, the disabled athletes has different laxity according to adaptive changes related to different kind of sports.

1864 Board #16 June 2, 2:00 PM - 3:30 PM  
**Aerobic Capacity after Bilateral Total Knee Replacement Surgery: A Case Study Report**

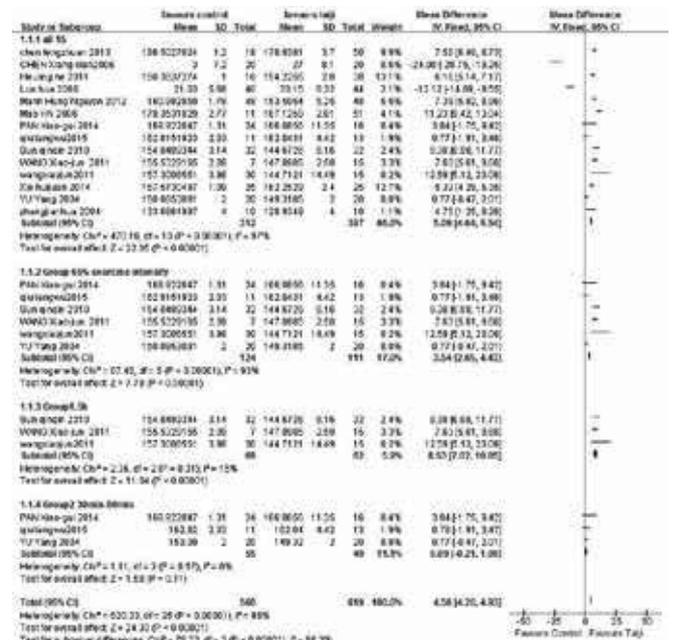
Melissa A. Whidden, W. Craig Stevens, FACSM. *West Chester University, West Chester, PA.* (Sponsor: W. Craig Stevens, FACSM)  
 Email: mwhidden@wcupa.edu  
 (No relationships reported)

**PURPOSE:** The purpose of this case study was to analyze aerobic capacity during a walking treadmill test and a staircase walk before and after bilateral total knee replacement (TKR) surgery. **METHODS:** The patient was a 61-year-old male who underwent a simultaneous bilateral TKR procedure for advanced osteoarthritis and began physical therapy four days post-surgery. His physician classified his condition as "bone-on-bone" prior to the surgery. The patient performed outpatient rehabilitation three times per week for a total of thirteen sessions and then returned to normal activities of daily living. Aerobic capacity, including heart rate, minute ventilation, and oxygen consumption during submaximal exercise were assessed one day before surgery and 2, 4, 6, and 12 months post-surgery using COSMED K4b2 mobile metabolic analyzer. **RESULTS:** Heart rate and oxygen consumption were higher throughout the walking treadmill test before TKR surgery when compared to all four post-surgery time points. Maximum exercise heart rate during the treadmill test was 23.9% lower 2 months, 37% lower 4 months, 37.8% lower 6 months, and 43.7% lower 12 months post-surgery. Maximum exercise oxygen consumption was 24.2% lower 2 months, 31.2% lower 4 months, 39% lower 6 months, and 27.2% lower 12 months post-surgery. Interestingly, minute ventilation was similar before and after surgery. The time it took the patient to perform four passes on a three story staircase greatly improved over time post-surgery from 8 minutes 2 months post-surgery to 5 minutes 12 months post-surgery. **CONCLUSION:** The case study patient demonstrated major improvements in aerobic capacity following the cessation of physical therapy both on the treadmill and during a staircase walk following bilateral TKR surgery.

1865 Board #17 June 2, 2:00 PM - 3:30 PM  
**The Efficacy Of Tai Chi Exercise For Primary Hypertension : A Systematic Review And Meta-analysis**

Deyi Lu<sup>1</sup>, Pengchao Zhang<sup>2</sup>, Libo Zhou<sup>3</sup>, Mengyi Zhou<sup>4</sup>, Hao Liu<sup>5</sup>, Derui Lu<sup>6</sup>. *1University of Illinois at Chicago, Chicago, IL. 2City College of Science and Technology, Chongqing University, Chongqing, China. 3Cornell University, Ithaca, NY. 4Duke University, Durham, NC. 5The Ohio State University-Columbus, Columbus, OH. 6Purdue University, Lafayette, IN.*  
 Email: dlu20@uic.edu  
 (No relationships reported)

**PURPOSE:** The aim of this study was to evaluate the effectiveness of Tai Chi intervention in essential hypertension.  
**METHOD:** A systematic literature search was performed in 7 databases from their respective inception from January 2013 to January 2015, including: PubMed, Scolar, Elsevier, Springer Link, Wiley Online Library, CNKI and Wanfang Databases. A meta-analysis was conducted by software Rev Man 5.1 to examine the pooled effect of Yang's Tai Chi Exercise controlling hypertension upon 789 subjects from randomized controlled clinical trial.  
**RESULTS:** The results of meta-analyses showed that Yang's Tai Chi intervention could lower blood pressure and increase the concentration of nitric oxide; Subgroup analysis showed that Tai Chi group was superior to the control group in decrease of SBP[MD=-8.53, 95%CI (7.02, 10.05), P=0.31], DBP[MD=-3.60, 95%CI(3.41, 3.78), P=0.91] and increase concentrations of NO[MD=5.16, 95%CI(1.20, 9.12), P=0.36].  
**CONCLUSIONS:** Tai chi exercise can increase the concentration of NO. Practicing Tai Chi for 1.5 hours per day while among 65%-85% of HRmax can significantly decrease the systolic blood pressure and diastolic blood pressure. And we will extend our research to the other branches of Tai Chi including Chen's, Sun's, Wu's.



THURSDAY, JUNE 2, 2016



had greater cancer deaths (89.1%). After adjustment for age, sex, race, and multiple baseline risk factors, men and women with all 5 to 7 combined ideal health metrics had a 70% (95% CI: 14% to 72%) lower risk of cancer mortality compared with men and women with zero ideal health metrics. The risks of cancer mortality across 0, 1, 2, 3, 4, and 5 to 7 ideal health metrics were (95% CI) 1.00 (referent), 0.92 (0.65, 1.31), 0.75 (0.51, 1.12), 0.57 (0.40, 0.83), 0.56 (0.32, 0.96), and 0.40 (0.18, 0.86) (p for trend <0.001), respectively. Men and women with increasing number ideal health metrics had a substantially lower risk of cancer mortality. Men and women with 5 to 7 compared with 0 combined ideal health metrics had a longer life expectancy by 11.8 years (95% CI: 1.0 to 20.5 years). Approximately 46% (95% CI: 11% to 73%) of all cancer deaths might have been avoided if men and women had adopted 5 or more combined health factors and healthy lifestyle behaviors.

**CONCLUSIONS:** The AHA's 7 ideal cardiovascular health metrics is associated with lower risk of cancer mortality and longer life expectancy in men and women. This study was supported by Medi Plus Solution Co., Ltd.

1868 Board #20 June 2, 3:30 PM - 5:00 PM  
**Associations Between Physical Activity, Metabolic Risk Factors, and Comorbidities In Cancer Survivors**

Dong-Woo Kang, Eun-Young Lee, Kerry S. Courneya.  
*University of Alberta, Edmonton, AB, Canada.*  
 Email: dongwoo.kang@ualberta.ca  
 (No relationships reported)

**PURPOSE:** Cancer survivors with high metabolic risks or comorbidities have poorer survival. Moreover, physical activity is associated with improved cancer prognosis. We investigated the associations between physical activity, metabolic risk factors, and comorbidities in Korean cancer survivors.

**METHODS:** The Korean National Health and Nutrition Examination Survey data from 2007 to 2013 were analyzed with a total number of 1,225 cancer survivors. Complex sample general linear models and logistic regression analyses were used. Moderate-to-vigorous physical activity (MVPA) was measured by self-administered questionnaire. Metabolic risk factors included waist circumference, blood pressure, triglyceride (TG), high-density lipoprotein-cholesterol, total cholesterol (TC), and fasting glucose. Comorbidities included diabetes, hypertension, stroke, arthritis, osteoporosis, and back pain.

**RESULTS:** In the sample overall, 38.4% were male, mean age and body mass index (BMI) were 62.3±12.4 years and 23.3±3.2 kg/m<sup>2</sup> respectively. Cancer types included stomach (n=276), cervical (n=179), breast (n=176), colorectal (n=145), lung (n=48), liver (n=44), and other cancers (n=402). The average time spent in MVPA was 148.1±355.7 min/wk and 26.1% met ACSM/ACS physical activity guidelines for cancer patients (≥ 150 min of moderate intensity or 75 min of vigorous intensity activity per week). The total amount of MVPA was inversely correlated with TG (p=.008), fasting glucose (p=.003) and insulin level (p=.025) after adjustment for sex, age, and BMI. Those who did not meet ACSM/ACS guidelines showed higher systolic blood pressure (p=.003) and an increased risk of hypertension (odds ratio [OR]=1.52; 95% confidential interval [CI]=1.01 to 2.28) compared to those who met the guidelines. Furthermore, those who participated in strength exercises less than 2 days/wk showed a higher level of fasting glucose (p=.001) and TC (p=.031), and a higher risk of stroke (OR=5.03; 95% CI=1.38 to 18.37), arthritis (OR=1.62; 95% CI=1.05 to 2.51), and back pain (OR=2.30; 95% CI=1.10 to 4.80) compared to those who participated in strength exercises at least 2 days/wk.

**CONCLUSIONS:** MVPA and strength exercise may play important roles in improving metabolic risk factors and preventing potential comorbidities in Korean cancer survivors.

1869 Board #21 June 2, 3:30 PM - 5:00 PM  
**Exercise Protects Against Cancer-Induced Cardiac Dysfunction While Inhibiting Tumor Growth**

Traci L. Parry<sup>1</sup>, Reid Hayward<sup>2</sup>. <sup>1</sup>University of North Carolina, Chapel Hill, NC. <sup>2</sup>University of Northern Colorado, Greeley, CO.  
 Email: traci\_parry@med.unc.edu  
 (No relationships reported)

Cancer has been shown to negatively stimulate autophagy, which can lead to declines in cardiac function. While exercise is cardioprotective, its influence over autophagy-mediated tumor growth and cardiac function are not well defined.

**PURPOSE:** To determine the effect of exercise on tumor morphology and cardiac function in the MatBIII rat cancer model.

**METHODS:** Female Fisher 344 rats were assigned to one of four groups: 1) sedentary non tumor-bearing (SED), 2) sedentary tumor-bearing (SED+T), 3) wheel run non-tumor bearing (WR), or 4) wheel running tumor bearing (WR+T). Rats remained sedentary or voluntarily exercised for 8 weeks. At week 6, rats in tumor groups were inoculated with MatBIII tumor cells in the left flank. At week 8, rats were sacrificed and cardiac function was measured using an isolated perfused working heart preparation and tumors were measured with calipers. Cardiac and tumor autophagy protein expression was determined by western blot.

**RESULTS:** SED+T animals exhibited significantly lower left ventricular developed pressure values when compared to SED, WR, and WR+T ( $P < 0.05$ ). This coincided with a significant increase in cardiac autophagic flux (increased LC3-II) in SED+T animals when compared to SED, WR, and WR+T ( $P < 0.05$ ). Furthermore, SED+T hearts showed a significant increase in  $\beta$ MHC expression vs NT groups ( $P < 0.05$ ). Tumor mass and volume were significantly larger ( $P < 0.001$ ) in SED+T animals when compared to WR+T animals, which was accompanied by a significant increase in tumor LC3-II protein expression ( $P < 0.05$ ).

**CONCLUSION:** Non-exercised tumor-bearing rats showed severe cardiac dysfunction and excessive, maladaptive autophagy in the heart and tumors. Voluntary exercise preserved cardiac function and attenuated the autophagic response in heart and tumor tissues. This preservation may be related to the reduced tumor growth observed in aerobically exercised rats, to the improved regulation of autophagy by exercise, or both.

1870 Board #22 June 2, 3:30 PM - 5:00 PM  
**Resistance Training in Advanced Cancer Patients Undergoing Tyrosine Kinase Inhibitor Therapy: A Clinical Feasibility Study**

Friederike Scharhag-Rosenberger, Emanuel Schembri, Sonia Vallet, Carsten Grölich, Joachim Wiskemann. *National Center for Tumor Diseases (NCT), Heidelberg University Hospital, Heidelberg, Germany.*  
 (No relationships reported)

**PURPOSE:** While there is growing evidence for the positive effects of resistance training (RT) on fatigue and quality of life (QoL) in cancer patients undergoing curative chemo- or radiotherapy, knowledge is scarce on advanced cancer patients receiving other therapies which cause fatigue. The present pilot study aimed at investigating feasibility and effects of RT in advanced cancer patients undergoing tyrosine kinase inhibitor (TKI) therapy.

**METHODS:** 24 patients at the beginning of TKI therapy were included in the study and assigned according to their place of residence to an intervention group (INT, 12 weeks of supervised machine-based progressive resistance training 2x/week) or a control group (CO, treatment as usual). 19 patients completed the study (INT: n=10, 80% males, 90% renal cell carcinoma, 65±11 years, BMI 25.9±3.9 kg/m<sup>2</sup>, peak oxygen uptake (VO<sub>2peak</sub>) 15±4 ml/min/kg; CO: n=9, 89% males, 67% renal cell carcinoma, 61±6 years, BMI 24.3±2.6 kg/m<sup>2</sup>, VO<sub>2peak</sub> 19±7 ml/min/kg). Strength (stationary isokinetic dynamometer test), VO<sub>2peak</sub> (cycle ergometry), fatigue (MFI), and QoL (EORTC QLQ30) were assessed at baseline and after 12 weeks.

**RESULTS:** In INT, 9 of 10 patients completed the training program (attendance rate 79%, 2 sessions abandoned due to hypoglycemia and weakness). One patient stopped the program after 2 sessions due to repeated nausea, vomiting and joint pain. No serious adverse events occurred. RT had significant beneficial effects on strength in INT (maximum voluntary isometric contraction of the knee extensors: from 158±61 to 169±61 Nm) compared to CO (from 166±48 to 150±36 Nm, adjusted p=.005). No effects were found on VO<sub>2peak</sub> (INT: -0.01±0.18 l/min, CO: 0.14±0.26 l/min, adjusted p=.488), general or physical fatigue (INT: 0.3±4.1 and 0.3±4.7, CO: 1.3±3.2 and -0.9±2.5, adjusted p=.303 and .275) and QoL (INT: -5.6±16.1, CO: -4.8±17.9, adjusted p=.763).

**CONCLUSIONS:** RT appears feasible in most but not all advanced cancer patients undergoing TKI therapy. In contrast to findings in curatively treated patients, the positive effects on strength were not associated with positive effects on fatigue and QoL. However, this should be interpreted cautiously regarding the small and heterogeneous sample and needs further evaluation.

1871 Board #23 June 2, 3:30 PM - 5:00 PM  
**Effects Of Postoperative Recovery Exercise Program On Body Composition, Functional Assessment, Depression, Fatigue, And Inflammatory Markers In Early Gastric Cancer Survivors**

Yoonsun Son<sup>1</sup>, In Cho<sup>2</sup>, Chong Do Lee<sup>1</sup>, Yoon Jung Bae<sup>3</sup>, Hyoung-Il Kim<sup>4</sup>, Woo Jin Hyung<sup>4</sup>, Dae Taek Lee<sup>5</sup>. <sup>1</sup>Arizona State University, Phoenix, AZ. <sup>2</sup>Catholic Kwandong University College of Medicine, Incheon, Korea, Republic of. <sup>3</sup>Medi Plus Solution, Seoul, Korea, Republic of. <sup>4</sup>Yonsei University College of Medicine, Seoul, Korea, Republic of. <sup>5</sup>Kookmin University, Seoul, Korea, Republic of.  
 Email: xppizim@naver.com  
 (No relationships reported)

**Purpose:** This study investigated the effects of postoperative recovery exercise program developed specifically for gastric cancer patients (PREP-GC) on body composition, functional assessment, depression, fatigue, and inflammatory markers in early gastric cancer survivors.

**Methods:** Twenty gastric cancer patients had minimally invasive gastrectomy and completed the PREP-GC after the surgery. The PRER-GC comprised a) in-hospital

exercise for 1 week, b) home exercise for 1 week, and c) fitness improvement exercise for eight weeks. The fitness improvement exercise program consisted the combination of aerobic and resistance exercise for 60 minutes/session for 3 times per week. All measurements including body composition, functional assessment, depression, fatigue, and inflammatory markers (e.g., WBC count, CRP, etc) were assessed during the preoperative period ( $T_1$ ), after postoperative recovery (2 weeks after surgery;  $T_2$ ), and after completing the PREP-GC (10 weeks after surgery;  $T_3$ ). Twenty additional gastric cancer patients (age-, sex-, and BMI-matched) were also recruited to compare inflammatory markers with those patients in the PREP-GC across intervention.

**Results:** Body weight ( $64.5 \pm 11.2$  vs.  $59.9 \pm 9.3$  kg), body mass index ( $23.6 \pm 3.0$  vs.  $21.9 \pm 2.5$  kg/m<sup>2</sup>), body fat mass ( $17.1 \pm 1.5$  vs.  $13.4 \pm 1.2$  kg), and waist-to-hip ratio ( $0.87 \pm 0.5$  vs.  $0.84 \pm 0.5$ ) were significantly reduced from  $T_1$  to  $T_3$  (all  $p < 0.05$ ). The skeletal muscle mass was also reduced after surgery ( $T_1$  vs  $T_3$ ;  $26.6 \pm 5.5$  vs.  $25.5 \pm 5.3$ ,  $p < 0.001$ ), but it significantly increased after the PREP-GC ( $T_2$  vs.  $T_3$ ;  $25.5 \pm 5.3$  vs.  $26.1 \pm 5.5$  kg,  $p = 0.013$ ). There were no statistical differences in social and functional well-being ( $p > 0.05$ ), but physical and emotional well-being and gastric cancer subscales were recovered or improved after the PREP-GC (all  $p < 0.05$ ). Depression remain unchanged, while fatigue was decreased at  $T_3$  ( $50.33 \pm 7.0$ ) as compared to  $T_1$  ( $68.00 \pm 8.4$ ) and  $T_2$  ( $78.00 \pm 9.7$ ) assessed by CES-D ( $p < 0.05$ ). There were no statistical differences in inflammatory markers between those GC patients with and without the PREP-GC.

**Conclusion:** Our results indicate that the combination of aerobic and resistance exercise was effective to improve muscle mass and physical and emotional well-being in gastric cancer patients after the gastrectomy.

1872 Board #24 June 2, 3:30 PM - 5:00 PM

### Pilot Study : Can Inspiratory Muscle Training Relieve Symptoms Of Dyspnoea And Improve Quality Of Life For Advanced Cancer Patients ?

Martin R. Lindley<sup>1</sup>, Mark Faghy<sup>1</sup>, Heidi Sowter<sup>2</sup>, Prof Timothy D. Mickleborough, FACSM<sup>3</sup>. <sup>1</sup>Loughborough University, Loughborough, United Kingdom. <sup>2</sup>University of Derby, Derby, United Kingdom. <sup>3</sup>Indiana University, Bloomington, IN.  
Email: m.r.lindley@lboro.ac.uk

(No relationships reported)

**PURPOSE:** Dyspnoea is a common symptom of advanced cancer patients, and impacts upon physical, social and psychological wellbeing. Currently opioids are recommended for those suffering with chronic dyspnoea, despite an association with longer term health issues. Inspiratory muscle training (IMT) promotes chronic adaptations within the inspiratory musculature and has consistently been shown to reduce dyspnoea and improve lung mechanics, functional exercise capacity and quality of life in a variety of clinical populations, however this has yet to be tested in patients with cancer. **METHODS:** This small pilot study recruited advanced stage cancer patients ( $n=3$ ) with dyspnoea from the Derby Royal Hospital (UK), who consented to an incremental IMT programme of 9 weeks (Powerbreath classic light). Patients were given advice on breathlessness management strategies and asked to record self-set goal achievement in a diary. Functional measurements taken at baseline, and then 3 and 9 weeks post IMT included a 6 minute walk test (6MWT), spirometry and maximal inspiratory mouth pressure (MIP). Ratings of perceived exertion (Borg 6-20 scale) and modified dyspnoea score (1-10) were recorded for the 6MWT. Additionally, participants completed a St. Georges Respiratory Questionnaire (SGRQ) at all time points and contributed to a focus group at the end of the study.

**RESULTS:** We found that participants showed a significant functional improvement after 9 weeks of IMT as measured by the 6MWT; although the distance travelled did not change pre  $282m \pm 141$ ; Post  $350m \pm 127$  ( $P > 0.05$ ), the dyspnoea (pre  $4.0 \pm 1.0$ ; post  $2.0 \pm 1.0$ ) and perceived exertion (pre  $12 \pm 3.0$ ; post  $9.0 \pm 2.0$ ) for each participant during the 6MWT was significantly reduced ( $P < 0.05$ ) at end of test. MIP increased in two of the participants (40% and 50%), but remained unchanged in the third participant, who had a higher than predicted baseline (MIP pre  $87 \pm 26$  cmH<sub>2</sub>O; post  $108 \pm 10$  cmH<sub>2</sub>O). During the focus group all participants asserted that this technique had helped them in their daily life and was easy to fit into their schedules. No significant results were found with the SGRQ or with the goal-setting diary.

**CONCLUSIONS:** IMT is a well-tolerated intervention for advanced cancer patients suffering from dyspnoea however a larger trial is needed and currently being planned.

1873 Board #25 June 2, 3:30 PM - 5:00 PM

### Weight Fluctuation And Cancer Risk In Post-Menopausal Women: The Women's Health Initiative

Laura M. Welti<sup>1</sup>, Daniel P. Beavers<sup>2</sup>, Mara Z. Vitolins<sup>1</sup>, Haleh Sangi-Haghpeykar<sup>3</sup>, Kristen M. Beavers<sup>1</sup>. <sup>1</sup>Wake Forest University, Winston-Salem, NC. <sup>2</sup>Wake Forest School of Medicine, Winston-Salem, NC. <sup>3</sup>Baylor College of Medicine, Houston, TX. (Sponsor: Peter Brubaker, FACSM)  
Email: lwelti92@gmail.com

(No relationships reported)

**BACKGROUND:** Weight fluctuation is a common occurrence, particularly in women; yet little is known about the association between lifetime body weight dynamics and cancer risk.

**PURPOSE:** To examine the role of weight fluctuation during early to late adulthood and associated risk of breast (BC), colorectal (CC), and endometrial (EC) cancer in postmenopausal women.

**METHODS:** Participants included 87,882 postmenopausal women (50-79 yrs) from the Women's Health Initiative Observational Study, categorized by self-reported weight change (weight stable, steady weight gain, lost weight, weight cycled) during adulthood (18-50 yrs). Adjudicated incident breast, colorectal, and endometrial cancer events were collected annually over 20 yrs. Cox models were used to estimate hazard ratios (HR) and 95% confidence intervals (CI).

**RESULTS:** In this group of women, 31.5% were weight stable, 28.4% weight gainers, 2.9% weight losers, and 37.2% weight cyclers. During a mean 12.8 years of follow-up, 8,801 (BC=6446, EC=884, CC=1471) incident cancer cases were identified among women who met study criteria. Compared to weight stability, women who identified as weight gainers were at increased risk of BC (HR: 1.19, CI: 1.12-1.26), CC (HR: 1.24, CI 1.08-1.41), and EC (HR: 1.37, CI 1.15-1.63). Weight cycling increased risk of BC (HR 1.08, CI 1.02-1.15) and EC (HR 1.42, CI 1.21-1.68), with a trend toward an increased risk of CC (HR 1.13, CI 1.00-1.28). Weight loss was not associated with cancer risk.

**CONCLUSIONS:** Weight gain and cycling are associated with increased risk of postmenopausal breast, colorectal, and endometrial cancer. These results suggest the need for further investigation of associations between different body weight patterns and risk of cancer.

1874 Board #26 June 2, 3:30 PM - 5:00 PM

### Leisure-time Running And All-cause Cancer Mortality

Duck-chul Lee<sup>1</sup>, Carl J. Lavie<sup>2</sup>, Timothy S. Church<sup>3</sup>, Xuemei Sui<sup>4</sup>, Steven N. Blair, FACSM<sup>4</sup>. <sup>1</sup>Iowa State University, Ames, IA. <sup>2</sup>Ochsner Health System, New Orleans, LA. <sup>3</sup>Pennington Biomedical Research Center, Baton Rouge, LA. <sup>4</sup>University of South Carolina, Columbia, SC. (Sponsor: Steven N. Blair, FACSM)

Email: dclee@iastate.edu

(No relationships reported)

**PURPOSE:** We investigated the association between running and overall cancer mortality. **METHODS:** Participants were 52,917 adults aged 18-100 years (mean age, 44), who received a preventive medical examination during 1974-2002 at the Cooper Clinic. At baseline, all participants were free of myocardial infarction, stroke, and cancer. Running was assessed on a medical history questionnaire. Participants were classified into 6 groups: nonrunners and 5 quintiles of weekly running amount, time, distance, and frequency. Mortality follow-up was through 2003 using the National Death Index. Cox regression models included baseline age, sex, examination year, smoking status, heavy alcohol drinking, levels of other physical activities, and each running characteristic. **RESULTS:** During an average follow-up of 14.6 years, 1,193 cancer deaths occurred. Compared with nonrunners, runners (24% of participants) had 21% lower risk of cancer mortality with the hazard ratio (HR) and 95% confidence interval (CI) of 0.79 and 0.68-0.92, respectively. HRs (95% CIs) of cancer mortality were 0.72 (0.53-0.99), 0.78 (0.58-1.04), 0.87 (0.65-1.17), 0.78 (0.58-1.06), and 0.80 (0.58-1.16) in 1-505, 506-812, 813-1,199, 1,200-1,839, and  $\geq 1,840$  MET-min/week of running; 0.72 (0.52-0.99), 0.81 (0.60-1.07), 0.75 (0.55-1.04), 0.92 (0.69-1.22), and 0.75 (0.54-1.04) in 1-50, 51-80, 81-119, 120-175, and  $\geq 176$  min/week; 0.69 (0.50-0.95), 0.83 (0.61-1.12), 0.80 (0.60-1.06), 0.85 (0.62-1.17), and 0.80 (0.58-1.09) in 1-5, 6-8, 9-12, 13-19, and  $\geq 20$  miles/week; 0.52 (0.32-0.83), 0.93 (0.70-1.24), 0.78 (0.59-1.03), 0.87 (0.67-1.13), and 0.73 (0.52-1.02) in 1-2, 3, 4, 5, and  $\geq 6$  times/week, respectively, compared with no running. Among runners, there were no significant differences in cancer mortality across quintiles of running doses. Compared with no running, weekly running even  $< 250$  MET-min/week and  $< 30$  min/week were associated with 53% (HR: 0.47, 95% CI: 0.23-0.93) and 59% (HR: 0.41, 95% CI: 0.17-0.99) lower risks of cancer mortality, respectively. **CONCLUSION:** This study highlights that running even less than half of the current minimum doses of vigorous-intensity aerobic activity, which is 500 MET-min/week or 75 min/week, is sufficient for substantial cancer mortality benefits. Supported by NIH Grant AG06945, HL62508, and DK088195.

1875 Board #27 June 2, 3:30 PM - 5:00 PM

**Resistance Training Improves Muscular Strength in Prostate Cancer Patients Undergoing Androgen Deprivation Therapy**Alexander R. Lucas<sup>1</sup>, Brian C. Focht, FACSM<sup>2</sup>, Elizabeth Grainger<sup>2</sup>, Christina Simpson<sup>2</sup>, Ciaran M. Fairman<sup>2</sup>, Jennifer M. Thomas-Ahner<sup>2</sup>, Steven K. Clinton<sup>2</sup>. <sup>1</sup>Wake Forest School Of Medicine, Winston Salem, NC. <sup>2</sup>The Ohio State University, Columbus, OH.

Email: arlucas@wakehealth.edu

(No relationships reported)

Prostate cancer (PC) patients treated with androgen deprivation therapy (ADT) are at risk for an increased rate of adipose tissue accumulation and skeletal muscle wasting, which may lead to reductions in muscular strength and ultimately functional decline and loss of independence. Resistance training that includes at least 2 sessions per week, targeting all major muscle groups, may offer one strategy to arrest these declines. **PURPOSE:** To examine i) changes in upper body (seated chest press) and a lower body (leg extension) muscular strength in older PC patients on ADT treatment and ii) the associations between age, time on treatment with ADT, muscular strength and body composition in 32 PC patients in the IDEA-P trial. **METHODS:** 32 PC patients were randomized to resistance training coupled with exercise and dietary counseling (16) or a standard care control group (16). The treatment group attended 2 sessions p/week of resistance training (supervised month 1&2, independent month 3). Muscular strength was assessed with a 1RM protocol for both upper (UB) and lower body (LB) at baseline and again after 2 and 3 months. Body composition (%BF) was measured with the BODpod, while time on treatment (TOT) was measured in months. **RESULTS:** At baseline PC patients were M=66±7.7 years of age, had been on ADT treatment for M=22 ±2.2 months and were obese according to their body composition (% Body fat M=38.2±9.1). At baseline, there were significant bivariate correlations between age, UB and LB muscular strength ( $r=-0.537$ ,  $p<0.01$ ) ( $r=-0.392$ ,  $p<0.05$ ) respectively. TOT was not associated with baseline scores but was associated with 2 month change in LB muscular strength. A 2 (treatment) x 3 (time) ANCOVA controlling for age revealed a significant treatment by time interaction for UB ( $F=6.721$ ,  $p<0.01$ ) and LB ( $F=3.988$ ,  $p<0.05$ ) strength. **CONCLUSION:** Resistance training is a safe and feasible means of improving and maintaining muscular strength in older men undergoing ADT for prostate cancer. Increases in muscular strength may protect aging PC patients against future declines in physical function. However, increasing adherence to home based exercise programs outside of supervised sessions is key to changing lifestyles and health outcomes for prostate cancer patients over the long term. Supported by NIH/NCI R03 CA16296901; 5R25 CA122061

1876 Board #28 June 2, 3:30 PM - 5:00 PM

**Effects of a Combined Exercise and Dietary Intervention on Mobility 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>1</sup>, Jennifer Thomas-Ahner<sup>1</sup>, Steven K. Clinton<sup>1</sup>. <sup>1</sup>The Ohio State University, Columbus, OH. <sup>2</sup>Wake Forest University, Winston Salem, NC.

Email: focht.10@osu.edu

(No relationships reported)

Although exercise consistently results in significant improvements in clinically relevant outcomes in prostate cancer (PC) patients undergoing androgen deprivation therapy (ADT), the synergistic benefits of promoting concomitant change in both exercise and dietary behavior could represent an optimal lifestyle intervention approach for offsetting the adverse effects of ADT on mobility performance experienced by PC patients. **PURPOSE:** The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a combined exercise and dietary (EX+D), implementing a group-mediate cognitive behavioral (GMCB) approach, relative to standard of care (SC) treatment upon change in mobility performance among PC patients undergoing ADT. **METHODS:** A total of 32 PC patients (M age = 65 years) on ADT were randomly assigned to the EX+D (n = 16) or SC (n = 16) interventions. Measures of mobility performance including 400M Walk and stair climb performance 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 ( $p<0.01$ ) for 400M Walk and stair climb performance. Post hoc analysis revealed that the intensive phase of the EX+D intervention resulted in superior improvements in 400M Walk ( $d = .60$ ) and stair climb ( $d = .47$ ) performance 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

mobility performance relative to SC approach. These results underscore the utility of promoting change in both exercise and dietary behavior for sustaining functional health among PC patients undergoing ADT. Supported by NIH/NCI R03 CA16296901

1877 Board #29 June 2, 3:30 PM - 5:00 PM

**Self-reported Lifetime Physical Activity and Body Mass Index among Hispanic Women with and without Breast Cancer**Damaris Feliciano-Gutierrez<sup>1</sup>, Cruz M. Nazario<sup>2</sup>, Lucia del R. Martinez<sup>1</sup>, Farah A. Ramirez-Marrero, FACSM<sup>1</sup>. <sup>1</sup>University of Puerto Rico Rio Piedras Campus, San Juan, Puerto Rico. <sup>2</sup>University of Puerto Rico Medical Sciences Campus, San Juan, Puerto Rico.

Email: damaris.feliciano1@upr.edu

(No relationships reported)

Physical activity (PA) behavior is beneficial for the prevention and control of breast cancer (BC), the most prevalent and mortal type of cancer among Hispanic woman in Puerto Rico (PR). **PURPOSE:** To evaluate and compare self-reported lifetime PA behavior and its relation with body mass index (BMI). **METHODS:** This study is part of a larger on-going population-based case-control study of BC in PR with 146 Hispanic women: 51 with and 95 without BC (age range 30-79 years). Lifetime PA questionnaire inquired about PA in different stages (6-11, 12-13, 14-22, 23-50, 51-64, and 65+ years of age), the duration/day, and intensity. Present PA behavior was also evaluated with one question inquiring about minutes/day of brisk walking. Participants were classified as active or inactive based on the estimated MET-min/week (<600 = inactive, >600 = active). Kruskal-Wallis test was used to compare the proportion of participants in each category of PA, and an independent t-test to compare BMI between groups. Association between PA behavior and BMI was evaluated with Spearman correlations. **RESULTS:** The majority of cases (98.7%) and controls (99.5%) were classified as active, with no between stage differences. Domestic PA was the most prevalent and leisure time PA the least prevalent type of PA in both groups; however, cases appear to engage more in leisure time and less in domestic type of PA compared with controls. BMI was higher in the older stages of life (>50 years). No significant association was observed between PA behavior and BMI; however, there was also a tendency for higher BMI among those extremely active based on present walking behavior. **CONCLUSION:** Results suggest a high level of self-reported PA behavior not associated with BMI among women with and without BC in PR. Self-reported PA behavior must be interpreted with caution.

1878 Board #30 June 2, 3:30 PM - 5:00 PM

**Influence of Structured Resistance Training on Daily Physical Activity Energy Expenditure in Breast Cancer Survivors**

Esther L. Moe, Jessica Dobek, Lillian Nail, Brad Wipfli, Kerri M. Winters-Stone, FACSM. Oregon Health &amp; Science University, Portland, OR. (Sponsor: Kerri Winters-Stone, PhD, FACSM)

(No relationships reported)

Structured exercise, such as resistance and impact training may reverse treatment-related bone and muscle loss in breast cancer survivors (BCS) and increase total daily energy expenditure beyond that from supervised training leading to further benefits. **PURPOSE:** This secondary data analysis examined the changes in daily energy expenditure (EE) from physical activity (PA) in participants of a one-year randomized controlled trial of structured exercise. Changes in EE were compared between BCS assigned to resistance + impact exercise (POWIR) or a placebo control stretching program (FLEX). **METHODS:** 71 BCS (mean age: 46.5 years) participated in the trial and in their assigned supervised group exercise classes 2 times/wk and home-based training 1 time/wk. Participants self-monitored their daily EE using accelerometry (Actical; Total EE and EE expended in light, moderate and vigorous activities measured in kcal/day) for 3 days at a time at baseline, 6 and 12 month time points. **RESULTS:** 30 women (n=14 POWIR; 16 FLEX) provided valid accelerometry data (>10 hrs wear time/day) at all 3 time points and were included in the analysis. Wear time included days with structured exercise sessions in only 14/126 (8%) of POWIR and 12/144 (11%) of FLEX data and thus primarily reflects EE outside of the intervention. The overall group by time (2x3) interaction was not statistically significant ( $p=0.10$ ). Further exploration found near significant interactions at 6 months ( $p=0.05$ ); women in POWIR increased total EE (+49.3 kcal/day) compared to declines in FLEX (-82.9 kcal/d). From 0 to 6 months a significant group by time interaction was observed for EE during moderate intensity PA ( $p=.02$ ), but not during light or vigorous PA. **CONCLUSION:** Overall PA levels in BCS may increase beyond that achieved by participating in a structured exercise program. A small increase in overall PA may have implications in terms of long-term weight management. However, the effect we

observed appears to be transient with group differences disappearing over the second half of the year intervention. Further investigation about the potential additional benefits of structured exercise on overall PA and how to sustain these increases warrant further investigation.

Supported by: American Cancer Society RSGPB-06-092-01-CPBP (PI Winters-Stone) & AHRQ K12 HS019456 01

1879 Board #31 June 2, 3:30 PM - 5:00 PM  
**Physical Activity Algorithm In A Comprehensive Cancer Center.**

Allica Austin, Whitney Thoman, Sally Scroggs, Shamsha Damani, Therese B. Bevers. *MD Anderson, Houston, TX.*  
Email: adaustin@mdanderson.org

(No relationships reported)

**Purpose:** One third of cancer cases are preventable through the implementation of healthier lifestyle choices including physical activity (PA), diet and weight management. Integrative Health Services (IH) was tasked with developing a PA algorithm (PAA), mapping patient screening and guidance through providing safe and effective PA interventions, to be implemented within clinical settings. The IH provides PA, diet, and weight management services to patients within a Cancer Prevention Center.

**Methods:** The algorithm was a collaboration of a multidisciplinary team including: medical and program directors, clinical managers, physical therapists, exercise physiology technologists, dietitians, physicians and clinical effectiveness representatives. This team merged relevant clinical practice with the 2014 National Comprehensive Cancer Network Survivorship Guidelines and American College of Sports Medicine (ACSM) PA guidelines for cancer survivors into a applicable process that can be adopted into any professional setting. The PAA includes risk stratification, with education, that addresses symptomatic and asymptomatic patients. The PAA aims to reduce patients' barriers for PA evaluation, assessment, and intervention by providing a unique process that guides professionals in successful conversations on PA for the reduction of chronic disease risks, specifically cancer risks. Every patient is unique and the PAA has been created to impact each person's unique situation in any setting.

**Results:** In October 2015, the PAA was approved for implementation throughout the institution. It is available to all who are interested in providing quality comprehensive PA services to participants within clinical practices, commercial programs, or even corporate wellness programs.

**Conclusion:** The PAA was developed to provide a clear process to guide healthcare professionals who are interested in improving the health of patients by providing PA assessment, intervention, and participant centered exercise prescription within any facility. Future goals include the implementation of the PAA throughout the institution, and the world, as a viable means of cancer risk reduction.

1880 Board #32 June 2, 3:30 PM - 5:00 PM  
**Effectiveness of a Home-based Exercise Intervention in Fitness Profile in Hispanic Breast Cancer Survivors**

Alexis Ortiz<sup>1</sup>, Daniel C. Hughes<sup>2</sup>, Maribel Tirado-Gomez<sup>3</sup>, Velda J. Gonzalez-Mercado<sup>3</sup>, JaeJoon Song<sup>4</sup>, Karen Basen-Engquist<sup>4</sup>. <sup>1</sup>Texas Woman's University, Houston, TX. <sup>2</sup>University of Texas Health Science Center at San Antonio, San Antonio, TX. <sup>3</sup>University of Puerto Rico Medical Sciences Center, San Juan, PR. <sup>4</sup>UT MD Anderson Cancer Center, Houston, TX.

Email: aortiz10@twu.edu

(No relationships reported)

Effectiveness of exercise interventions in Hispanic breast cancer survivors is an area warranting further research.

**PURPOSE:** To determine the effectiveness of a culturally-tailored and standard home-based exercise program in Hispanic breast cancer survivors.

**METHODS:** Ninety women breast cancer survivors were recruited from the Puerto Rico Comprehensive Cancer Center and MD Anderson Cancer Center in Houston, TX three months post-treatment. Participants were randomized into one of three groups; standard intervention (SI); culturally tailored intervention (CTI) or waiting list control group (WLC). The SI and CTI groups followed a 16-week exercise program while the control group continued with their normal activities. The intervention groups were mailed bi-weekly newsletters organized around seven themes (7 newsletters). Participants in the CTI received culturally adapted newsletters that emphasized important exercise variables applicable to Latina breast cancer survivors based on results of focus group discussion and analysis of a previous survey. Participants were given a tri-axial accelerometer to be worn for a week prior to laboratory measures to establish their baseline physical activity and fitness. Participants completed a self-reported physical activity questionnaire (IPAQ) and a series of physical fitness assessments. The physical fitness assessment included: anthropometric measures, percent body fat, a six-minute walk test (6MWT), sit-to-stand in 30 seconds, grip, upper extremity, low back, and leg strength, shoulder range of motion, and a functional

reach test. Repeated measures ANOVA were performed to test effects of time, intervention group, and intervention group effects on time for measures for fitness, physical activity, and sedentary time.

**RESULTS:** At baseline there were no differences in sedentary behavior, physical fitness and disability measures across intervention groups. For participants as a group there was a strong effect of time on physical activity, muscle strength, and shoulder ROM. However, there were no significant differences between groups.

**DISCUSSION:** A culturally tailored intervention did not seem to offer additional benefits to a standard intervention seeking to improved fitness levels in Hispanic breast cancer survivors.

1881 Board #33 June 2, 3:30 PM - 5:00 PM  
**Diet and Physical Activity in Prostate Cancer Survivors in Relation to Muscle and Physical Function**

Jacqueline Kiwata, Christina M. Dieli-Conwright, E. Todd Schroeder, FACSM. *University of Southern California, Los Angeles, CA.*

Email: kiwata@usc.edu

(No relationships reported)

Androgen deprivation therapy (ADT) is associated with prolonged survival in prostate cancer survivors (PCS), yet PCS on ADT have lean body mass (LBM) and physical function losses. Current guidelines to attenuate adverse outcomes in PCS suggest a minimum of 150 min/wk of physical activity (PA) and a dietary intake of 20-35% of energy from fat, 45-65% energy from carbohydrate (CHO), and 10-35% energy from protein (PRO) with at least 0.8 g PRO/kg weight (RDA). It is unclear if meeting these diet and PA guidelines enhance LBM and physical function (muscle strength and aerobic fitness) in hypogonadal PCS on ADT.

**PURPOSE:** We investigated relationships between macronutrient intake and PA level in relation to LBM and physical test performance in PCS on ADT.

**METHODS:** Nineteen PCS (66.4 ± 9.1 yr) on currently prescribed ADT for at least 3 months were recruited from the USC Norris Comprehensive Cancer Center as part of a larger ongoing exercise trial. Energy intake was reported using a 3 day diet log, while PA was assessed through questionnaire. Total LBM was measured by dual-xray absorptiometry. Muscle strength was assessed on the seated row and leg curl through estimation of the 1 repetition maximum (RM) from 8-12 RM. The 400 m walk was used as a measure of aerobic fitness. Relationships were analyzed using Pearson correlation tests with a statistical significance of p<0.05.

**RESULTS:** The majority of PCS (76%) met current PA guidelines, and performed 3513.7 ± 3703.5 MET-min/wk (mean ± SD). Over half (52%) met the macronutrient guidelines for % energy, while 71% satisfied the RDA. On average, 1609.0 ± 320 kcal were consumed daily, with 20.0 ± 5.3% kcal from PRO (1.06 ± 0.44 g/kg·day), 47.4 ± 12.1% from CHO and 32.2 ± 7.7% from fat. A moderate correlation was found between % energy from fat and LBM (r=0.68, p<.01), while % energy from CHO was inversely correlated with LBM (r=-0.55, p=.01). LBM was significantly correlated with strength (seated row: r=0.60, p<.01; leg curl: r=.63, p<.01), but not 400 m walk time. PA level was not significantly correlated with any outcome.

**CONCLUSIONS:** Among this limited sample of PCS on ADT, our findings indicate that higher % energy intake from fat and lower % energy intake from CHO may be associated with greater LBM. Furthermore, self-reported PA was not related to aerobic fitness, but greater LBM may improve muscle strength.

1882 Board #34 June 2, 3:30 PM - 5:00 PM  
**Impact Of Exercise On Prognosis, Quality Of Life, And Exercise Capacity In Lung Cancer Survivors**

Keith M. Thraen-Borowski, Keith P. Gennuso, Ronald Ganganon, Amy Trentham-Dietz, Kelli F. Koltyn, Alex K. Adams, Toby Campbell, Lisa H. Colbert, FACSM. *University of Wisconsin-Madison, Madison, WI.* (Sponsor: Lisa H. Colbert, FACSM)

Email: thraenborows@wisc.edu

(No relationships reported)

**Purpose:** To determine the feasibility and effects of an exercise intervention on biomarkers of prognosis, health-related quality of life (HQOL), and exercise capacity in lung cancer survivors.

**Methods:** Participants were recruited over 13 months for this eight-week intervention. Subjects were randomized to usual care or an intervention consisting of supervised exercise training two days per week in-clinic and a prescription for at-home exercise three days per week, totaling 150 min/wk of moderate-intensity physical activity (PA). Exercise capacity (long distance corridor walk), health-related quality of life (FACT-L), and serum levels of inflammatory biomarkers (IL-6, IL-8, IL-10, TNF- $\alpha$ , and hs-CRP) and oxidative stress (8-OHdG) were measured pre- and post-intervention. Descriptive statistics and effect sizes (Cohen's *d*) were calculated.

**Results:** Of all eligible subjects (n=191), less than 7% agreed to participate, leaving a final analytic sample of 11 survivors (n=5 treatment; n=6 control) with a mean age of 63 (±7.3) years, 64% of which were female, 91% white, and 100% diagnosed with

non-small cell lung cancer. Those randomized to the exercise arm more frequently had Stage IV cancer (80% vs. 17% in controls) and were currently receiving cancer treatment (60% vs. 0% in controls). Both the retention and adherence rate in our exercise group was 83%. Negative effects of our treatment were observed in some outcomes (IL-8, IL-10, 8-OHdG, FACT-L), though hs-CRP was lowered ( $d = -0.66$ ) and exercise capacity was maintained.

**Conclusions:** For individuals interested in and well enough to participate, exercise training appears to be safe and feasible. The majority of our sample was compliant with the intervention and met the 150 min/wk PA goal, though our small sample size did not allow for a thorough evaluation of the effectiveness of this intervention as it relates to biomarkers of prognosis, HQOL, and exercise capacity.

1883 Board #35 June 2, 3:30 PM - 5:00 PM  
**The Effect Of Exercise Training On Mediators Of Inflammation In Breast Cancer Survivors: A Systematic Review With Metaanalysis**

Robinson Ramírez-Vélez<sup>1</sup>, Jose Meneses-Echávez<sup>2</sup>, Jorge Enrique Correa-Bautista<sup>3</sup>, Esteban Sabogal<sup>1</sup>, Javier Martínez-Torres<sup>1</sup>, Katherine González-Ruiz<sup>3</sup>. <sup>1</sup>Universidad Santo Tomas, Bogotá D.C, Colombia. <sup>2</sup>Norwegian Knowledge Centre for Health Services, Oslo, Norway. <sup>3</sup>Universidad del Rosario, Bogotá D.C, Colombia.  
 Email: robin640@hotmail.com  
 (No relationships reported)

**PURPOSE:** Several evidences have proposed that exercise during and after breast cancer could positively modulate the tumor microenvironment. This metaanalysis aimed to determine the effects of exercise training on mediators of inflammation in breast cancer survivors.

**METHODS:** We searched for randomized controlled trials published from January 1990 to March 2014. An inverse variance method of metaanalysis was performed using a random effects model in the presence of statistical heterogeneity ( $I^2 > 50\%$ ).

**RESULTS:** Eight highquality trials ( $n = 478$ ) were included. Exercise improved the serum concentrations of IL6 (Weighted mean difference (WMD) = 0.55 pg/mL, (95% CI 1.02 to 0.09), TNF $\alpha$  (WMD= 0.64 pg/mL, 95% CI 1.21 to 0.06), IL8 (MD = 0.49 pg/mL, 95% CI 0.89 to 0.09), IL2 (WMD= 1.03 pg/mL, 95% CI 0.40 to 1.67). Conversely, no significant differences were found in the serum concentrations of C reactive protein (CRP) (WMD= 0.15, 95% CI 0.56 to 0.25) or IL10 (WMD= 0.41, 95% CI 0.18 to 1.02).

**CONCLUSIONS:** Exercise training positively modulates chronic low grade inflammation in women with breast cancer, which may impact upon carcinogenic mechanisms and the tumor microenvironment. These findings align with the other positive effects of exercise for breast cancer survivors, reinforcing the appropriateness of exercise prescription in this population.

1884 Board #36 June 2, 3:30 PM - 5:00 PM  
**Effect Of Different Rest Intervals On Isokinetic Muscle Performance In Hodgkin's Lymphoma Survivors**

Ritielli Valeriano<sup>1</sup>, Carlos Alexandre Vieira<sup>2</sup>, Filipe Dinato de Lima<sup>1</sup>, Lorena Cruz<sup>1</sup>, Claudio L. Battaglini, FACSM<sup>3</sup>, Martim Bottaro<sup>1</sup>, Ricardo Jacó de Oliveira<sup>1</sup>. <sup>1</sup>Universidade de Brasília, Brasília - DF, Brazil. <sup>2</sup>Universidade Federal de Goiás, Goiânia - GO, Brazil. <sup>3</sup>University of North Carolina, Chapel Hill, NC. (Sponsor: Claudio L Battaglini, FACSM)  
 Email: ritielli@gmail.com  
 (No relationships reported)

Hodgkin's lymphoma is a cancer that affect the lymphatic system. Resistance training (RT) can be an effective alternative in reducing the deleterious effects of cancer treatment, such as lean mass loss and fatigue. However, there are no studies to date on the appropriate rest interval (RI) between sets of RT exercises in Hodgkin's lymphoma survivors (HLS) so more effective RT programs can be designed and implemented in this cancer population.

**Purpose:** To evaluate the acute effect of different RIs in isokinetic muscle performance of HLS after treatment.

**Methods:** This is an early exploratory study, which evaluated 9 HLS who had completed treatment within at least 6 months, with mean age  $34.11 \pm 10.35$  years. The HLS performed an isokinetic exercise - unilateral extension of the right knee - consisting of three sets of 10 repetitions at 60°/s, with 3 different rest intervals (1, 2 and 3 min) between sets. The three exercise protocols were performed on different days, separated by a minimum of 72 hours and maximal of 1 week between each session; RIs trials were randomized and counterbalanced. The isokinetic muscle performance was evaluated by peak torque (PT) and total work (TW). Before the exercise protocol, volunteers performed a warm-up consisting of two sets of five repetitions at 60°/s with 1 min rest between sets. Kolmogorov-Smirnov test confirmed data normality. A three-way ANOVA was used to analyze data, with Bonferroni post hoc. A significance level of  $p < 0.05$  was used for all analyses.

**Conclusions:** Results indicate a decline in the PT and TW in all sets regardless of the different RIs. However, the decline of performance was lower as the RI was increased, suggesting that HLS need a longer RI (at least three minutes) to better recover between sets.

| Results: PT and TW in HLS. |                  |                             |                   |                   |                            |                     |
|----------------------------|------------------|-----------------------------|-------------------|-------------------|----------------------------|---------------------|
|                            | 1st Mean<br>± SD | PT (Nm)<br>2nd Mean<br>± SD | 3rd Mean<br>± SD  | 1st Mean<br>± SD  | TW (J)<br>2nd Mean<br>± SD | 3rd Mean<br>± SD    |
| 1 min                      | 176,3 ±<br>56,5  | 163,0 ±<br>50,0             | 143,5 ±<br>43,8*  | 1549,0 ±<br>536,8 | 1442,5 ±<br>452,4          | 1230,9 ±<br>393,2*  |
| 2 min                      | 174,8 ±<br>52,8  | 167,4 ±<br>49,2             | 155,1 ±<br>46,4*§ | 1566,6 ±<br>557,0 | 1475,9 ±<br>465,7          | 1357,6 ±<br>405,5*  |
| 3 min                      | 182,1 ±<br>57,8  | 179,6 ±<br>56,1             | 167,8 ±<br>50,7§  | 1579,6 ±<br>592,4 | 1548,0 ±<br>422,6          | 1420,2 ±<br>443,3†§ |
| * p                        | † p              | § p                         | -                 | -                 | -                          | -                   |

1885 Board #37 June 2, 3:30 PM - 5:00 PM  
**General Fatigue and Decline of Muscle Performance in Hodgkin's Lymphoma Survivors**

Filipe D. de Lima<sup>1</sup>, Ritielli O. Valeriano<sup>1</sup>, Lorena Cruz<sup>1</sup>, Claudio L. Battaglini, FACSM<sup>2</sup>, Ricardo Jacó de Oliveira<sup>1</sup>. <sup>1</sup>University of Brasilia - UnB, Brasilia, Brazil. <sup>2</sup>University of North Carolina, Chapel Hill, NC. (Sponsor: Claudio L Battaglini, FACSM)  
 Email: fdinatolima@gmail.com  
 (No relationships reported)

Cancer Related Fatigue (CRF) is characterized by a subjective feeling of exhaustion and tiredness experienced by cancer patients. CRF promotes a depressant effect on the physical, emotional and mental function. Physical exercise has been shown to significantly reduce CRF. However, it is still unclear if a relationship exists between CRF and the decline of muscle performance during an acute bout of isokinetic exercise training.

**PURPOSE:** To explore the relationship between fatigue and decrease in muscle performance during a bout of isokinetic exercise training in Hodgkin's lymphoma survivors (HLS).

**METHODS:** This is an initial exploratory study where 9 HLS, mean age  $34.11 \pm 10.35$  years, where fatigue was assessed using the Multidimensional Fatigue Inventory (MFI-20) on the domains of physical, mental, reduced motivation, reduced activity and general fatigue.

Subjects performed 3 sets of 10 unilateral isokinetic knee extension repetitions, with the right leg at 60°/s(-1), with one minute between sets. The fatigue index (FI) was calculated as the difference between total work (TW) of the first set and TW of third set. Spearman correlations were used to analyze the relationship between the domains and general fatigue of the MFI-20 and FI. A level of significance of  $p \leq 0.05$  was used for all analyses.

**RESULTS:** General fatigue of  $11.91 \pm 3.94$  was observed using the MFI-20. HLS scored  $10.09 \pm 4.70$  for the physical aspect,  $12.09 \pm 4.57$  for the mental aspect,  $8.45 \pm 3.98$  for activity reduction and  $7.91 \pm 3.33$  for reduced motivation domains of the MFI-20. A fatigue index of  $19.69 \pm 8.60\%$  was attained during the acute bout of isokinetic exercise training. There was no significant correlation between FI and MFI-20 general fatigue ( $r = 0.538$ ;  $p = 0.135$ ) and any domain of the MFI-20. However, the relationship between FI and the MFI-20 domain of reduced motivation approached significance ( $r = 0.608$ ,  $p = 0.083$ ).

**CONCLUSIONS:** From this initial exploratory study, it appears that the subjective evaluation of general fatigue and the different domains of the MFI-20 do not correlate with the FI. The relatively small sample could have influenced the study results. It could also be speculated that the subjective measurement of fatigue may not be sensitive enough to capture specific muscular alterations, commonly observed in HLS due to anti-cancer treatments.

1886 Board #38 June 2, 3:30 PM - 5:00 PM  
**Inpatient Exercise Therapy Versus Relaxation And Mental Training In Pediatric Stem Cell Transplantation: Results Of A Rct**

Katharina Schmidt<sup>1</sup>, Anna Senn-Malashonak<sup>2</sup>, Susanne Wallek<sup>2</sup>, Andreas Rosenhagen<sup>1</sup>, Lutz Vogt<sup>1</sup>, Klaus Siegler<sup>2</sup>, Michael Jung<sup>3</sup>, Peter Bader<sup>2</sup>, Winfried E. Banzer<sup>1</sup>. <sup>1</sup>Goethe University, Frankfurt, Germany. <sup>2</sup>University Hospital Goethe University, Frankfurt, Germany. <sup>3</sup>Hochschule Fresenius, Idstein, Germany.  
 Email: Schmidt@sport.uni-frankfurt.de  
 (No relationships reported)

Hematopoietic stem cell transplantation (SCT) as aggressive treatment for hematological malignancies and the long hospitalization lead to declines in physical

function and psychosocial well-being. While a growing number of studies show beneficial effects of exercise before, during and after SCT in adults, RCTs in the pediatric cancer population are missing.

**PURPOSE:** To evaluate the effects of an inpatient exercise intervention on physical function and quality of life in children and adolescents undergoing SCT for hematological malignancies.

**METHODS:** 70 children and adolescents hospitalized for SCT participated in this RCT. Following baseline tests (T0; day of hospitalization), participants were randomly assigned to an exercise intervention (IG; n = 35; 10.9 ± 3.6 yrs.) or a non-exercise control group (CG; n = 35; 10.6 ± 4 yrs.). During hospitalization, the exercise intervention included a supervised and individually adapted training with endurance, strength and flexibility components of 30 - 60 min daily. The control intervention comprised a daily mental and relaxation training (30 - 60 min). Outcome measures at T0 and day of discharge (T1) included maximum isometric quadriceps strength relative to body weight (strain gauge force transducer), hand grip strength (HGS; JAMAR dynamometer), the distance walked in 6 minutes (6MWD; 6-minute walk test), and quality of life (QoL; age-corresponding KINDL-R questionnaire).

**RESULTS:** On average, subjects of the CG and IG participated in 2.7 ± 1.2 or 3.1 ± 0.6 sessions (139 ± 74.7 or 158 ± 42.3 min) per week. Data analysis revealed significant group differences (p < .05) concerning the change in 6MWD and HGS. Both parameters significantly (p < .05) decreased in the CG, while there were no changes in the IG (6MWD: -18.1 ± 19.4% vs. -2.2 ± 18%; HGF: -12.4 ± 17.6% vs. -2.4 ± 16%). Quadriceps strength (CG: -5.6 ± 36%; IG: 5.4 ± 28%) did not change. QoL (total score) significantly (p < .05) decreased in both groups.

**CONCLUSIONS:** Our results indicate that an exercise therapy during the inpatient period for pediatric SCT contribute to preserve physical function in contrast to a decline in the non-exercise control group. Considering the compliance with the intervention, an inpatient approach with individually tailored exercises seem to be a feasible and promising strategy during pediatric SCT.

## D-25 Free Communication/Poster - Carbohydrate Metabolism in Athletes

Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
Room: Exhibit Hall A/B

### 1887 Board #39 June 2, 2:00 PM - 3:30 PM Sustained Acoustic Medicine Accelerates Recovery From an Acute Bout of High Intensity Resistance Training

Craig O. Mattern<sup>1</sup>, Heidi K. Byrne<sup>1</sup>, Timothy Henry<sup>1</sup>, Kelly Stratton<sup>2</sup>, Susan McHale<sup>2</sup>, George Lewis<sup>2</sup>, Matthew D. Langer<sup>2</sup>.  
<sup>1</sup>The College at Brockport - SUNY, Brockport, NY. <sup>2</sup>ZetrOZ Inc, Trumbull, CT.

Email: cmattern@brockport.edu  
(No relationships reported)

Accumulation of lactic acid in skeletal muscle during intense anaerobic exercise limits athletic performance. Lactic acid accumulation decreases muscle pH, compromising force production. Sustained acoustic medicine (sam®, ZetrOZ Inc), or long-duration, low-intensity continuous wave wearable therapeutic ultrasound, is hypothesized to facilitate increased oxygenation of muscle tissue and accelerate lactate removal.

**PURPOSE:** To investigate the impact of sustained acoustic medicine on exercise recovery and performance through a double-blind, sham-controlled, crossover study.

**METHODS:** Sixteen healthy male subjects (age 22 ± 2 years) with previous weight training experience participated in the study. Subjects performed five exercises: lunges, seated hamstring flexion, Smith squats, seated quadriceps extension, and leg press. Single repetition maximum (1-RM) weight was estimated, and subsequent exercise was conducted at 70% of the 1-RM. Subjects participated in two identical sessions, wearing an active device or a sham device before, during, and after exercise. Blood lactate concentration was measured before exercise and at 7 time points over the 60 minutes immediately after. Subjects then performed leg extension and flexion exercises on an isokinetic dynamometer at two different movement speeds. Data were analyzed utilizing matched pairs t-tests, with a family wide type I error (false discovery rate) of 25% for the isokinetic data. **RESULTS:** Blood lactate levels at each of the 7 time points were significantly reduced with the active device (p < 0.05), with the extent of reduction varying from 10% to 21%. Muscle force output was increased for 18 of the 24 measured variables. **CONCLUSION:** Sustained acoustic medicine significantly reduced blood lactate following high intensity resistance training, accompanied by an increase in muscle force output. These data suggest sustained acoustic medicine is effective for accelerating post-exercise lactate removal and sustaining muscle performance.

### 1888 Board #40 June 2, 2:00 PM - 3:30 PM Effects Of Varying Postexercise Nutrition On Subsequent Exercise Performance In Active Adults Habitually Consuming A Low- Carbohydrate/high-fat Diet

Allyson Derosier, William Lunn. Southern Connecticut State University, New Haven, CT.

Email: allyson.derosier@gmail.com  
(No relationships reported)

Evidence suggests that endurance athletes who follow a habitual, high fat/adequate protein/low carbohydrate meal plan can maintain endurance performance in a singular exercise bout. However, whether active exercisers who are accustomed to a high fat/low carbohydrate meal plan require specific postexercise nutrition to support subsequent exercise is unknown. **PURPOSE:** To determine if postexercise nutrition affects subsequent endurance performance following an initial endurance bout in adults accustomed to a high fat/low carbohydrate meal plan. **METHODS:** Regularly exercising males and females (n=10, 22.5 ± 3.3 y, V O<sub>2</sub>max = 45.6 ± 9.5 ml·kg<sup>-1</sup>·min<sup>-1</sup>) consumed a 29-d, eucaloric meal plan that consisted of 40 g·d<sup>-1</sup> of carbohydrate, 1.5 g·kg<sup>-1</sup>·d<sup>-1</sup> protein, and the remaining kilocalories from fat. Performance testing covered three nonconsecutive days, each separated by 72 h. Each test day, a 60-min exercise bout on a cycle ergometer was performed (65%-75% of V O<sub>2</sub>max, switching every 10 min), followed by ingestion of one of three isovolumic, postexercise beverages: 20g fat, 5g carbohydrate, 25g protein (FAT); 50g carbohydrate, 25g protein (CHO); or 25g protein (PRO). Each participant recovered passively for 3 h and then completed a 15-min maximal time trial (TT) on the ergometer, during which total work produced (TW), mean power output (MP), mean V O<sub>2</sub>, and mean respiratory exchange ratio (RER) were recorded. **RESULTS:** RMANOVA resulted in no significant mean difference in TW (2.2 ± 0.5 kJ·kg<sup>-1</sup>, 2.1 ± 0.5 kJ·kg<sup>-1</sup>, 2.2 ± 0.5 kJ·kg<sup>-1</sup>), MP (2.4 ± 0.6 W·kg<sup>-1</sup>, 2.4 ± 0.6 W·kg<sup>-1</sup>, 2.4 ± 0.6 W·kg<sup>-1</sup>), V O<sub>2</sub> (27.9 ± 5.4 ml·kg<sup>-1</sup>·min<sup>-1</sup>, 28.5 ± 5.7 ml·kg<sup>-1</sup>·min<sup>-1</sup>, 28.5 ± 5.8 ml·kg<sup>-1</sup>·min<sup>-1</sup>), or RER (0.84 ± 0.08, 0.85 ± 0.08, 0.85 ± 0.08) during each TT among PRO, CHO, and FAT, respectively (p < 0.05). **CONCLUSION:** Consuming postexercise beverages of varying macronutrient content resulted in similar subsequent exercise performance and metabolic outcomes, and in fact resulted in similar performance measures compared to individuals on a traditional high-carbohydrate diet. For regularly exercising males and females habitually consuming a low-carbohydrate/high fat meal plan, consuming any of the three beverages would be a logical postexercise nutrition option. Funding provided by Southern Connecticut State University School of Graduate Studies

### 1889 Board #41 June 2, 2:00 PM - 3:30 PM Effects of Exercise Intensity on Post-Exercise Oral Glucose Tolerance Test Response

William A. Braun, FACSM, William Bennett, Kelsey Chatten, James DeFrancisco, Corinne Urland. Shippensburg University, Shippensburg, PA.

Email: wabrau@ship.edu  
(No relationships reported)

Glucose uptake by muscle is mediated by up-regulation of glucose transporters during exercise. It is presumed that higher intensity exercise eliciting more forceful contractions will promote increased glucose transport into active tissue. Whether exercise intensity affects blood glucose regulation during recovery from exercise is of interest. **PURPOSE:** To examine whether fixed distance exercise (walking vs. running) causes differences in oral glucose tolerance test (OGTT) response following exercise.

**METHODS:** Seven participants performed two exercise trials, consisting of one trial of running (RT: 7.5 mph for 3 miles using 2-min intervals with 2-min recovery segments) and one trial of continuous walking (CW: 4 mph for 3 miles). Each trial day, participants arrived having fasted for at least four hours prior to testing. Participants ingested 75 g of dextrose, in 300 ml of water upon completion of the assigned exercise trial. Blood glucose (BG) was sampled every 15 min over a 75-min OGTT period. Trial order was counter-balanced.

**RESULTS:** VO<sub>2</sub>, HR, RER, and RPE for the RT condition were significantly higher (p < .02). BG was significantly higher for RT post exercise (~45% higher) and at 15 minutes (~29% higher) of the OGTT (p < .01). These differences were attributed to two outliers. When outliers were removed, the differences disappeared. Area under the curve during the OGTT following RT tended (p = .109) to be smaller (9,535±534 vs. 10,834±482 a.u.) with outliers removed.

**CONCLUSIONS:** Based on the study results, when energy expenditure is controlled between low and high exercise intensities, BG regulation following exercise of the same fixed distance tends to be enhanced when the exercise is performed at a higher intensity.

- 1890 Board #42 June 2, 2:00 PM - 3:30 PM  
**The Impact Of Exercise-induced Lactate On Executive Function After High-intensity Interval Exercise In Humans**  
 Hayato Tsukamoto<sup>1</sup>, Tadashi Suga<sup>1</sup>, Saki Takenaka<sup>1</sup>, Daichi Tanaka<sup>1</sup>, Tatsuya Takeuchi<sup>1</sup>, Takafumi Hamaoka, FACSM<sup>2</sup>, Tadao Isaka<sup>1</sup>, Shigehiko Ogoh, FACSM<sup>3</sup>, Takeshi Hashimoto, FACSM<sup>1</sup>. <sup>1</sup>Ritsumeikan University, Shiga, Japan. <sup>2</sup>Tokyo Medical University, Tokyo, Japan. <sup>3</sup>Toyo University, Saitama, Japan. (Sponsor: Takeshi Hashimoto, FACSM)  
 Email: gr0168ir@ed.ritsumei.ac.jp  
 (No relationships reported)

A single bout of aerobic exercise improves executive function (EF), but thereafter EF returns to the baseline level quickly. Compared with a single bout of aerobic exercise, recently, we found that high-intensity interval exercise (HIIE) could maintain the improvement in EF longer. However, the mechanism of the effect of different exercise mode on modifications of EF remains unclear.

**PURPOSE:** The purpose of the present investigation was to test our hypothesis that the amount of exercise-induced lactate production and its accumulation affects the human brain function during and after exercise, thereby affecting post-exercise EF. **METHODS:** To manipulate the concentration of HIIE-induced lactate by muscle glycogen depletion, 10 healthy male subjects performed the two HIIE protocols with a 60 min resting period between 1<sup>st</sup> and 2<sup>nd</sup> HIIEs. The HIIE protocol consisted of four 4-min bouts of cycling exercise at 90% peak  $\dot{V}O_2$  and three 3-min active recovery period at 60% peak  $\dot{V}O_2$  between each exercise bout. Blood glucose and lactate concentrations were measured at each experimental stage. To evaluate EF, a color-word Stroop task was performed, and reverse-Stroop interference scores were obtained. **RESULTS:** EF immediately after the 1<sup>st</sup> HIIE was significantly improved from the resting baseline ( $P < 0.05$ ), and this improved EF was sustained throughout 40 min of the post-exercise recovery. However, in the 2<sup>nd</sup> HIIE protocol, the improved EF was only sustained at the beginning of the post-exercise recovery period (~10 min). In addition, the concentration of HIIE-induced lactate was lower in the 2<sup>nd</sup> HIIE ( $P < 0.01$ ), and it was likely associated with the different response of EF to 2<sup>nd</sup> HIIE. **CONCLUSIONS:** These findings of the present study suggest that the lower lactate production/accumulation could not sustain adequately elevations in brain neuronal activity and metabolism throughout the recovery period following the 2<sup>nd</sup> HIIE. Exercise-induced lactate may be an important physiological factor to determine EF during and after exercise.

- 1891 Board #43 June 2, 2:00 PM - 3:30 PM  
**Ultrasound Technology Fails To Provide Indirect Estimate Of Muscle Glycogen Concentration**  
 Julia L. Bone<sup>1</sup>, Meg L. Ross<sup>1</sup>, Kristylen A. Tomcik<sup>2</sup>, Nikki A. Jeacocke<sup>1</sup>, John A. Hawley<sup>2</sup>, Louise M. Burke, FACSM<sup>1</sup>. <sup>1</sup>Australian Institute of Sport, Bruce, Australia. <sup>2</sup>Australian Catholic University, Melbourne, Australia. (Sponsor: Louise Burke, FACSM)  
 Email: julia.bone@ausport.gov.au  
 (No relationships reported)

The direct quantification of muscle glycogen storage or utilization during exercise involves an invasive biopsy protocol, while indirect measurements via magnetic imaging require expensive and inaccessible equipment. Recently, ultrasound technology has been promoted as a practical, non-invasive technique for determining muscle glycogen based on changes in the grey scale of the image associated with glycogen-binding of water. If valid, this technology would have widespread application in applied sports nutrition. **Purpose:** To validate ultrasound technology for the measurement of muscle glycogen (Gly) concentrations in well-trained individuals under conditions considered to achieve normal (GlyN), depleted (GlyD) or loaded (GlyL) concentrations of Gly. In addition, creatine (Cr) loading was undertaken by some subjects to provide a potentially confounding effect on muscle water. **Method:** Twelve well trained cyclists undertook a protocol where Gly was measured by biopsy from the vastus lateralis and ultrasound on the non-biopsied leg. Muscle Glycogen was measured under the conditions of GlyN, GlyD or GlyL, with and without Cr loading in the case of GlyN and GlyL (CrN-GlyN; CrN-GlyL; CrL-GlyN; CrL-GlyL). The mean values from 5 ultrasound determinations of glycogen were calculated, whereby images were analysed by proprietary software (MuscleSound 2015) and an arbitrary score indicating Gly concentration was generated. **Results:** Spearman's Rho correlation between ultrasound scores and biopsy Gly concentrations was -0.060 ( $p=0.694$ ) for all conditions (Fig 1). When separated into CrL and CrN, the correlations were 0.474 ( $p=0.167$ ) and 0.234 ( $p=0.170$ ) respectively. Correlation between the change in Gly from GlyN to GlyD measured by biopsy and calculated by the ultrasound was -0.50 ( $p=0.884$ ). The correlation between change scores from GlyN to GlyL for all conditions was -0.264 ( $p=0.432$ ), and when separated into CrN and CrL, the correlations were 0.088 ( $p=0.868$ ;) and 0.354 ( $p=0.559$ ), respectively. **Conclusion:** Although it is an attractive prospect, we were unable to validate the use of ultrasound

technology to estimate muscle glycogen or increases/decreases in these stores across a range of scenarios including exercise-depletion, normalized stores, carbohydrate loading and concomitant creatine loading.

- D-26 Free Communication/Poster - Carbohydrate Metabolism in Health/Disease  
 Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
 Room: Exhibit Hall A/B

- 1892 Board #44 June 2, 3:30 PM - 5:00 PM  
**The Acute Effect Of Prolonged High-intensity Rowing On Postprandial Lipemia And Markers Of Insulin Resistance**  
 Matthew J. Sedgwick<sup>1</sup>, Laura A. Barrett<sup>2</sup>, Alice E. Thackray<sup>2</sup>, David J. Stensel<sup>2</sup>. <sup>1</sup>Leeds Trinity University, Leeds, United Kingdom. <sup>2</sup>Loughborough University, Loughborough, United Kingdom. (Sponsor: Jonathan Folland, FACSM)  
 Email: m.sedgwick@leedstrinity.ac.uk  
 (No relationships reported)

Repeated bike sprints of up to 30 s duration have been shown to lower lipemia and reduce insulin resistance, however this type of exercise is difficult to tolerate. High-intensity but submaximal short duration exercise appears to be more tolerable. Furthermore, rowing a whole-body exercise may be more effective than cycling which is localised to the legs, whilst still being appealing by supporting body mass. **PURPOSE:** To determine the effect of repeated 3 min bouts of high-intensity rowing on postprandial lipemia and markers of insulin resistance. **METHODS:** Fifteen healthy men (age 23.0±0.6 years) completed two, 2-day main trials (control and exercise) in a counterbalanced cross-over design. On day 1 participants were either inactive (control trial) or completed four, 3-min high-intensity rowing intervals (each separated by 3 min passive rest) at a rating of perceived exertion of 17 (exercise trial). On day 2, participants rested and consumed 82.5 g of glucose monohydrate at 0 h and a high-fat meal at 2 h (51% fat, 37% carbohydrate, 12% protein and 56.3 kJ per kg body mass). 15 venous blood samples were collected between 0 and 8 h to measure plasma triacylglycerol, glucose and insulin concentrations. **RESULTS:** Fasting triacylglycerol concentration was lower (0.86±0.07 mmol·l<sup>-1</sup> vs 0.99±0.08 mmol·l<sup>-1</sup>,  $P=0.004$ ) and remained lower on completion of the oral glucose tolerance test (2 h) in the exercise trial (0.71±0.07 mmol·l<sup>-1</sup> vs 0.86±0.09 mmol·l<sup>-1</sup>,  $P=0.006$ ). The total area under the triacylglycerol concentration versus time curve from the ingestion of the high-fat meal to the end of observation (2 - 8 h) was 14% lower in the exercise trial (7.52±0.70 mmol·l<sup>-1</sup> 6h vs 8.68±0.81 mmol·l<sup>-1</sup> 6h,  $P=0.004$ ) but there was no difference in the incremental area ( $P=0.295$ ). There was no difference between trials for fasting or areas under the concentration versus time curve for glucose or insulin ( $P>0.05$ ). Fasting HOMA-IR or the Insulin Sensitivity Index calculated following either the glucose load or the high-fat meal were not different between trials ( $P>0.05$ ). **CONCLUSION:** Repeated prolonged bouts of high-intensity rowing were well tolerated with all participants completing the exercise without any signs or symptoms of light-headedness or nausea. Exercise reduced postprandial lipemia but had no effect on markers of insulin resistance.

- 1893 Board #45 June 2, 3:30 PM - 5:00 PM  
**Relationship between Plasma Glucose Concentration and Body Composition in Older Sedentary Women**  
 Ryan R. Porter, Charity B. Breneman, Kimberly Bowyer, J. Larry Durstine, FACSM, Sabra Smith, Xuewen Wang. University of South Carolina, Columbia, SC.  
 (No relationships reported)

Due to the ever-growing population affected by metabolic disease and because regulation of glucose plays a major role in multiple metabolic disorders, we must increase our understanding of factors that may contribute to the regulation of glucose homeostasis. **PURPOSE:** To determine whether a correlation exists between plasma glucose concentration and the following body composition components in sedentary older women: lean mass percentage (%LM), total lean mass (TLM), total fat-free mass (TFFM), total fat mass (TFM), and skeletal muscle mass index (SMI) (SMI = TLM/height<sup>2</sup>). **METHODS:** Body composition was determined using dual x-ray absorptiometry (DEXA) and fasting blood samples were collected from fifty-eight older sedentary women (age = 64.9±4.2 years; height = 1.63±0.06 m; weight = 67.4±9.9 kg; body mass index = 25.6±3.7 kg/m<sup>2</sup>) prior to an exercise intervention.

**RESULTS:** In this population, plasma glucose concentration ( $6.12 \pm 0.76$  mM/L) was negatively correlated with %LM ( $60.0 \pm 6.4\%$ ) ( $r = -0.04$ ,  $P < 0.01$ ) and positively correlated with TFM ( $r = 0.36$ ,  $P < 0.01$ ). The positive correlation with TFM remained when adjusted for TLM ( $r = 0.39$ ,  $P = 0.05$ ).

**CONCLUSIONS:** Results from this study are consistent with literature from other population studies supporting greater %LM as being beneficial in glucose regulation and being associated with lower plasma glucose concentration. The benefit of greater %LM may be due to the required quantity of glucose absorption needed for sustained metabolic function of the larger muscle mass. A greater TFM associated with elevated plasma glucose concentration may be due to the inhibitory effect of fatty acids on insulin, which results in greater glucose concentration.

Supported by NIH/NIA R00AG031297

1894 Board #46 June 2, 3:30 PM - 5:00 PM

**The Effect of Exercise and Resveratrol on Hippocampus in Type 2 Diabetes Mellitus**

Han Li, Yun Chang, Peng Zhao. *China Institute of Sport Science, Beijing, China.*

(No relationships reported)

Type 2 Diabetes Mellitus (T2DM) is a metabolic disease which is characterized by hyperglycemia resulting from insulin secretion defects or insulin action disorders. The hippocampus as one of the most important brain regions, is really easy to be impaired by T2DM. Resveratrol and exercise training have been considered useful measures for treating T2DM. However, the definite mechanism is still unknown.

**PURPOSE:** To investigate the possible mechanism of SIRT1 and exercise training on the effect of Akt/PKB insulin signaling pathway in the hippocampus of T2DM rats. **METHODS:** 75 Male mature T2DM SD rats were divided into RE, R, E and Control groups. Both RE group and E group rats were arranged to loaded swimming 5 days/week, 1 hour/day. At the same time, RE group and R group rats needed to take resveratrol with the dosage of 45mg/kg/day, 7 day/week, but the Control group without any treatment. After 8 weeks, we examined the content of IRS-1, AKT, SIRT1 of all the rats which in the hippocampus.

**RESULTS:** (1) When compared with other 3 groups, the content of SIRT1 and pAKT-Ser473 in the Control group rats decreased with extreme significance ( $p < 0.01$ ). (2) The volume of SIRT1 and pAKT-Ser473 in the RE, E, R group rats improved, but RE group increased more evidently (RE vs. R, E,  $p < 0.05$ ). (3) When compared with other 3 groups, the expression of pIRS-1-Ser307 in the Control group rats increased significantly ( $p < 0.05$ ). (4) The volume of SIRT1 in the RE, E, R group rats improved, RE group increased more evidently than E group rats (RE vs. E,  $p < 0.05$ ).

**CONCLUSIONS:** 8-week swimming or/and resveratrol could ameliorate the hippocampus of the T2DM rats. Meanwhile, the results showed two remedies could ameliorate effectively than the single treatment. The possible reason was, SIRT1 as an important NAD<sup>+</sup> dependent histone deacetylase, exercise training or/and resveratrol through SIRT1 enhancing the volume of the pIRS-1-Ser307 and pAKT-Ser473, which could activate the Akt/PKB insulin signaling pathway and strengthen the susceptibility of hippocampus cell to insulin.

1895 Board #47 June 2, 3:30 PM - 5:00 PM

**Circadian Rhythms In Blood Glucose And Blood Pressure: Are They Reproducible?**

Brian E. Barnett<sup>1</sup>, Samuel L. Buckner<sup>2</sup>, Scott J. Dankel<sup>2</sup>, Brittany R. Counts<sup>2</sup>, Matthew B. Jessee<sup>2</sup>, J Grant Mouser<sup>2</sup>, Tanya M. Halliday<sup>3</sup>, Jeremy P. Loenneke<sup>2</sup>. <sup>1</sup>Delta State university, Cleveland, MS. <sup>2</sup>The University of Mississippi, University, MS. <sup>3</sup>Virginia Tech University, Blacksburg, VA.

(No relationships reported)

Circadian rhythms are physiologic fluctuations over a 24-hour period. Two variables thought to demonstrate a circadian rhythm include brachial blood pressure and blood glucose. However, there is great variation among the protocols in the current literature, and a lack of congruity on time-points chosen for measurement.

**PURPOSE:** To examine potential rhythms of systolic (SBP), diastolic (DBP) blood pressure and blood glucose without interrupting an individual's natural sleep/wake cycle. A second aim was to determine if these potential rhythms are reproducible.

**METHODS:** After establishing a normal waking time, 7 strength trained participants scheduled their first "Circadian testing" day. The first measurement of SBP, DBP and blood glucose were taken approximately 2 hours after their normal wake time. Measurements were repeated every 2 hours for 12 hours, while participants rested. To examine the repeatability of the potential rhythm, participants returned and completed the same procedures as before within 14 days of their first "Circadian testing" visit. Food and drink intake was recorded during the first visit and participants consumed the same diet on the second day of "Circadian Testing". A 2x7 (Day x Time) repeated measures ANOVA was used to determine if differences existed for SBP, DBP, and blood glucose. Significance was set at  $p \leq .05$ . Data are presented as mean  $\pm$  SD. Cosinor analysis was used to determine rhythm patterns for each variable each day

**RESULTS:** There was no interaction ( $p = 0.751$ ) or time main effect ( $p = 0.236$ , range: 115-120 mmHg) for SBP. There was a main effect of day, with SBP being lower on Day 2 than Day 1 [116 (7) vs. 119 (5) mmHg,  $p = 0.018$ ]. No differences were observed with DBP. For blood glucose, there was no interaction ( $p = 0.844$ ), time main effect ( $p = 0.613$ , range: 95.1-103.7 mmol/L), or main effect of day [Day 1: 98.7 (7) vs. Day 2: 97.5 (4) mmol/L,  $p = 0.501$ ]. Cosinor analysis revealed that there was no rhythm for blood pressure or blood glucose across time for either day ( $p > 0.05$ ).

**CONCLUSIONS:** When accounting for an individual's natural sleep/wake cycle, no measurable rhythms for SBP, DBP, or blood glucose were detected. Given this finding was observed twice, suggests that these hypothesized intrinsic rhythms may be masked by different zeitgebers or, perhaps, less pronounced when not disturbing sleep.

1896 Board #48 June 2, 3:30 PM - 5:00 PM

**Effects Of Dietary Fiber And Exercise On Cognition, Muscle Function, And Sca In Young Mice**

Brandt D. Pence, Tushar K. Bhattacharya, Jennifer L. Rytch, Pul Park, Jacob M. Allen, Yi Sun, Robert H. McCusker, Keith W. Kelley, Rodney W. Johnson, Justin S. Rhodes, Jeffrey A. Woods, FACSM. *University of Illinois at Urbana-Champaign, Urbana, IL.*

Email: bpence2@illinois.edu

(No relationships reported)

**PURPOSE:** Short chain fatty acids (SCFAs) contribute to immune and brain function and are produced by gut bacteria through metabolism of fermentable fiber.

**METHODS:** Young (6 week) male C57Bl/6J mice were fed AIN-93M diet or AIN-93M with 5% pectin substituted for cellulose for 6 weeks and voluntarily exercised on a wheel (VWR) or remained sedentary (SED), making up four groups with  $n = 5$ /group. After 4 weeks, mice underwent muscle and cognitive function testing. At sacrifice, cecal contents were collected for quantitation of SCFAs.

**RESULTS:** VWR mice maintained body weight, while Sed mice gained 2 grams ( $p < 0.001$ , time\*VWR). Neither exercise ( $p = 0.233$ ) or pectin ( $p = 0.481$ ) affected performance on the active avoidance task. In the Morris Water Maze task, neither exercise ( $p = 0.908$ ) or pectin (0.781) affected latency to find the hidden platform during the acquisition phase, and no significant differences were found during the probe trials for either treatment. Interestingly, both pectin and exercise decreased grip strength, although only the pectin effect remained after normalization to body weight ( $p = 0.004$ ). As expected, VWR increased performance on the rotarod ( $p = 0.028$ ) and exhaustive fatigue test ( $p = 0.012$ ). Pectin increased cecal acetate ( $p = 0.001$ ), propionate ( $p = 0.002$ ), and butyrate ( $p = 0.005$ ). Interestingly, there was also a significant VWR effect for increased acetate ( $p = 0.030$ ) and a significant VWR effect ( $p = 0.002$ ) and interaction ( $p = 0.031$ ) such that the pectin + VWR group had the highest levels of cecal propionate. **CONCLUSION:** In conclusion, pectin and/or VWR had little effect on cognitive function but tended to increase cecal SCFAs in young mice, which may have implications for brain and immune system function.

Funding from the Abbott-UIUC Center for Nutrition, Learning, and Memory,

1897 Board #49 June 2, 3:30 PM - 5:00 PM

**Passive Heating As An Option For Improving Glucose Control: Take A Bath!**

Steve H. Faulkner, Sarah Jackson, Kate McDaid, George Havenith, FACSM, Christof A. Leicht. *Loughborough University, Loughborough, United Kingdom.* (Sponsor: George Havenith, FACSM)

Email: S.Faulkner2@lboro.ac.uk

(No relationships reported)

Obesity and type 2 diabetes are increasing in prevalence and can be treated by lifestyle interventions such as diet and exercise. Acute exercise has an insulin sensitizing effect, leading to improved glucose control. This may in part be due to the attenuated synthesis of heat shock protein 70 (HSP70) in obesity and diabetes. HSP70 may be elevated by exercise and passive heating (PH). Furthermore, animal studies suggest PH may be beneficial to glucose control.

**PURPOSE:** To determine the effect of PH versus exercise on the HSP70 response and glucose control in overweight and lean humans.

**METHODS:** In a crossover design, ten physically inactive males (5 lean (L) BMI =  $23.5$  kg.m<sup>-2</sup>, fat mass =  $9.5 \pm 4.8$  kg; 5 overweight (OW) BMI =  $28.0$  kg.m<sup>-2</sup>, fat mass =  $20.9 \pm 5.3$  kg) underwent 60 minutes of exercise at a fixed rate of metabolic heat production (EX, 7.5W.kg<sup>-1</sup>). In a second trial, participants underwent PH (2.0 W.kg<sup>-1</sup>) matched to EX for duration, core temperature (Tc) increase and dietary intake. A venous blood sample was obtained before and immediately following heating for analysis of HSP70. Continuous glucose monitoring was used to measure interstitial glucose for the subsequent 24 hours.

**RESULTS:** There were no differences in  $\Delta Tc$  between groups (L =  $0.87 \pm 0.23^\circ C$ ; OW =  $0.85 \pm 1.7^\circ C$ ,  $p = 0.784$ ) or conditions (EX =  $0.8 \pm 0.2^\circ C$ , PH =  $0.9 \pm 0.2^\circ C$ ,  $p = 0.913$ ) following heating. Resting HSP70 was negatively correlated with fat mass ( $r = -0.528$ ,  $p < 0.05$ ). There was a trend between  $\Delta HSP70$  and fat mass ( $r = -0.303$ ,  $p = 0.194$ ).

HSP70 increased 6.8% after heating ( $p < 0.05$ ) with a greater increase in L ( $0.40 \pm 0.44$  ng.mL<sup>-1</sup>) compared to OW ( $-0.26 \pm 0.27$  ng.mL<sup>-1</sup>,  $p < 0.05$ ) after PH but no difference in  $\Delta$ HSP70 between L and OW following EX. There was no difference in glucose area under the curve between PH and EX, but peak glucose in the first meal following heating was lower for PH ( $6.7 \pm 1.4$  mmol.L<sup>-1</sup> vs.  $7.4 \pm 1.2$  mmol.L<sup>-1</sup>;  $p < 0.05$ ). CONCLUSION: The HSP70 response after PH is impaired in OW compared to L and appears linked to fat mass. As PH resulted in no increase in HSP70 in OW, this suggests a need for greater inflammatory stimulus from muscular contraction to elicit rises in HSP70 in OW. PH reduces peak glucose excursions in the first meal after heating and may contribute to improved insulin sensitivity following repeated acute PH exposures, which warrants future investigation.

1898 Board #50 June 2, 3:30 PM - 5:00 PM  
**Effects of Postmeal Exercise on Postprandial Glucose in People Treated with Metformin**

Melissa L. Erickson<sup>1</sup>, Kevin K. McCully, FACSM<sup>1</sup>, Jonathan Little<sup>2</sup>, Nathan Jenkins<sup>1</sup>. <sup>1</sup>University of Georgia, Athens, GA. <sup>2</sup>University of British Columbia Okanagan, Kelowna, BC, Canada.  
 Email: melissa9@uga.edu  
 (No relationships reported)

Postprandial hyperglycemia is associated with the development of macrovascular and microvascular diseases. Thus, there is a need for effective treatments that reduce postprandial hyperglycemia. Metformin is used clinically to reduce blood glucose, however, hyperglycemia is not always adequately controlled with metformin. It is currently unknown how the combination of metformin and postmeal exercise affects postprandial glucose. PURPOSE: Examine the effects of postmeal exercise on postprandial glucose in people being treated with metformin. METHODS: 2-hr area under the curve after a standardized breakfast meal and peak postprandial glucose, assessed with continuous glucose monitoring, were compared in sedentary versus postmeal exercise conditions in 6 people treated with metformin. Postmeal exercise began 30 minutes into the postprandial phase and consisted of 5 x 10 minutes bouts of treadmill walking at 60% maximal oxygen uptake. RESULTS: 2-hr area under the breakfast curve was 27% lower after postmeal exercise (sed: 1315  $\pm$  299 vs. ex: 998  $\pm$  235 mmol/L x 2 hr;  $p = 0.008$ ). Peak glucose was 28% lower after postmeal exercise (sed: 11.8  $\pm$  2.9 vs. ex: 8.9  $\pm$  1.1 mmol/L;  $p = 0.01$ ). Postmeal exercise lowered postprandial glucose levels below the current International Diabetes Federation postmeal recommendation of 8.8 mmol/L in 3 of 6 participants. CONCLUSION: Postmeal exercise resulted in postprandial glucose reduction in people being treated with metformin, and therefore may be a useful approach for managing postprandial hyperglycemia. Funded by the University of Georgia College of Education, Office of the Vice President for Research, and the Mary Ella Lunday Soule Scholarship.

1899 Board #51 June 2, 3:30 PM - 5:00 PM  
**The Effect of Eight Weeks of Interval Sprinting Exercise on Fasting Insulin of Postmenopausal Women**

Chun Ping Lin, University of New South Wales, Sydney, Australia. (Sponsor: Stephen H. Boutcher, FACSM)  
 (No relationships reported)

**The effect of eight weeks of interval sprinting exercise on insulin resistance of postmenopausal women**

Chun Ping Lin<sup>1</sup>, Diana Liu<sup>1</sup>, Jarrod Meekin<sup>2</sup>, Stephen H. Boutcher<sup>1</sup> FACSM, Yati Boutcher<sup>1</sup>  
<sup>1</sup>University of New South Wales and <sup>2</sup>MeasureUp Ltd, Sydney, AUSTRALIA

Interval sprinting exercise (ISE) has been shown to decrease insulin resistance levels of overweight premenopausal women. However, the effect of ISE on insulin resistance of overweight postmenopausal women is undetermined.

PURPOSE: Thus, the purpose of this study was to investigate the insulin resistance response of sedentary postmenopausal women to eight weeks of ISE.

METHODS: Postmenopausal females (n=24), aged 53 $\pm$ 0.8 years, with a BMI of 28.9 $\pm$ 0.7 kg.m<sup>-2</sup>, and body mass of 76.2 $\pm$ 2.3 kg underwent pre- and post-testing including a maximal oxygen uptake test and dual energy x-ray absorptiometry (DEXA). Women were randomly assigned to ISE or control groups. ISE women performed three bouts of ISE a week for eight weeks. The ISE group completed 20 minutes of exercise (8 s sprint, 12 s recovery) each session, whereas controls performed no structured exercise for eight weeks. Dietary intake was monitored through food diaries. Blood samples were collected for determination of fasting insulin and glucose and insulin resistance was determined using HOMA and QUICKI. Controls were advised to maintain their previous lifestyle.

RESULTS: The intervention group experienced a 21% increase in aerobic power and a significant decrease in body fat and increase in lean mass,  $p < 0.05$ . Fasting insulin level of the intervention group, assessed by ELISA, was 11.4 $\pm$ 1.3  $\mu$ U/ml and for controls was 7.8 $\pm$ 1.2  $\mu$ U/ml. Fasting insulin was reduced by 17%,  $p < 0.05$ , for the ISE group. Insulin resistance assessed by HOMA and QUICKI was also significantly lower for the ISE group,  $p < 0.05$ . Control group measures were unchanged.

CONCLUSION: Twenty four sessions, equivalent to 8 hours of ISE, significantly increased aerobic fitness and decreased fasting insulin and insulin resistance of sedentary, overweight postmenopausal women.

1900 Board #52 June 2, 3:30 PM - 5:00 PM  
**Effect Of Hypertriglyceridemia, Sugar Ingestion, And Exercise On Substrate Metabolism In Overweight And Obese Individuals**

Andrea N. Steward, Jay W. Porter, John T. Halvorson, Ashley E. Connors, Sarah Bronsky, John G. Seifert, Mary P. Miles, FACSM. Montana State University, Bozeman, MT.  
 (No relationships reported)

Carbohydrate ingestion may induce oxidative stress, inflammation, impaired insulin action, and altered substrate metabolism in a way that may counteract exercise-induced improvements in insulin sensitivity and metabolic flexibility. Benefits from exercise may differ in individuals with hypertriglyceridemia (hyperTG) compared to individuals with normal TG (normTG). HyperTG and sugar ingestion are linked to metabolic disease. PURPOSE: Compare the triglyceride (TG), glucose (Glu), insulin (Ins), and C-peptide (CPEP) responses between exercise bouts with sugar sweetened beverage consumption (EX+SSB) versus water only (EX+H2O). METHODS: Overweight and obese men (n=9) and women (n=11) (18-55 years) with fasting TG > (hyperTG) or < (normTG) 150 mg-dl<sup>-1</sup> completed exercise. Each exercise was a 45-minute 10% grade uphill walk at 65% predicted VO2max. A standard, isocaloric diet to meet energy needs was given post exercise in the EX+H2O condition, but SSB replaced 2 g per kg lean mass of calories from food in the EX+SSB condition. An oral glucose tolerance test (OGTT) was completed the next day. Blood samples were collected pre-, 15, 30, 45, 60, 90, and 120-minutes post-OGTT for analysis of TG, Glu, Ins, and CPEP. Respiratory exchange ratio (RER) was measured collecting expired gas. RESULTS: The release of insulin, as measured by CPEP from 0 to 30 min of the OGTT, was lower ( $p = 0.04$ ) while fasting TG were higher ( $p = 0.03$ ) for the EX+SSB condition (mean $\pm$ SEM; 178.5 $\pm$ 22.5 mg-dl<sup>-1</sup>) compared to the EX+H2O condition (148.4 $\pm$ 14.1 mg-dl<sup>-1</sup>). Glucose area under the curve was higher ( $p < 0.001$ ) in the normTG group compared to the hyperTG group in the EX+H2O condition. Resting RER was lower ( $p = 0.05$ ) in the normTG group (0.74 $\pm$ 0.03 VCO2/VO2) compared to the hyperTG group (0.78 $\pm$ 0.04 VCO2/VO2) in the EX+H2O condition. CONCLUSION: Consuming sugar with exercise was followed by higher fasting TG and lower Glu and Ins responses compared to EX+H2O during the OGTT. Fat utilization and metabolic flexibility during the OGTT were lower in the hyperTG group compared to the normTG group. Sugar consumption affected post-exercise metabolism more negatively in individuals with hyperTG. Supported by the Mountain West Clinical Translational Research - Infrastructure Network under a grant from NIGMS of the NIH under Award Number 1U54GM104944.

1901 Board #53 June 2, 3:30 PM - 5:00 PM  
**Associations Between Antioxidant Capacity And Insulin Sensitivity At Baseline But Not Following Six-weeks Of HIIT Or MIT In Obese Males.**

Samuel P. Cauffman, Jonathan L. Warren, Sule Bulur, Gordon Fisher. University of Alabama at Birmingham, Birmingham, AL.  
 (No relationships reported)

Obesity is an independent risk factor for type 2 diabetes and cardiovascular disease. Oxidative stress or low total antioxidant capacity has been shown to be associated with decreased insulin sensitivity (SI) in overweight/obese individuals. Exercise training has been shown to improve systemic antioxidant capacity (TAC) and SI; however whether or not correlations between SI and TAC observed under untrained conditions are associated following exercise training is less clear. PURPOSE: The purpose of this study was twofold: 1) to determine if SI was correlated with serum TAC in a cohort of overweight/obese men at baseline and following six-weeks of exercise training; and 2) to determine if the relationships between SI and TAC responded differently following High Intensity Interval (HIIT) vs Moderate Intensity-Training (MIT). METHODS: 16 sedentary, overweight/obese young men (age = 20  $\pm$  1.5 years, body mass index = 29.5  $\pm$  3.3 kg/m<sup>2</sup>) were randomly assigned to HIIT or MIT and evaluated at baseline and post-training. Baseline and post training assessments included DXA for body composition assessment, oral glucose tolerance test to measure SI, and the oxygen radical absorbance capacity assay to assess TAC. Additionally, acute serum TAC responses were assessed at pre-exercise (PRE), immediately post exercise (IPE) and 30 minutes post exercise (30min-Post) at baseline and six-weeks post training. RESULTS: A significant correlation was observed between SI and TAC at baseline ( $R^2 = 0.548$ ,  $P = 0.001$ ). SI significantly improved from baseline to post-training in both groups ( $P = 0.037$ ), with no significant time x group interactions for HIIT or MIT. No significant changes in TAC were found from baseline to post-training. No significant correlations were found between SI and TAC in the trained condition. A significant increase in TAC was observed IPE compared to pre-exercise at baseline and six-weeks post training following HIIT ( $P < 0.05$ ). A significant decrease in TAC

was found 30min-Post compared to IPE six-weeks post training in HIIT and MIT.  
**CONCLUSION:** The observed baseline correlation between SI and TAC did not persist after training, which suggests that factors other than changes in TAC may be mediating the exercise-induced improvement in SI. Ongoing studies will attempt to identify exercise-induced mediators in SI.

1902 Board #54 June 2, 3:30 PM - 5:00 PM  
**High-Intensity Interval Training Improves Whole Body Insulin Resistance Via The Hepatic AdipoR1 Mediated-Signaling Pathway**

Jinkyung cho, Donghyun Kim, Inhwan Lee, Jungmoon Chang, Hyunsik Kang. *Sungkyunkwan university, cheoncheon dong, Korea, Republic of.*  
*(No relationships reported)*

High-intensity interval training (HIT) represents a very time-efficient mode of exercise training and induces several health benefits. However, little is known regarding the role of HIT to combat whole body insulin resistance.

**PURPOSE:** To investigate the effect of HIT on whole body insulin resistance in high-fat diet (HFD)-induced obese mice. **METHODS:** At 5-week postnatal period, a total of 30 male mice (C57BL/6) were randomly assigned to standard chow (SC) (n=10) or HFD (n=20) for 23 weeks. After 15 weeks of dietary treatment, the HFD mice were further assigned to HFD (n=10) or HFD+HIT (HFD+HIT, n=10). The HFD+HIT mice were subjected to HIT on a motor-driven rodent treadmill during the last 8 weeks of the 23-week HFD course. **RESULTS:** HIT suppressed HFD-induced increases in body weight (HFD 47.3±1.4 vs. HFD+HIT 44.2±1.2g, p=0.023), subcutaneous fat mass (HFD 2.7±0.1 vs. HFD+HIT 2.4±0.1g, p=0.038), serum total cholesterol (HFD 253.5±48.5 vs. HFD+HIT 198.7±7.4mg/L, p=0.010), area under the curve of glucose tolerance test (HFD 53070±8585 vs. HFD+HIT 45401±4312, p=0.031), and area under the curve of insulin tolerance test (HFD 9367±987 vs. HFD+HIT 6416±619, p=0.016). HIT prevented HFD-induced decreases of total adiponectin in serum (p=0.001) and adipose tissue (p=0.016). Along with improved metabolic risk factors, HIT prevented HFD-induced decreases in proteins of adiponectin receptor 1 (p=0.010), AMP-activated protein kinase (p=0.001), and NAD-dependent deacetylase sirtuin-1 (p=0.010) and HFD-induced decreases in mRNAs of peroxisome proliferator-activated receptor- $\alpha$  (p=0.027), carnitine palmitoyltransferase 1 (p=0.023), and acyl CoA oxidase (p=0.030) in skeletal muscle. **CONCLUSION:** The current findings show that HIT alleviates whole body insulin resistance associated with obesity via the AdipoR1 and AMPK mediated-signaling pathway in skeletal muscle, implying the therapeutic role of HIT to combat whole body insulin resistance. Supported by the National Research Foundation Grant funded by the Korean Government (NRF-2015S1A5B5A02012775).

1903 Board #55 June 2, 3:30 PM - 5:00 PM  
**Glucose And Lipid Responses To A Meal: Effects Of Sitting Vs Standing**

Christy Finney, Ronald Cox, Christina Ohlinger. *Miami University, Oxford, OH.*  
 Email: finneyca@miamioh.edu  
*(No relationships reported)*

A growing body of literature suggests that differences in metabolic responses to nutritional challenge can be demonstrated when the postural condition of the individual is changed from sitting to standing. Previously we have shown striking differences in the response to a glucose tolerance test between sitting and a proxy for standing. **PURPOSE:** To compare glucose and lipid clearance, in healthy individuals in response to a high fat commercial breakfast meal performed under standard sitting conditions or while during a proxy for standing (0.5 mph walk on an Active Workstation). **METHODS:** 9 individuals, 3 females and 6 males (87.9±20.1 kg.) performed two tests (sit & 0.5 mph walk). After a minimum of an 8-hour fast a baseline glucose, total cholesterol, triglycerides (Trigly), HDL and LDL measurements were obtained. Subjects then ingested a fast food breakfast containing a minimum of 20 grams of fat. In a counterbalanced manner, subjects either spent the next two hours sitting or walking at 0.5 mph (a proxy for standing) on an Active Workstation. A blood sample (finger stick) was obtained every 30 min for the next two hours (Cholestech®). **RESULTS:** The Trigly (Mean±SD) levels (mg %) showed a significant rise across time in the sitting condition: 109.7±34.1 to 151±47.3) vs a non-significant rise in the 0.5 mph group: 120±49.2 to 148.5±69.3. Glucose responses (mg %) across time were similar in both groups, however the sitting group showed a significantly higher level at the 30 min sample (112.5±10.0 vs 101.5±15.5, t= 2.1, df=8, p<.03). **CONCLUSIONS:** These results provide limited support for the impact of very low levels of physical activity (proxy for standing) on metabolic responses to a meal. Two hours may be too short an interval to detect the maximum effect of the meal and posture on lipid changes. The results are consistent with the potentially deleterious effects of sitting.

1904 Board #56 June 2, 3:30 PM - 5:00 PM  
**Exercise Reduces Hepatic Gluconeogenesis in Obese and Insulin Resistant Animals Through CLK2 Protein (Cdc2-Like Kinase)**

Rafael C. Gaspar<sup>1</sup>, Vitor R. Muñoz<sup>1</sup>, Rania A. Mekary<sup>2</sup>, Leandro P. Moura<sup>1</sup>, Marcella R. Sant'Ana<sup>1</sup>, Paula Quaresma<sup>1</sup>, Patricia O. Prada<sup>1</sup>, Rodolfo Marinho<sup>1</sup>, José Rodrigo Pauli<sup>1</sup>. <sup>1</sup>Faculty of Applied Sciences - FCA/UNICAMP, Limeira, Brazil. <sup>2</sup>Harvard T. Chan School of Public Health, Boston, MA.  
 Email: rafael.gaspar92@gmail.com  
*(No relationships reported)*

**PURPOSE:** CLK2 protein (Cdc2-like kinase) after being phosphorylated by Akt, phosphorylates PGC-1 $\alpha$  and consequently reduces the transcription of gluconeogenic genes. Obese and insulin resistant (IR) animals showed lower levels of CLK2 in the liver, which makes this protein an important therapeutic target in the control of glucose homeostasis. On the other hand, the exercise is an effective strategy to reduce IR and control hepatic glucose production. So far, no study has been performed in order to assess the role of exercise in modulating the CLK2 protein in obese animals. Therefore, the aim of this study was to evaluate the role of chronic physical exercise on the levels and phosphorylation of CLK2 in hepatic tissue of obese and IR mice. **METHODS:** Twenty four Swiss mice (4 weeks old) were divided into 3 groups (8 animals / group): Sedentary Control (C) sedentary animals fed with control diet, Sedentary Obese (SO) sedentary animals fed with HFD and Trained Obese (TO) animals fed with HFD and submitted to the training protocol. Protocol training was carried out for 1h / day, 5 days / week during 8 weeks and it was performed at the intensity of 60% of maximum power, which was determined at the beginning of the experiment. During the last experimental week the insulin tolerance test (ITT) and glucose tolerance test (GTT) were performed. Twenty four hours after the last exercise session the animals were euthanized and the liver was harvested for subsequent analysis. **RESULTS:** After the training protocol, TO group improved insulin sensitivity when compared to SO group. This finding was, in part, due to the increased phosphorylation of CLK2 by Akt in the trained animals. Because after occurring the elevation of CLK2 phosphorylation there was increased phosphorylation and nuclear extrusion of FoxO1 and this resulted in a reduced synthesis of gluconeogenic enzymes (G6Pase, PEPCK and PCB) which consequently reduced the hepatic glucose production. **CONCLUSION:** Therefore, it can be concluded that physical exercise, through CLK2 protein, reduces hepatic glucose production which collaborate to reduce the development of type 2 diabetes in obese animals. Supported by CNPq and FAPESP (2013/21491-2)

1905 Board #57 June 2, 3:30 PM - 5:00 PM  
**The Effect Of A High Fat/high Sugar Diet And Physical Activity On Body Fat Percentage And Bone Mineral Density**

Ayland C. Letsinger, Heather L. Vellers, Jorge Z. Granados, Nick R. Walker, Madison E. Spier, Isabel Lambertz, Robin Fuchs-Young, J. Timothy Lightfoot, FACSM. *Texas A&M University, College Station, TX.* (Sponsor: J. Timothy Lightfoot, FACSM)  
 Email: aylandletsinger@gmail.com  
*(No relationships reported)*

Ayland C. Letsinger<sup>1</sup>, Heather L. Vellers<sup>1</sup>, Jorge Z. Granados<sup>1</sup>, Nick R. Walker<sup>1</sup>, Madison Spier<sup>2</sup>, Isabel Lambertz<sup>2</sup>, Robin Fuchs-Young<sup>2</sup>, & J. Timothy Lightfoot<sup>1</sup>

<sup>1</sup>Department of Health & Kinesiology, Texas A&M University, College Station, TX 77840

<sup>2</sup>Department of Molecular & Cellular Medicine, Texas A&M Health Science Center, College Station 77840

**BACKGROUND:** It is well known that a caloric deficit will cause detrimental bone loss. Physical activity has been shown to improve bone mineral density as long as over training does not occur. However, the effects of excess fat and sugar consumption on bone health are unclear, especially when coupled with physical activity.

**PURPOSE:** The purpose of this study was to investigate the effect of diet and physical activity on bone mineral density (BMD) and body fat percentage (BF) in outbred, female SENCAR mice.

**METHODS:** The TAMU IACUC approved all procedures. SENCAR breeder pairs (Charles River) were mated and at 3 weeks of age, the pups were co-caged and randomly assigned to one of three diet types with wheel running access (WR) or without (no-WR): 1) ad-lib (AL) (10% fat) (n=2 WR; n=3 no-WR); 2) diet restricted (DR) (12% kcal reduction from control) (n=8 WR; n=7 no-WR); or 3) high fat/high sugar (HFHS) (45% fat/10% fructose solution drinking water) (n=5 WR; n=9 no-WR). At 4 weeks of age, the mice were randomly assigned to WR or no-WR groups. After 20 weeks, BF and BMD were determined with a PIXImus DEXA scan at termination. **RESULTS:** BF percent was reduced by WR across all diet types (p-value<0.0001). Average BF across all groups was 166% higher in no-WR (42.9 ± 9.0 gms) than in WR

(25.8 ± 9.5 gms). WR did not reverse decreases in overall BMD associated with the HFHS (0.067 ± 0.005 gms/cm<sup>2</sup>) or DR (0.066 ± 0.002 gms/cm<sup>2</sup>) diets compared to the AL (0.080 ± 0.003 gms/cm<sup>2</sup>) diet (p<0.01).

**CONCLUSION:** Wheel running reduced body fat percentages similarly in HFHS, DR, and AL diet fed mice. However, wheel running did not affect the loss of BMD in animals on HF/HS diets.

**ACKNOWLEDGMENTS:** This project was funded by the US Army through the Department of Defense projects W81XWH-13-1-0278 (Fuchs-Young) and W81XWH-13-1-0279 (Lightfoot).

## D-27 Free Communication/Poster - Concussion I

Thursday, June 2, 2016, 1:00 PM - 6:00 PM

Room: Exhibit Hall A/B

1906 Board #58 June 2, 2:00 PM - 3:30 PM

### The Effect of Over-the-Counter Medication on Symptom Severity Following Sport-Related Concussion

Michael J. Pepin, David R. Howell, William P. Meehan, III.  
Boston Children's Hospital, Waltham, MA.  
Email: michael.pepin@childrens.harvard.edu  
(No relationships reported)

**TITLE:** The effect of over-the-counter medication on symptom severity following sport-related concussion

**Authors:** Michael J. Pepin, David R. Howell, William P. Meehan III

**Purpose:** Although over-the-counter (OTC) medications are commonly administered following sport-related concussion, their effect on reducing symptoms remains unknown. We sought to examine the effect of nonsteroidal anti-inflammatory drugs (NSAIDs) and melatonin on post-concussion symptom severity.

**Methods:** We conducted a prospective cohort study of patients who presented to a sport concussion clinic within 21 days of injury. We examined the effect of NSAID use on the sum of "Headache" and "Pressure in the Head" scores (HA score) on the post-concussion symptom scale (PCSS) endorsed by the international consensus on concussion in sport. In addition, we examined the effect of melatonin on "Trouble Falling Asleep" scores (Sleep score). Patients who reported taking NSAIDs (n=30) and melatonin (n=16) were matched by age, gender, HA or Sleep score respectively, and overall PCSS scores with controls (n=70 and 35 respectively) who did not report the use of these medications. Mean differences in PCSS scores from the initial clinic visit and first follow-up visit were compared by repeated measures ANOVA.

**Results:** There was significant improvement in mean HA score for both NSAID users (6.4 vs. 3.7; p<0.001) and non-users (6.6 vs. 2.8; p<0.001). The mean difference in HA score between initial visit and follow-up visit of NSAID users was not significantly different than that of non-users (2.7 vs. 3.8; p=0.102). Similarly, there was significant improvement in Sleep score between visits in both melatonin users (3.8 vs. 2.0; p<0.001) and non-users (3.7 vs. 1.6; p<0.001) showed. The mean difference in Sleep score between initial visit and follow-up visit, however, did not differ between those who used melatonin and those who didn't (1.8 vs. 2.1; p=0.691).

**Conclusion:** Headache symptom severity and difficulty falling asleep are commonly treated following concussion using OTC medications such as NSAIDs and melatonin. Our results suggest that symptom severity improves over time, but this effect may not be enhanced by the use of OTC medications.

1907 Board #59 June 2, 2:00 PM - 3:30 PM

### Athletes That Continue To Play With Sport-Related Concussion Demonstrate Prolonged Recovery And Worse Outcomes

R.J. Elbin<sup>1</sup>, Alicia Sufinko<sup>2</sup>, Philip Schatz<sup>3</sup>, Jonathan French<sup>2</sup>, Michael W. Collins<sup>2</sup>, Anthony P. Kontos<sup>2</sup>. <sup>1</sup>University of Arkansas, Fayetteville, AR. <sup>2</sup>University of Pittsburgh, Pittsburgh, PA. <sup>3</sup>Saint Joseph's University, Philadelphia, PA. (Sponsor: Stavros Kavouras, FACSM)  
(No relationships reported)

The Centers for Disease Control (CDC) Head's Up Concussion education program states, "It is better to miss one game than the whole season." However, due to sport culture (i.e., play through injury), lack of awareness of sport-related concussion (SRC) signs and symptoms, and limited access medical professionals, many athletes continue to play with SRC. The impact of continuing to play with SRC on recovery is unknown. Purpose: To compare recovery outcomes among athletes who were removed or not removed from play following SRC

Methods: A retrospective cohort repeated measures design was used to assess neurocognitive, symptom, and vestibular/oculomotor scores in 36 athletes (15.71 ± 1.73 years) removed (REMOVED) and 39 athletes (15.70 ± 1.73 years not

removed (NOT REMOVED) from play following SRC. Neurocognitive (ImPACT) and symptom assessments (PCSS) were administered at baseline, 1 - 7 days, and 8 - 30 days post injury, and a vestibular and oculomotor assessment (VOMS) was administered at 1 - 7 days post injury. Recovery time was calculated as total days elapsed between injury and medical clearance. A series of 2 group (REMOVED, NOT REMOVED) X 3 time (baseline, 1 - 7, 8 - 20 days) repeated measures analysis of variance was used to examine differences in neurocognitive performance, and a series of independent samples t-tests were performed to examine differences in vestibular/oculomotor function and recovery time between groups. Statistical significance was set at a Bonferroni-corrected p < .001 for multiple comparisons.

Results: The NOT REMOVED group (36.84 ± 24.41 days) took significantly longer to recover from SRC than the REMOVED group (19.47 ± 14.43 days; p = .001, exhibited significantly greater vestibular/oculomotor impairment at 1 - 7 days following injury than the REMOVED group (p < .001), and demonstrated significantly worse neurocognitive performance and increased symptoms at both the 1 - 7 (p < .001) and 8 - 20 day (p < .001) post-injury time points compared to the REMOVED group. Conclusions: Athletes that continue to play with a SRC demonstrate longer recovery times and worse outcomes than athletes that are removed from play following SRC. Immediate removal from play is the first line of prevention for prolonged SRC recovery. Removal from play may be a new modifying factor that predicts protracted SRC recovery.

1908 Board #60 June 2, 2:00 PM - 3:30 PM

### The Prevalence Of Sports-related Concussion In Intramural And Club Athletes At The Collegiate Level

Melissa N. Anderson, R.J. Elbin, Makenzie L. Brown, Evan M. Dobbs, Morgan N. Anderson. University of Arkansas, Fayetteville, AR. (Sponsor: Dr. Kavouras, FACSM)  
Email: mna004@uark.edu  
(No relationships reported)

Sport-related concussions (SRC) are a serious brain injury that influences the physical, cognitive, emotional, and social functioning of student athletes and can impair academic performance when undetected or mismanaged. The majority of SRC research has focused on varsity university athletes, which comprises approximately 6% of the entire university student body population. There are approximately 400,000 intramural and club sport athletes that participate in similar contact and collision sports (e.g., soccer, hockey, basketball) and at risk for SRC. There is a lack of data on the prevalence of SRC in this population and the effects of SRC are unknown.

Purpose: 1) To investigate the prevalence and academic effects of SRC in university intramural and club sport athletes, and 2) to document medical oversight and access to care for SRC in this population.

Methods: A total of 900 collegiate intramural and club sport athletes (M = 20.38, SD = 2.03 years) at four southern universities completed a survey that assessed demographic information, SRC history, concussion knowledge, and barriers to seeking medical care for SRC. Descriptive statistics were used to describe medical coverage, SRC history, and academic difficulties.

Results: Sixty percent (270/452) of respondents reported having medical coverage for club games and 33% (148/454) reported coverage for practices. Medical coverage for intramural games and practices were 41% (284/698) and 8% (62/703), respectively. Medically diagnosed concussions were reported by 9% (40/501) of club athletes and 1% (10/704) of intramural athletes. Sixty-three percent (31/49) of respondents with SRC reported academic difficulties lasting 2 - 3 weeks. Only 22% (7/31) sought academic accommodations.

Conclusion: University intramural and club sport athletes also sustain SRC and experience academic difficulties following their injury. Additional resources are needed to improve care for SRC in these student-athletes.

1909 Board #61 June 2, 2:00 PM - 3:30 PM

### Baseline Normative Data Of The Vestibular/ocular Motor Screening (voms) Assessment For High School Athletes

Morgan Anderson<sup>1</sup>, Melissa Anderson<sup>1</sup>, Evan Dobbs<sup>1</sup>, R.J. Elbin<sup>1</sup>, Philip Schatz<sup>2</sup>. <sup>1</sup>University of Arkansas, Fayetteville, AR. <sup>2</sup>Saint Joseph's University, Philadelphia, PA. (Sponsor: Dr. Kavouras, FACSM)  
Email: mnanders@uark.edu  
(No relationships reported)

Dizziness occurs in 50% of athletes following sport-related concussion (SRC) and is indicative of vestibular and oculomotor dysfunction. The Vestibular/Ocular-Motor Screening (VOMS) assessment is a brief, screening tool designed to detect vestibular and ocular motor impairment and symptoms following SRC. Currently there are no normative data for this measure in high school (HS) athletes, and the base rate of scores above clinical cutoffs is unknown.

PURPOSE: To establish normative baseline (i.e., pre-season) data for the VOMS in high school athletes.

**METHODS:** A total of 468 HS athletes (15.84 ± 1.23 years; 140 females - 29.9%) completed baseline VOMS testing. The VOMS is comprised of a series of vestibular (e.g., vestibular oculomotor reflex) and ocular motor components (e.g., saccadic eye movement). Symptom provocation ratings for headache, dizziness, nausea, and fogging are recorded on a 10-point Likert scale each VOMS component. Descriptive statistics were used to document normative performance for the total sample. The percentage of baseline scores above published clinical cut-offs were tabulated for each VOMS component. Scores outside of 95% confidence intervals (CI) were documented and new cutoff scores were determined using multivariate base rates.

**RESULTS:** Approximately 83% (388/468) of the total sample exhibited VOMS scores within the expected, normal range, whereas 17% (80/468) of the sample were above clinical cutoffs on any one VOMS item. In addition, 12% (54/486) were above clinical cut-offs on two VOMS items, 6% (27/486) were above clinical cut-offs on three VOMS items. However, the clinical cut-off of four VOMS items yielded an acceptable false-positive rate of less than 5% in this population.

**CONCLUSION:** Approximately 83% athletes reported VOMS symptoms scores below clinical cutoffs. These findings suggest that researchers and sports medicine professionals should consider using clinical cutoff scores ≥ 2 on at least 4 VOMS items.

1910 Board #62 June 2, 2:00 PM - 3:30 PM

**Aerobic Exercise for Adolescents with Prolonged Symptoms after mTBI: A Randomized Clinical Pilot Study**

Paul J. Gubanich, Jason Hugentobler, Catherine Quatman-Yates, Jennifer Taylor, Mekibib Altaye, Shari L. Wade, Brad G. Kurowski. *Cincinnati Children's Hospital Medical Center, Cincinnati, OH.* (Sponsor: Greg Myer, FACSM)  
Email: paul.gubanich@cchmc.org  
(No relationships reported)

**Pediatric traumatic brain injury (TBI) is among the most common causes of acquired morbidity and mortality in adolescents. Approximately, 75-85% of TBIs in children and adolescents are mild TBIs, with an estimated 10-33% of individuals experiencing persistent symptoms beyond 1 to 3 months. There is a critical need to develop evidence-based interventions for individuals with persistent symptoms.**

**PURPOSE:** We conducted a pilot randomized clinical trial (RCT) to assess benefits of aerobic exercise in adolescents with persistent symptoms after mTBI. We hypothesized that performance of aerobic exercise at sub-symptom provoking thresholds would be associated with more rapid resolution of symptoms compared to a generalized stretching intervention. **METHODS:** Adolescents (ages 12-17) who remained symptomatic for 4-16 weeks post mTBI were randomized to either a six week, sub-symptom provoking aerobic exercise or a stretching intervention. The primary outcomes measure, the Post-Concussion Symptom Inventory (PCSI), was completed by both the adolescent and parent at pre-injury (based on retrospection), pre-intervention, at each interval visit, and at the final assessment.

**RESULTS:** Thirty participants were randomized into the aerobic exercise or stretching intervention. There were no statistically significant differences in baseline characteristics between the two groups. Twenty-six participants completed the study (1 dropped out, 1 failed treatment, 2 became ineligible due to non-study related injuries). Repeated measures, mixed model analysis of the adolescent reported PCSI ratings over the six weeks of the intervention demonstrated a significant group by time interaction, indicating an improved rate of recovery for the aerobic exercise compared to the stretching group (F-value=4.45, p-value=0.04).

**CONCLUSIONS:** This randomized clinical trial supports the utilization of an active rehabilitation program in adolescents with prolonged symptoms after mTBI. Symptom ratings were improved during the six weeks of aerobic exercise versus a stretching intervention. Additional studies are needed to improve the generalizability of these results, identify individuals most likely to benefit, and determine optimal type, timing, and intensity of active rehabilitation programs for this population.

1911 Board #63 June 2, 2:00 PM - 3:30 PM

**Level of Pre-Injury Aerobic Exercise and Concussion Outcomes**

Jessalynn G. Adam<sup>1</sup>, Daniel Corwin<sup>2</sup>, Phillip R. Bryant<sup>2</sup>, Matthew F. Grady<sup>2</sup>, Christina L. Master<sup>2</sup>. <sup>1</sup>Hospital of the University of Pennsylvania, Philadelphia, PA. <sup>2</sup>The Children's Hospital of Philadelphia, Philadelphia, PA.  
(No relationships reported)

*Exercise is well known to have beneficial effects on the brain, specifically on learning, memory, and mood. Recent studies have shown that aerobic exercise aids recovery in the sub-acute phase of concussion. However, research has not found any preventive strategies to reliably improve concussion outcomes. Risk factors for prolonged recovery have been identified but no modifiable factors prognosticating better recovery have been described.*

**PURPOSE:** To determine if pre-injury exercise level correlates with improved outcomes, specifically concussion severity and duration of recovery.

**METHODS:** A retrospective, exploratory cohort study of 247 patients age 5-18 years with concussion referred to a tertiary pediatric hospital-affiliated sports medicine clinic from July 1, 2010 through December 31, 2011 was conducted. A random sample of all eligible patient visits (3740) was chosen for review. Three subsets of patients were selected according to the Classification of Sports: high dynamic, low static sport, soccer n=32; high dynamic and low-moderate static sport, soccer and basketball combined, n= 53; and non-athletes, n=57. Statistical comparisons using Student's t-test were made between groups.

**RESULTS:** The percent with vestibular deficits on initial visit was equivalent across groups: 81.3% soccer, 81.1% soccer and basketball, and 80.7% non-athletes. Mean days until vestibular symptoms resolved was significantly less for athletes: 83.88 soccer vs 160 non-athletes (P=0.04), 82.4 soccer and basketball vs non-athletes (P=0.007). Average initial symptom score approached statistical significance, (24.4 for soccer and basketball vs 32.17 for non-athletes, P=0.07). Mean days of school and mean days of sport missed were not statistically significant.

**CONCLUSION:** These findings suggest that pediatric and adolescent athletes with concussion may experience a significantly shorter recovery period, with shorter duration of vestibular symptoms compared to non-athletes, despite similar incidence of initial vestibular deficits. Also, while not statistically significant, there was a trend towards lower initial symptom score in the athlete groups.

Supported by NIH, National Center for Advancing Translational Sciences UL1TR000003 for UPHS; CHOP Research Institute Clinical Translational Sciences Award

1912 Board #64 June 2, 2:00 PM - 3:30 PM

**The Effect of Repeated Head Impacts on Measures of Gait Stepping Kinematics**

Jessie R. Oldham, Melissa S. DiFabio, Ryan M. DeWolf, Thomas W. Kaminski, FACSM, Thomas A. Buckley. *University of Delaware, Newark, DE.*  
Email: jroldham@udel.edu  
(No relationships reported)

Collegiate athletes participating in contact sports have arguably sustained large numbers of head impacts during the span of an athletic career. Alterations in gait parameters have been demonstrated following concussion; however, the effect of participation in sports with repeated head impacts on measures of gait has not been explored.

**PURPOSE:** To evaluate the effects of ongoing participation in contact versus non-contact sports on gait stepping characteristics.

**METHODS:** Ninety-nine NCAA Division I student-athletes were divided into two groups based on the contact nature of his or her sport. There were 57 student-athletes (Age: 19.5 ± 1.3 years, Height: 181.6 ± 9.1 cm, Weight: 84.4 ± 15.3 kg) who participated in contact sports (e.g., football, men's lacrosse, women's soccer) and 42 student-athletes (Age: 19.7 ± 1.3 years, Height: 166.7 ± 7.9 cm, Weight: 63.3 ± 15.4 kg) in non-contact sports (e.g., softball, field hockey). All student-athletes wore three valid and reliable accelerometers (one on each foot and one on the lumbar region) and completed five standard gait trials. During a standard gait trial, the individuals were instructed to be walking on an auditory cue, transverse a 10m walkway, turn around a specified endpoint and return to the original starting position. A multivariate ANCOVA for height was utilized to investigate differences in gait velocity, stride length, and double support with subject height serving as the co-variate.

**RESULTS:** There were no significant differences found between student-athletes participating in a contact versus non-contact sport for gait velocity (1.22 ± 0.15 m/s, 1.27 ± 0.11 m/s, p=0.34), stride length (1.30 ± 0.11 m, 1.25 ± 0.07 m, p=0.18) or double support time (18.82 ± 2.84%, 16.12 ± 2.47%, p=0.61).

**CONCLUSION:** No significant differences were seen in gait stepping characteristics between student-athletes in a contact versus non-contact sport. This suggests that the number of head impacts sustained over the course of an athletic career does not affect gait stepping kinematics. Future studies should incorporate dual task challenges and perturbation studies to further stress the postural control systems.

1913 Board #65 June 2, 2:00 PM - 3:30 PM

**Division I Power-Five Institution's Compliance with NCAA Concussion Management Plan**

Melissa S. DiFabio<sup>1</sup>, Christine M. Baugh<sup>2</sup>, Christine Flora<sup>1</sup>, Thomas A. Buckley<sup>1</sup>. <sup>1</sup>University of Delaware, Newark, DE. <sup>2</sup>Harvard University, Cambridge, MA.  
Email: mdifabio@udel.edu  
(No relationships reported)

The current NCAA concussion management, enacted in January 2015, requires member institutions to develop concussion management plans consistent with a series of recommendations and requirements for best practices. Each plan was reviewed by NCAA affiliates and published on the NCAA website; however, independent review of these plans has published, to date.

Abstracts were prepared by the authors and printed as submitted.

**PURPOSE:** To evaluate institutions' concussion management plans for compliance with NCAA concussion management plan guidelines.

**METHODS:** We reviewed and evaluated the compliance of the 65 publicly available concussion protocols submitted with the guidelines checklist provided by the NCAA. Each school's protocol was reviewed and graded as "yes" or "no" with respect to each checklist item recommended or required by the NCAA. The overall compliance rate as well as the component compliance were evaluated with descriptive statistics.

**RESULTS:** The overall compliance was 93.6% (2,858/3,055). The pre-participation section had the highest compliance of 99.7% (322/325). Return to learn had the lowest compliance of 87.0% (622/715). The most common missed information of the return to learn section were modification of schedule/academic accommodations for up to two weeks as indicated, with help from the identified point person (80%[52/65]), re-evaluation by team physician if concussion symptoms worsen with academic challenges (81.5%[53/65]), and remaining at home/dorm if SA cannot tolerate light cognitive activity (81.5%[53/65]).

**CONCLUSION:** This study found that plans previously evaluated by the NCAA were generally in compliance with their guidance. However, no areas achieved full compliance, with the return to learn section having the highest lack of compliance. Future studies should compare the institutions' stated concussion management plan to the actual clinical practice.

1914 Board #66 June 2, 2:00 PM - 3:30 PM  
**Cognitive Symptoms Are More Prevalent Post-Concussion in Athletes with Attention Deficit-Hyperactivity Disorder**

Jonathan M. Oliver<sup>1</sup>, Stephanie M. Turner<sup>1</sup>, Damond Blueitt<sup>2</sup>, Tami Case<sup>2</sup>, Tiffany McGuffin<sup>2</sup>, Kalyssa Pollard<sup>3</sup>, J. Craig Garrison<sup>3</sup>, Anthony J. Anzalone<sup>1</sup>, Margaret T. Jones, FACSM<sup>4</sup>.  
<sup>1</sup>Texas Christian University, Fort Worth, TX. <sup>2</sup>Ben Hogan Sports Medicine Concussion Center, Fort Worth, TX. <sup>3</sup>Ben Hogan Sports Medicine, Fort Worth, TX. <sup>4</sup>George Mason University, Manassas, VA. (Sponsor: Margaret Jones, FACSM)  
 Email: jonathan.oliver@tcu.edu  
 (No relationships reported)

Attention deficit hyperactivity disorder (ADHD) is characterized by cognitive and attentional impairments, which may have implications for athletes recovering from a sports-related concussion (SRC) as symptoms and deficits of ADHD overlap with those assessed following SRC. A longer recovery from head trauma has been reported in patients with ADHD compared to those without ADHD. Additionally, increased or persistent cognitive symptoms following concussion are a risk factor for protracted recovery, independent of ADHD status. The Post-Concussion Symptom Scale (PCSS), a widely used clinical assessment, contains six symptoms associated with cognitive function: feeling "dazed", confusion, feeling "slowed down", difficulty concentrating, difficulty remembering, feeling like "in a fog". **PURPOSE:** Therefore, we examined the relationship between cognitive symptoms and the presence of ADHD in athletes with SRC diagnosis. **METHODS:** A retrospective chart review of patient (n = 223; 80 girls, 143 boys) records (age range: 11-19 yr; mean ± SD; 15±2) for those presenting with SRC from Jan - Dec 2014 was conducted. Initial PCSS response to symptoms associated with cognitive dysfunction was summed and secondarily recorded using a dichotomous scale (0=not present, 1=present). Diagnostic history of ADHD was self-reported.  $\chi^2$  analyses were employed to examine the relationship between ADHD and PCSS cognitive symptoms. **RESULTS:** ADHD was present in 14.3% of patients. The average cognitive symptom severity (sum) was greater for those with ADHD (7.4±6.4) than those without (5.1±6.1; p = 0.051). A greater proportion of patients with ADHD reported feeling "dazed" (66.7% vs. 46.8%; p = 0.036), confusion (60.6% vs. 36.3%; p = 0.009), feeling slowed down (75.8% vs. 55.8%; p = 0.031), and having difficulty concentrating (75.8% vs. 57.4%; p = 0.046). No difference was observed in proportion presenting with or without ADHD with PCSS symptoms feeling like "in a fog" (p = 0.148) or having difficulty remembering (p = 0.107). **CONCLUSION:** These data suggest that symptoms associated with cognitive dysfunction are more likely to be present in athletes with ADHD following SRC. However, it is unclear whether the observed longer recovery following SRC in individuals with ADHD is due to increased susceptibility to cognitive symptoms.

1915 Board #67 June 2, 2:00 PM - 3:30 PM  
**No Relationship Between Head Impacts and Dynamic Postural Control in Collegiate Football Players.**

Thomas A. Buckley<sup>1</sup>, Jessie R. Oldham<sup>1</sup>, Kelsey M. Evans<sup>2</sup>, Nicholas G. Murray<sup>3</sup>, Barry A. Munkasy<sup>3</sup>, Eric D. Shiflett<sup>4</sup>.  
<sup>1</sup>University of Delaware, Newark, DE. <sup>2</sup>Emory University, Atlanta, GA. <sup>3</sup>Georgia Southern University, Statesboro, GA. <sup>4</sup>Forsyth Country Day School, Lewisville, NC. (Sponsor: Chris J. Hass, FACSM)  
 Email: TBuckley@UDe.edu  
 (No relationships reported)

There is considerable recent interest in the effects of repeated head impacts on neurological function. Most investigations have focused on functional imaging and cognitive performance; however, the effects of repeated head impacts on motor performance is unclear. **PURPOSE:** To investigate the effects of head impacts suffered over the course of a single football season on gait initiation (GI) stepping characteristics. **METHODS:** We enrolled 36 NCAA Division I football players (age: 20.2 ± 1.2 years old; height: 185.7 ± 7.1cm; weight: 103.4 ± 18.5kg) and 20 non-contact athletes (age: 19.8 ± 1.2 years old; height: 161.2 ± 9.2cm; weight: 58.3 ± 10.5kg). The football players wore helmets instrumented with the Helmet Impact Telemetry System (HITS). All participants completed 5 GI trials prior to and immediately the football season and kinetic data was collected with 4 forceplates. HITS outcome measures included; the number of impacts, linear acceleration sum, mean linear acceleration, and number of impacts exceeding 100 g's. GI outcome measures included initial step length and velocity as well as displacements of the center of pressure (COP) during the anticipatory postural adjustment (APA) phase. Outcomes were compared between groups with a 2 (group) x 2 (time) repeated measures ANOVA. A linear regression compared HITS measures to change in gait characteristics. **RESULTS:** There were a total of 18,704 head impacts (mean: 550.1 ± 402) with an average of 5.9 ± 5.6 impacts exceeding 98g's. The mean linear acceleration was 27.9 ± 3.1g's and the mean cumulative linear acceleration was 15,917.1 ± 12,112.7g's. There was no overall group by time interaction (p=0.849) for GI outcomes measures. Exploratory post-hoc analysis did not identify changes in any of the specific GI measures (e.g., step length: football PRE: 56.5 ± 3.1cm POST: 58.6 ± 6.2cm; non-contact: PRE: 56.1 ± 3.9cm POST: 58.7 ± 3.7cm; p=0.785). There was no predictive relationship between the head impact kinematics and GI characteristics (p>0.05). **CONCLUSION:** A single season of college football did not adversely affect GI performance compared to a non-head impact control group and the head impact kinematics did not predict GI performance. Future studies need to address longer term changes in neurological performance and additional posturally destabilizing challenges.

1916 Board #68 June 2, 2:00 PM - 3:30 PM  
**Concussion Discharge: Emergency Room For Improvement?**

Liane M. McAuliffe, Joshua Ness, Erin Morine, Rushad Juyia, Deborah Light, Hamish Kerr. Albany Medical College, Albany, NY.  
 Email: mcaulil@mail.amc.edu  
 (No relationships reported)

**Background**

Each year 3.8 million people are affected by sports-related concussion in the U.S., and Emergency Department (ED) visits for concussions are on the rise. Concussion is often initially managed by ED providers, who play a key role in educating patients to minimize risk and improve outcomes.

**Objective**

The authors set out to evaluate ED discharge instructions for sports-related concussion in an urban tertiary care center and hypothesized that ED staff would provide inadequate discharge education for patients diagnosed with concussion.

**Methods**

A retrospective chart review of patients discharged from an urban tertiary care center with the diagnosis of concussion from 1/1/13 - 6/1/14 was conducted. A follow up phone survey was then conducted. The patient list was obtained by searching the ED database for patients aged 6-60 discharged from the ED with ICD9 code 850.9. 760 patients were identified. Based on inclusion and exclusion criteria, reviewers narrowed the list to 330 sports or recreation related concussions. Exclusion criteria included positive CT scan findings other than a linear skull fracture or admission to the hospital. **Results**

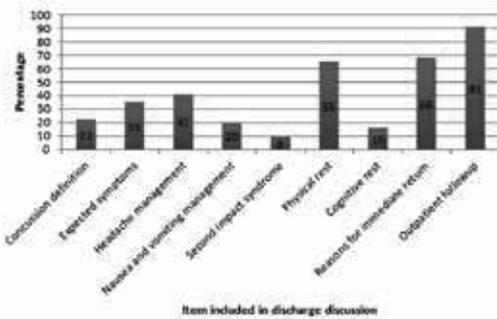
There were 117 females and 213 males included in the study with median patient age of 15 years. Results of the chart review are summarized in Figure 1. Results of the phone survey are summarized in Figure 2.

**Conclusion**

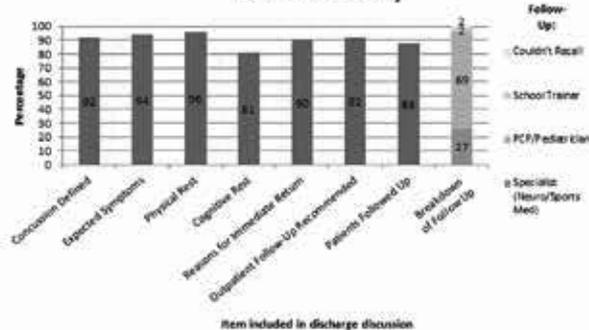
According to the chart review, most ED providers missed the mark in educating their patients about expected post concussive symptoms, headache and nausea management,

second impact syndrome, and the importance of cognitive rest. However, the phone survey revealed that ED providers are in fact discussing key items at discharge much more frequently than is reflected in the medical record.

**Figure 1: Percentage of Concussion Patients who Received Education on Key Items at Discharge**



**Figure 2: Percentage of Concussion Patients Who Received Education on Key Items at Discharge Per Phone Survey**



1917 Board #69 June 2, 2:00 PM - 3:30 PM  
**Assessing Concussions In Collegiate Football Players**  
 B. Sue Graves, FACS<sup>1</sup>, John Burnside<sup>1</sup>, Manish K. Gupta<sup>2</sup>.  
<sup>1</sup>Florida Atlantic University, Boca Raton, FL. <sup>2</sup>Sports & Orthopedic Center, Boca Raton, FL.  
 Email: sgraves@fau.edu  
 (No relationships reported)

**PURPOSE:** Concussion-related injuries are approximately 6% of all collegiate injuries. Assessing and managing concussions are generally a multifaceted approach (Guskiewicz et al., 2004), but research in this area has been insufficient, especially within the university football population. The purpose of this study was to evaluate symptoms and recovery periods after a concussion was identified in college football players, using balance and a computerized neurocognitive assessment tool.  
**METHODS:** Division 1 college football athletes, from 18 to 24 years (n = 166; age, 19.3±1.2 y; height, 183.6±5.5 cm; weight, 102.7±7.6 kg), before fall practice, over a period of 3 years, underwent baseline postural stability testing (sensory organization test [SOT], NeuroCom) and the Impact assessment. Players, who had a concussion (e.g., headache, dizziness, fatigue, confusion, and/or loss of consciousness) during practice or actual competition (n=15, 18.6±8 y, 185.9±4.5 cm, 107.8±6.6 kg), were reevaluated on both assessments, starting at 24 hours post-concussion. When the player was considered asymptomatic, the test was repeated on the 1st and 7th day. They did retake the online concussion assessment. A control group of non-concussed college males were age-matched to the concussed player. The controls were tested during the same time frame as the concussed players.  
**RESULTS:** Results indicated the concussion group had a statistically significant (p = 0.037) change from their baseline SOT (balance) score and the control group (p = 0.025). This change remained significant until day 14 of post-testing. The concussion online assessment also was significant (p=0.41) from their pre-test scores.  
**CONCLUSIONS:** The online (Impact) and balance (SOT) assessment tests, if available, should be considered as other methods of evaluating concussed college-aged football players. This information may also provide additional scientific data to aid with the decision for the player to exercise, attend football practice and, possibly, return to play. This study was only one small part of the complete evaluation provided to the decision makers (physicians, coaches, athletic trainers, and strength and conditioning coaches) in the concussed athlete's return to play.

1918 Board #70 June 2, 2:00 PM - 3:30 PM  
**The Incidence Of Concussion And The Risk Of Subsequent Concussions In Professional Rugby League**

Pete Walker<sup>1</sup>, Lisa Hodgson<sup>1</sup>, Conor Gissane<sup>2</sup>, Paul Maruff<sup>3</sup>, David Darby<sup>3</sup>. <sup>1</sup>University of Nottingham, Nottingham, United Kingdom. <sup>2</sup>St Mary's University, London, United Kingdom. <sup>3</sup>University of Melbourne, Melbourne, Australia.  
 (No relationships reported)

**Background:** Proper recognition and management of concussion within sport has become a hot topic as research suggests that the mismanagement of these injuries can lead to extended time out of play, and morbidity after a player retires. Computerized neuropsychological testing (CogSport) was introduced in Rugby League (RL) in 2004 to aid in return to play criteria and to help safeguard player's welfare.  
**Aims:** To identify the incidence and lifetime risk following a concussion over the years 2006-2012 within the Rugby Football League (RFL) and whether a full recovery from concussion leads to an increased risk of subsequent concussions.  
**Method:** Participant players were those who held a professional contract with the Rugby Football League UK between 2006-2012 representing 39 professional clubs at first and academy team level. It is mandatory within the professional game to provide an annual baseline test and following any diagnosed concussion, with full symptom resolution, a valid return to play test. Concussion test data was provided by CogState Australia from tests performed over 7 seasons.  
**Results:** Over the 7 year period there were 4762 players within the RFL (age range 16-34 years), suffering 470 concussion (2.65/1000 hours). The odds of sustaining 1 concussion was 7%, whereas the chances of receiving 2 or more was 1%. Incidentally, the probability of having 3 or more concussions was 0.2%. The time between concussions for any individual who suffered two or more concussions was on average 355 days. The average return to play time was 1.46 days following the first return to play test. The mean age of suffering a concussion was 22.6 years. The study showed a moderate association between age and concussion risk, with each advancing year giving rise to an 8% increased risk of a concussion.  
**Conclusions:** This report is the first to follow RL players over a prolonged period and as such is the first to demonstrate the risk of subsequent concussions. In RL concussions managed correctly and fully resolved have not been shown to have detrimental effects on future concussions and in general there is a lack of evidence linking appropriately managed concussions in other sports to detrimental future effects. Ethics University of Nottingham

D-28 Free Communication/Poster - Concussion II  
 Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
 Room: Exhibit Hall A/B

1919 Board #71 June 2, 3:30 PM - 5:00 PM  
**Symptom Provocation More Likely Following Vestibular/Ocular Motor Screening in Athletes with Attention Deficit Hyperactivity Disorder**  
 Damond Blueitt<sup>1</sup>, Anthony J. Anzalone<sup>2</sup>, Tami Case<sup>1</sup>, Tiffany McGuffin<sup>1</sup>, Kalyssa M. Pollard<sup>3</sup>, J. Craig Garrison<sup>3</sup>, Margaret T. Jones, FACS<sup>4</sup>, Jonathan M. Oliver<sup>2</sup>. <sup>1</sup>Ben Hogan Sports Medicine Concussion Center, Fort Worth, TX. <sup>2</sup>Texas Christian University, Fort Worth, TX. <sup>3</sup>Ben Hogan Sports Medicine, Fort Worth, TX. <sup>4</sup>George Mason University, Manassas, VA.  
 Email: damondblueitt@texashealth.org  
 (No relationships reported)

Vestibular and ocular-motor impairments are routinely reported in patients with a sports-related concussion (SRC) and may result in delayed return to play. The Vestibular/Ocular Motor Screening (VOMS), a brief clinical assessment for vestibular and ocular-motor impairments, has been shown to be a sensitive clinical assessment for identifying patients with a concussion. However, in athletes with attention deficit hyperactivity disorder (ADHD), the VOMS may not be indicated as these patients exhibit impairment of the ocular-motor system in the absence of concussive injury. Thus, VOMS findings in an athlete with ADHD may be overstated and a higher proportion of athletes reporting symptom provocation are likely.  
**PURPOSE:** To determine if differences exist between those athletes with and without ADHD in relation to symptom provocation during VOMS.  
**METHODS:** A retrospective chart review of patient (n = 223; 80 girls, 143 boys) records (age range: 11-19 yr; mean ± SD; 15±2) of those presenting with SRC from Jan - Dec 2014 was conducted. As part of the initial visit a VOMS assessment was performed by trained medical personnel who documented symptom provocation using a dichotomous scale (0=not present, 1=present). The VOMS used in this clinic consisted of the following domains: smooth pursuits (SMO\_PUR), horizontal

(HOR<sub>0</sub>) and vertical saccades (VER\_SAC), horizontal (HOR<sub>0</sub>) and vertical vestibular ocular reflex (VER\_VOR), convergence (CONV), and accommodation (ACCOM). Diagnostic history of ADHD was self-reported.  $\chi^2$  analyses for categorical variables was used to examine relationship between ADHD and VOMS symptom provocation. RESULTS: ADHD was present in 14.3% of patients. A greater proportion of patients with ADHD reported symptom provocation in the following VOMS domains: SMO\_PUR (57.6% vs. 36.6%;  $p=0.023$ ), HOR\_SAC (69.7% vs. 48.7%;  $p=0.026$ ), HOR\_VOR (64.5% vs. 41.8%;  $p=0.019$ ), VER\_SAC (69.7% vs. 53.8%;  $p=0.089$ ) approached significance. No difference was observed in proportion presenting with or without ADHD in domains of VER\_VOR, ACCOM, or CONV. CONCLUSION: Athletes with ADHD may report symptom provocation during specific domains of the VOMS assessment more often than those athletes without ADHD. These findings may have important implications in the diagnosis and treatment of concussions in athletes with ADHD.

1920 Board #72 June 2, 3:30 PM - 5:00 PM

### Repetitive Head Impacts Influence On The Postural Control System During An Athletic Season

Nicholas G. Murray<sup>1</sup>, Eric D. Shiflett<sup>1</sup>, Barry A. Munkasy<sup>1</sup>, Katelyn E. Grimes<sup>1</sup>, Klarie E. Ake<sup>1</sup>, Nathan R. D'Amico<sup>1</sup>, Megan E. Mormile<sup>1</sup>, Douglas W. Powell<sup>2</sup>, Thomas A. Buckley<sup>3</sup>.  
<sup>1</sup>Georgia Southern University, Statesboro, GA. <sup>2</sup>Campbell University, Buies Creek, NC. <sup>3</sup>University of Delaware, Newark, DE.  
Email: nmurray@georgiasouthern.edu  
(No relationships reported)

Evidence suggests that a concussive blow negatively impacts the postural control system post-injury. However, little is known regarding the role of repetitive head impacts on posture over the course of one athletic season. PURPOSE: The purpose of this study was to investigate changes in the postural control system after a season of repetitive head impacts (RHI) in Division I football athletes using traditional and nontraditional measures of posture. METHODS: Fourteen Division I football players (CON) (age = 20.4 ± 1.12 years) and fourteen non-contact athletes (NON) (2 male, 11 female; age=19.85 ± 1.21 years) completed a single trial of two minutes of eyes open quiet upright stance on a force platform (1000Hz) prior to athletic participation (PRE) and at the end of the athletic season (POST). All CON athletes wore helmets outfitted with Head Impact Telemetry (HIT) sensors and total number of RHI and linear accelerations forces of each RHI were recorded. Center of Pressure (CoP) Peak Excursion Velocity (PV), Sample Entropy (SampEn), in the anteroposterior (AP) and mediolateral (ML) directions, and 95% Confidence Ellipse (CE) were calculated at both PRE and POST. RESULTS: CON group experienced 649.5±496.8 mean number of impacts, 27.1±3.0 mean linear accelerations, with ≈1% of total player impacts exceeded 98g over the course of the season. Mixed model ANOVAs (2 groups x 2 assessment periods) revealed no significant interactions ( $p=0.499$ ) at PRE (CON=0.54 ± 0.14; NON=0.68 ± 0.12;  $p=0.499$ ) or POST (CON=0.56 ± 0.12; NON=0.68 ± 0.13;  $p=0.499$ ) in the SampEn AP direction and no significant interactions ( $p=0.984$ ) at PRE (CON=0.49 ± 0.08; NON=0.47 ± 0.07) or POST (CON=0.46 ± 0.11; NON=0.50 ± 0.11) in the SampEn ML direction. No significant interactions were observed for PV AP ( $p=0.262$ ) or ML ( $p=0.977$ ) directions, and 95% CE ( $p=0.327$ ). CONCLUSIONS: A single season of repetitive head impacts in college football did not negatively affect the postural control system when measured by traditional (PV and 95% CE) and nontraditional (SampEn) calculations of CoP. These measures are highly sensitive in determining postural instability during quiet upright stance immediately and longitudinally post-concussion. Future research needs to address the impact of RHI on dual-task performance and functional measures of postural control.

1921 Board #73 June 2, 3:30 PM - 5:00 PM

### Assessment Of Anti-saccades Within 24 To 48 Hours Post-concussion

Nathan R. D'Amico<sup>1</sup>, Megan E. Mormile<sup>1</sup>, Klarie M. Ake<sup>1</sup>, Katelyn E. Grimes<sup>1</sup>, Dougals W. Powell<sup>2</sup>, Rebecca J. Reed-Jones<sup>3</sup>, Anthony P. Salvatore<sup>4</sup>, Nicholas G. Murray<sup>1</sup>.  
<sup>1</sup>Georgia Southern University, Statesboro, GA. <sup>2</sup>Campbell University, Buies Creek, NC. <sup>3</sup>Prince Edward Island University, Charlottetown, PE. <sup>4</sup>The University of Texas at El Paso, El Paso, TX.  
Email: nd01374@georgiasouthern.edu  
(No relationships reported)

Over 30% of concussed athletes report visual issues after injury, with saccade (rapid eye movement) deficits being the most prominent oculomotor impairment. Anti-saccades are saccade deficits that are readily recorded and their neural substrates are well understood. Assessments of anti-saccades may provide a fast, accurate, and reliable way to screen for concussion. However, little research quantitatively explores anti-saccades post-concussion. PURPOSE: To investigate anti-saccades, involuntary reflexive gaze deviations from a fixed point or area of interest, between NCAA Division I athletes 24 to 48 hours post-concussion (PC) and healthy athletes

(NC) during a dynamic postural task, the Nintendo Wii Fit Soccer Heading game (WFS). METHODS: 6 PC (2 female, 4 male; age: 19.8 ± 0.8 years) and 6 position and gender matched NC (2 female, 4 male; age: 18.5 ± 0.8 years) wore a monocular eye tracking device (240Hz) while performing 2 trials of the 60-second WFS. During play, participants were instructed to not deviate their gaze from the center fixed area of interest. Ocular raw point of gaze coordinates were tracked during play for specific areas of interest (left, right, and center) to determine gaze deviations away from the center fixed area of interest. RESULTS: One-way ANOVAs revealed significantly greater anti-saccades ( $p=0.031$ ) in the PC group (15.2 ± 7.1) when compared to the NC group (5.4 ± 5.2), significantly greater anti-saccade duration ( $p=0.023$ ) in the PC group (11.2 ± 8.8 sec) when compared to the NC group (1.2 ± 1.3 sec), and significantly greater average anti-saccade duration ( $p<0.001$ ) in the PC group (0.671 ± 0.2 sec) when compared to the NC group (0.13 ± 0.04 sec). CONCLUSIONS: These results suggest a considerable oculomotor impairment, demonstrated by the amount and duration of anti-saccades within 24-48 hours post-concussion. These deficits may indicate that PC do not have sufficient gaze stability to adequately navigate through their environment immediately post-injury. These findings could be a novel objective marker for oculomotor impairment post-concussion. Further research needs to track these deficits longitudinally and compare oculomotor recovery with current neuropsychological and postural stability measures.

1922 Board #74 June 2, 3:30 PM - 5:00 PM

### Relationship Between Position, Cumulative Impacts And Cumulative Accelerations In Ncaa Division I Football Players

Katelyn E. Grimes<sup>1</sup>, Eric D. Shiflett<sup>1</sup>, Barry A. Munkasy<sup>1</sup>, Klarie M. Ake<sup>1</sup>, Nathan R. D'Amico<sup>1</sup>, Megan E. Mormile<sup>1</sup>, Douglas W. Powell<sup>2</sup>, Thomas A. Buckley<sup>3</sup>, Nicholas G. Murray<sup>1</sup>.  
<sup>1</sup>Georgia Southern University, Statesboro, GA. <sup>2</sup>Campbell University, Buies Creek, NC. <sup>3</sup>University of Delaware, Newark, DE.  
Email: kg03893@georgiasouthern.edu  
(No relationships reported)

PURPOSE: The purpose of this study was to investigate the potential differences of cumulative and mean linear acceleration magnitudes (LA) over the course of a single football season between positions (line vs. skill) and participation settings (games vs. practice). METHODS: Thirty-two NCAA Division I football players were fitted with Head Impact Telemetry (HIT) System sensors to measure acceleration forces associated with a head impact (player vs. player or contact with ground). LA were recorded for all head impacts above 10 g during the 2014-2015 competitive football season. Recorded LA were totaled per session (practice and game) and over the entire season to yield the cumulative LA of each session and for the entire season. For statistical analysis, players were dichotomized into two groups: line-position players (LINE), which consisted of offensive and defensive linemen; and skill-position players (SKILL), which consisted of running backs, wide receivers, linebackers, defensive backs, and quarterbacks. Cumulative and mean LA of both practices and games were then compared with paired sample t-tests. RESULTS: Position demographics were as followed: offensive SKILL: n=12, defensive SKILL: n=8, defensive LINE: 2, and offensive LINE: n= 10. Over the course of one season, players had significantly higher ( $p=0.001$ ) cumulative LA during practices (10,247.18g ± 8,730.69g) than games (5,271.17g ± 5,196.77g). Cumulative LA during practices were significantly higher ( $p<0.001$ ) in LINE (19,692.43 g ± 7,338.59 g) than SKILL (4,645.91 ± 2,872.57g). However, there was no significant difference ( $p=0.079$ ) between LINE cumulative LA (7,830.19g ± 6,453.36g) and SKILL cumulative LA (3,264.15g ± 3,538.72g) during games. Mean LA during practices were significantly higher ( $p=0.027$ ) in LINE (27.67g ± 2.54g) than SKILL (25.32g ± 2.85g). Conversely, mean LA during games were not significantly different ( $p=0.944$ ) between SKILL (29.04g ± 6.11g) and LINE (29.24g ± 4.11g). CONCLUSION: Over the course of a single football season, line-position players experienced significantly higher cumulative LA compared to skill-position players during both practices and games. This could be due to the more total contact hours that line-players experience than skill-position players.

1923 Board #75 June 2, 3:30 PM - 5:00 PM

### Utility of a Brief Open Source Test of Working Memory to Enhance Concussion Assessment and Management

Bethany Smith<sup>1</sup>, Matthew Wright<sup>2</sup>, Scott Sailor<sup>1</sup>, Catherine Jackson, FACS<sup>1</sup>, Cherie Smith<sup>3</sup>.  
<sup>1</sup>California State University, Fresno, Fresno, CA. <sup>2</sup>UCLA, Los Angeles, CA. <sup>3</sup>Reedley College, Reedley, CA.  
Email: renalvet2be@mail.fresnostate.edu  
(No relationships reported)

PURPOSE: Develop an assessment approach more sensitive to sports-related concussions by collecting an athlete's cognitive performances at baseline along with historical concussion data. METHODS: A community college and university took part in the study with a total of (n=255) participants. There were (n=59) participants who had a history of concussions

and (n=196) who did not have a history of concussions. At baseline, participants were administered the Standard Concussion Assessment Tool 3 (SCAT3; an open source screening measure of the common signs and symptoms of concussion), the Auditory Consonant Trigram (ACT; an open source test of working memory), and a questionnaire to assess concussion frequency, concussion related post-traumatic amnesia (PTA) and retrograde amnesia (RA), and basic demographics. The SCAT3 and ACT were re-administered and PTA and RA were assessed within 48 hours of the concussion.

**RESULTS:** Statistical analysis was conducted through t-tests, correlations, hierarchical linear regression, and simple linear regression. Male and female data was analyzed separately, as gender differences were found in variables of interest. The threshold for significance was  $p < 0.05$ . For males, ACT 18 second scores predicted PTA duration related to past-concussions, SCAT3 symptoms predicted past concussion frequency, PTA frequency, and RA frequency, and SCAT3 symptom severity predicted past concussion frequency. For females, ACT 18 second scores and SCAT3 symptom severity predicted concussion frequency and SCAT3 Balance Error Scoring System predicted PTA frequency and RA frequency.

**CONCLUSION:** Overall, ACT adds predictive power and can enhance concussion assessment. ACT scores were found to correlate with concussion history unlike any of the cognitive scores from SCAT3. The data suggest that a concussion assessment that better taps into cognitive areas affected by concussions and does not prematurely return athletes to play needs to be developed. Any new tool that is developed should take into account potential gender differences in concussive histories and outcomes.

1924 Board #76 June 2, 3:30 PM - 5:00 PM  
**Mixed Martial Arts Fighter Susceptibility to In-Fight Concussion: A Preliminary Analysis of Archival Data**  
 Kyle Rybarczyk, Bethany L. Shivers, Justin Dailey, Colby Matthews, Bethany Ranes. *US Army Aeromedical Research Laboratory, Fort Rucker, AL.*  
*(No relationships reported)*

**PURPOSE:** To investigate whether susceptibility to concussion with and without loss of consciousness (LOC) increases as multiple concussions are experienced among mixed martial arts (MMA) fighters. It was hypothesized that by using publicly available data, an analysis of in-fight concussion susceptibility would demonstrate that fighters became more susceptible to in-fight concussions after experiencing one or more in-fight concussions. Findings will provide information that may assist with development efforts to establish Warrior and athlete return-to-duty assessments, fitness-for-duty standards, and injury prevention countermeasures and requirements.

**METHODS:** For this IRB-exempt project, researchers from the U.S. Army Aeromedical Research Laboratory (USAARL) reviewed fight records from 20 years of archived online data. Fights resulting in LOC, (knock out [KO]), or suspected concussion (technical KO [TKO]) were flagged, and technicians later reviewed video footage to determine if the KO or TKO was the result of a significant blow to the head. An analysis of variance (ANOVA) for concussion susceptibility was completed, and a within-groups test was conducted to determine if fighters were significantly more or less susceptible to concussion after receiving their first suspected in-fight concussion.

**RESULTS:** Concussion susceptibility ratios were computed for 51 MMA fighters, all of whom had at least one suspected in-fight concussion and had fought in at least one MMA fight after receiving their first suspected concussion. Concussion susceptibility ratios were simply a ratio of the number of concussions to number of total fights, with separate ratios conducted for fights up to the first concussion (pre) and for fights after the first concussion (post). A one-way repeated-measures ANOVA on pre- and post-concussion susceptibility ratios demonstrated that fighters experienced a lower rate of concussions per fight following their first suspected in-fight concussion.

**CONCLUSIONS:** The lower number of concussions may be explained by increased awareness and caution taken by fighters to avoid additional concussions, which does not exclude or address the possibility of a physiologically based predisposition to future concussion following an initial concussion event.

1925 Board #77 June 2, 3:30 PM - 5:00 PM  
**Psycho-affective And Cognitive Outcomes In Slow To Recover Concussed Athletes**  
 Christophe Alarie, Robert D. Moore, Marc Letourneau, Frederique T. Lefebvre, Sophie Martin, Jeremie L. Prevost, Dave Ellemberg. *University of Montreal, Montreal, QC, Canada.*  
 Email: christophe.alarie@gmail.com  
*(No relationships reported)*

**PURPOSE:** Although the majority of concussed athletes are believed to recover within 7 to 10 days following the injury, up to 20% of injured athletes will experience persisting symptoms (McCrory, 2013). However, little is known about the psycho-affective and cognitive outcomes of slow to recover athletes (SRA) compared to asymptomatic concussed athletes (ACA). Compare the psycho-affective and cognitive health in SRA, ACA and athletes without a history of concussion (NHC). We hypothesized that SRA would significantly differ from ACA and NHC for both emotional symptoms and cognitive performance.

**METHODS:** Twenty SRA were matched on age, gender, time since injury ( $m = 49.3 \pm 40.0$  days) and history of concussion ( $m = 2.2 \pm 1.3$  with twenty ACA) and on age and gender with NHC. All participants completed the Beck's Depression Inventory-II (BDI-II), which measures depression, and the Profile of Mood State (POMS), which measures aspects of mood disturbance (Tension-Anxiety, Depression-Dejection, Anger-Hostility, Fatigue-Inertia, Vigor-Activity and Confusion-Bewilderment) and total mood disturbance. Participants also completed a 2-back task to evaluate working memory.

**RESULTS:** SRA exhibited greater depressive symptoms on the BDI-II relative to ACA and NHC ( $p = < 0.05$ ). SRA also differed from ACA and NHC in terms of Depression-Dejection, Anger-Hostility, Vigor-Activity, Confusion-Bewilderment, and total mood disturbance on the POMS ( $p = < 0.05$ ). Analysis of the 2-back revealed that SRA exhibited slower RT and lower ACC relative to NHC ( $p = < 0.05$ ), but not ACA. ACA did not differ from NHC on any measure.

**CONCLUSIONS:** These results suggest that athletes with persistent symptoms exhibit worse psycho-affective status relative to asymptomatic athletes with and history of concussion and poorer cognitive performance relative to control athletes. Thus, psycho-affective status and cognitive performance might be used to track recovery and help clinical management of athletes with persistent symptoms.

1926 Board #78 June 2, 3:30 PM - 5:00 PM  
**Long-term Effects Of Adolescent Concussion History On Cognition**  
 Douglas N. Martini<sup>1</sup>, James T. Eckner<sup>2</sup>, Sean K. Meehan<sup>2</sup>, Steven P. Broglio, FACSM<sup>2</sup>. <sup>1</sup>*Oregon Health and Science University, Portland, OR.* <sup>2</sup>*University of Michigan, Ann Arbor, MI.* (Sponsor: Steven Broglio, FACSM)  
 Email: martidou@ohsu.edu  
*(No relationships reported)*

Following concussion, persistent changes in cognition in an elite athlete population is thought to occur. However, it is unclear if concussion history affects cognitive performance in a non-elite athlete population. **PURPOSE:** To assess the long-term effects of concussion history on cognitive performance in a non-elite athlete population. **METHODS:** Participants (N=84) were divided into three age groups (18-29 years, n=45; 40-49 years, n=19; 60-69 years, n=20) and two concussion history groups (control, n=54; concussion history, n=30) based on self-report. Following consent, each participant was instructed to complete a computerized clinical battery assessing multiple cognitive domains. The cognitive battery consists of four test modules: detection (simple reaction time), identification (choice reaction time), one card learning (working memory), and one back speed/accuracy (attention and working memory). The cognitive battery provides five output scores: processing speed, attention, learning, working memory speed, and working memory accuracy. Two-factor (Age x Group) multivariate ANOVA, *post hoc* comparisons when indicated, and Cohen's d effect sizes were calculated to compare within age and between groups. **RESULTS:** There were no significant ( $p > 0.05$ ) main effects for age group or concussion history group, nor an age by concussion history interaction on the five outcome measures. **CONCLUSION:** These data do not support a relationship between prior concussion history and long-term cognitive declines in non-elite athletes. These results may differ from previous findings in an elite-athlete population due to differences in cumulative sub-concussive head trauma exposure between the two populations. Future research should employ a more sensitive cognitive test battery capable of detecting more subtle cognitive impairment.

1927 Board #79 June 2, 3:30 PM - 5:00 PM  
**Establishing Normative Concussion Baseline Values for Groups within the Dancer Population**  
 Lauren McIntyre. *Harkness Center for Dance Injuries, New York, NY.*  
 Email: lauren.mcintyre@nyumc.org  
*(No relationships reported)*

The risk of concussion in dance has not been formally established, however; a self-report survey of dancers in 2014 revealed that 23.5% of participants had experienced one at some point in their career. A baseline assessment may be helpful in identifying abnormal findings after concussive injury, but many dancers do not have access to baseline testing. Normative values may be helpful in recognizing concussion but can be influenced by numerous factors so it is important to establish normative values for specific, target groups. **PURPOSE:** Establish normative values for various subgroups within the dancer population.

**METHODS:** 236 dancers (65 male; 171 female; 153 university; 83 professional) were recruited in pre-season screenings between 2013-2015. The Sport Concussion Assessment Tool 3 (SCAT3) and King-Devick Test (KD) were utilized. IRB approval was acquired before the start of this study. Mann Whitney U, t-test, Pearson & Spearman's Rho correlations were used to determine significance.

**RESULTS:** Mean symptom score was 16.48 ( $\pm 12.798$ ); Mean cognitive score was 27.49 ( $\pm 1.780$ ); mean KD was 41.565 seconds ( $\pm 8.19$  sec); mean modified BESS was

3.21 errors ( $\pm 3.123$ ). Females had superior KD scores ( $p=.026$ ). Hours of sleep before testing was negatively correlated to symptoms ( $p=.000$ ); increased weekly alcohol consumption showed a low positive relationship with symptom scores ( $p=.049$ ). History of depression was related to increased symptom scores ( $p=.029$ ) Females had less errors than males on modified BESS ( $p=.013$ ). There was no significant findings in those with history of concussion (4.2%).

**CONCLUSIONS:** Similar to athletes, it cannot be assumed that a dancer's baseline symptom score is zero. Dancers may have higher baseline symptom scores than athletes. Normative concussion baseline values are different between sexes and ages and influenced by lifestyle habits and mental health. Normative values should always be used with caution.

1928 Board #80 June 2, 3:30 PM - 5:00 PM  
**The District of Columbia Concussion Care & Training Project: A National Model for Youth Concussion Education**

Andrew E. Lincoln<sup>1</sup>, Gerard A. Gioia<sup>2</sup>, Shireen Atabaki<sup>3</sup>, Michael Yochelson<sup>4</sup>, Elizabeth Delasobera<sup>4</sup>, Catherine McGill<sup>2</sup>, Maegan Sady<sup>2</sup>, Jessica Clark<sup>4</sup>, Justin Cooper<sup>1</sup>, Ethan Urbansky<sup>1</sup>.  
<sup>1</sup>MedStar Sports Medicine, Baltimore, MD. <sup>2</sup>Children's National Medical System, Rockville, MD. <sup>3</sup>Children's National Medical System, Washington, DC. <sup>4</sup>MedStar Sports Medicine, Washington, DC.  
 Email: andrew.e.lincoln@medstar.net  
 (No relationships reported)

**PURPOSE:** The District of Columbia's "Concussion Protection Act of 2011" legislation requires training of a broad set of athletic, school, medical and family personnel in public and private schools and non-scholastic youth sports programs to ensure increased awareness of concussion and training to properly recognize, treat, and recover from a concussion. A partnership between the Children's National Medical Center (CNMC), MedStar Sports Medicine (MSM) and a broad set of stakeholders was established in March 2015 to develop an infrastructure and pathways for appropriate training and documentation of compliance.

**METHODS:** The Concussion Care & Training Program (CCTP) included 4 priority areas: Creating Awareness, Concussion Training, Policy & Protocol Development, and Evaluation and Performance Measurement. The CCTP team implemented a combined clinical/medical and community/public health approach to provide comprehensive, up-to-date training and documentation. Partnerships were established with the Office of the Superintendent of Schools and Education, Department of Parks & Recreation with support from the Brain Injury Association of DC and the Children's School Services to establish the necessary training needs and maximal accessibility of target audiences.

**RESULTS:** The evaluation and performance measurement plan provides stakeholders with key tracking data of goal attainment, and serves as a mechanism for continuous program improvement. Specific products developed for use in the CCTP are: the "Play Smart, Your Brain Matters" resource website, "Train the Trainer" manual to develop "Organizational Concussion Coaches", an informational video on concussion entitled "Play Smart, Your Brain Matters," sample concussion education/ training policy and procedures, training activity roadmap, and an electronic web-based concussion education and training registration, tracking and reporting system (InjureFree) that also serves as a concussion resource site with videos, handouts, and other assistive tools.

**CONCLUSIONS:** The program is designed to reach all ages and levels of youth athletes across diverse communities leveraging the experience and resources of the CCTP team to provide concussion education/ training, media outreach and public awareness.

Sponsored by the DC Department of Health.

1929 Board #81 June 2, 3:30 PM - 5:00 PM  
**Determining Mean Heart Rate At Symptomatic Threshold In Post-Concussion Syndrome**

Marc Letourneau, Christophe Alarie, Davis Moore, Dave Ellemberg. *University of Montreal, Montreal, QC, Canada.*  
 Email: marc.letourneau@umontreal.ca  
 (No relationships reported)

Aerobic exercise protocols are promising for rehabilitating individuals with post-concussion syndrome. However, these protocols usually include triggering/exacerbating symptoms to determine the starting intensity and to track progress and adjust exercise intensity. Unfortunately, triggering/exacerbating symptoms can impede recovery and deter adherence. **PURPOSE:** We sought to provide a less traumatic therapeutic approach by establishing the threshold at which symptoms are triggered/exacerbated. This will enable to avoid exercise-induced symptoms and allow personalising the aerobic exercise protocol by providing a sub-threshold starting intensity. **METHOD:** Forty-two concussed individuals (24 yrs.,  $\pm 9.8$ ) reporting persisting symptoms at rest ( $M=149.1 \pm 233.7$ ;  $F=63.7 \pm 128.2$  days) completed a graded exercise test (GXT) on a stationary ergocycle until symptoms were triggered/exacerbated. **RESULTS:** Mean resting heart rate was 77.8 bpm ( $\pm 10.1$ ) for men and

71.1 bpm ( $\pm 10.8$ ) for women. Symptoms were triggered/exacerbated at 62.9 % ( $\pm 8.2$ ) of maximal theoretical heart rate (MTHR) for men and 58.8 % ( $\pm 8.1$ ) of MTHR for women. For both men and women, there is a significant correlation ( $M=0.451$ ;  $F=0.762$ ) between resting heart and symptom threshold (% of MTHR). Further, for men, number of days since injury is significantly correlated with the symptom score (0.712) and resting heart rate (0.467). There was no other significant correlation for either group between symptomatic threshold and age at injury, number of symptoms at rest, or number of injuries ( $p > 0.05$ ). **CONCLUSION:** These results could help define a more adapted starting intensity for symptomatic individuals. They could also contribute to the development of an algorithm for a sub-maximal progressive aerobic exercise therapy, which would take into account gender differences.

1930 Board #82 June 2, 3:30 PM - 5:00 PM  
**An Assessment Of Population-based Norms In Child And Adolescent On The King-devick**

Eric W. Slattery, Kelsey Logan, Paul Gubanich. *Cincinnati Children's Hospital, Cincinnati, OH.*  
 Email: eric.slattery@cchmc.org  
 (No relationships reported)

The King-Devick test (KD) has been utilized to assess visual motor deficits associated with sports related concussions. The utility of the assessment has been investigated in adults, but clinical usefulness has not been established in children and adolescents. As most concussion patients present to clinical settings without a baseline score, comparative normative data may be useful to help identify visual motor deficits associated with sports related concussion and support clinical management of return to sport.

**PURPOSE:** To determine age specific normative values and potential learning effects associated with repeat administration of the KD test.

**METHODS:** Patients, ages 11-18, who presented to two Sports Medicine Clinics for evaluation and treatment of non-concussive injuries and whose presenting complaint was not believed to confound test administration (LE injury, recovered injury, etc.) were recruited for baseline testing. Testing involved the reading of numeric sequence of up to three cards while the time to completion and number of errors were recorded. Two trials were conducted for each participant, with about 15-30 seconds between trials. Paired t-tests were performed to compare Subject's Trial 1 (KD<sup>1</sup>) to their Trial 2 (KD<sup>2</sup>) to examine for the potential of an immediate learning effect. Results were then aggregated into 4 age groups (11-12, 13-14, 15-16, and 17-18).

**RESULTS:** 312 patients (114 male, 198 female) were enrolled in the study. There was a significant effect of time (KD<sup>1</sup> vs KD<sup>2</sup>;  $p < 0.001$ ,  $d = 1.575s$ ) for the full cohort. In addition, each subgroup, except 11-12 ( $p < 0.211$ ,  $d = 0.665s$ ), showed a significant learning effect between tests: 13-14 ( $p < 0.000$ ,  $d = 1.888s$ ), 15-16 ( $p < 0.000$ ,  $d = 1.892s$ ), and 17-18 ( $p < 0.000$ ,  $d = 2.226s$ ). Regression analysis indicated a strong effect of age on the overall KD time ( $R^2 = .91$ ).

**CONCLUSION:** Significant improvements of KD baseline test were noted with age and with repeat administration indicating the need for age specific normative values. Future studies are needed to determine the number of KD baseline tests necessary to negate the immediate learning effect.

1931 Board #83 June 2, 3:30 PM - 5:00 PM  
**Predictors of Recommended Academic Accommodations Among Concussed Student-Athletes Presenting to the Primary Care Setting**

Mackenzie M. Herzog<sup>1</sup>, Johna K. Register-Mihalik<sup>1</sup>, Valerie J. De Maio<sup>1</sup>, Janna Fonseca<sup>2</sup>, O. Josh Bloom<sup>2</sup>. <sup>1</sup>University of North Carolina Chapel Hill, Chapel Hill, NC. <sup>2</sup>Carolina Family Practice & Sports Medicine, Cary, NC. (Sponsor: Kevin Guskiewicz, FACS)M  
 Email: mherzog@email.unc.edu  
 (No relationships reported)

**PURPOSE:** To describe academic accommodations primary care sports medicine physicians recommend to adolescents presenting with sports-related concussion and to identify clinical predictors of accommodations.

**METHODS:** This analysis was nested in a prospective cohort study of concussed student-athletes presenting to a primary care sports medicine clinic for initial evaluation. Enrolled patients (8-18 years old) were injured during organized or recreational sport, presented within 3 days of injury, and consented to participate. A standardized form including academic accommodations, return to sport guidelines, therapy prescriptions, and referrals was completed by the provider at the initial visit. Patients with no recommendation form were excluded. Recommendations were grouped into 2 academic accommodation categories: 1) cognitive (e.g. limited or no testing, extra time for schoolwork), and 2) visual-vestibular (e.g. auditory participation only, limit visual stimuli). Symptom scores, average visual near-point convergence, and ImPACT composite percentiles (visual memory, verbal memory, reaction time and processing speed) were included in a multivariable backwards selection regression model to predict accommodations.

**RESULTS:** 110 patients met the inclusion criteria (mean age=14.3±2.1 years; 57 males, 52%). Most patients received instruction for academic accommodations (N=95; 86%). The most common recommendations were: "Take rest breaks during the day as needed" (N=75, 68%), "Allow extra time to complete tasks" (N=69, 63%), and "Patient is to limit visual stimulants and screen time" (N=69, 63%). 84 patients (76%) received cognitive accommodations, 80 (73%) visual-vestibular, and 69 (63%) both. Patients with lower visual memory percentile were more likely to receive cognitive accommodations ( $\beta=-0.0175$ ;  $p=0.03$ ). Patients with higher symptom score ( $\beta=0.0372$ ;  $p=0.01$ ) and lower processing speed percentile ( $\beta=0.0223$ ;  $p=0.01$ ) were more likely to receive visual-vestibular accommodations.

**CONCLUSIONS:** Most student-athletes received recommendations for accommodations. Symptom and neurocognitive measures may aid clinicians in decision-making about recommended academic accommodations. This study was funded by the National Operating Committee on Standards for Athletic Equipment.

## D-29 Free Communication/Poster - Diabetes - Exercise

Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
Room: Exhibit Hall A/B

1932 Board #84 June 2, 2:00 PM - 3:30 PM  
**The Effects of Evening Exercise Mode on Nocturnal Hypoglycemia During an Adult Diabetes Training Camp**  
Robert Powell<sup>1</sup>, Matthew Corcoran<sup>2</sup>. <sup>1</sup>Marshall University, Huntington, WV. <sup>2</sup>Diabetes Training Camp, Lancaster, PA.  
Email: powellro@marshall.edu  
(No relationships reported)

Exercise is a cornerstone for diabetes management. Still, glycemic control has proven difficulty in exercisers with type 1 diabetes. While light to moderate aerobic and relaxation style exercise, like Yoga, frequently show reductions in glucose levels, anaerobic exercise can increase glucose due to its adrenergic effects. These responses may ensue both during and after the bout making treatment difficult and increasing risk of hypoglycemia, often occurring overnight. **PURPOSE:** To examine the effects of different exercise modes (Hatha Yoga versus Resistance Training) on the incidence of nocturnal hypoglycemia in adults with diabetes participating in a week long, high volume exercise training camp. **METHODS:** Adults with diabetes attending the 2015 Diabetes Training Camp<sup>TM</sup> were recruited to volunteer in this study. Participants were randomized to 1 of 3 groups: 1) Hatha Yoga (Y); Resistance Training Circuit (RT); or Non-exercise control (C). Each intervention group performed 45 minutes of evening exercise for 3 consecutive days. Data were collected through either electronic uploading using continuous glucose monitoring or self-reported monitoring. **RESULTS:** Twelve participants provided complete data to be analyzed (6 RT, 5 Y and 1 C). Demographics involved a mean age of 49.2±13 years; 83% female; 92% Caucasian; BMI=26.5±3.8 kg/m<sup>2</sup>; estimated VO<sub>2</sub>peak=36±7.4 ml/kg/min. Also, 75% of the adults were current exercisers with a mean of 4±2 days of hypoglycemic events per week. No significant differences were found between the groups. Overall, 41% of the study participants experienced at least one nocturnal hypoglycemic event (1 of 6 in RT; 3 of 5 Y; and 1 of 1 C) during the 3 day study. Those who participated in either the Y or C group were more likely to experience a nocturnal hypoglycemic event compared to the Resistance Training group ( $p=.068$ ). Additionally, 40% of the Y group experienced nocturnal hypoglycemia on at least 2 of the 3 nights compared to only 16% in the RT group ( $p=.80$ ). **CONCLUSION:** Performing RT in the evening, following a high volume of various exercise activities throughout the day, may reduce the incidence of nocturnal hypoglycemia. Future studies should examine additional exercise strategies, with larger samples, to reduce the barriers of hypoglycemia in adults exercising with diabetes.

1933 Board #85 June 2, 2:00 PM - 3:30 PM  
**The Effect Of A Single Exercise Session On Markers Of Autophagy In Insulin-resistant Individuals**  
James J. McCormick, Trisha A. McLain, Cassandra G. Ulrich, Karol Dokladny, Christine M. Mermier. *University of New Mexico, Albuquerque, NM.* (Sponsor: Ann Gibson, Ph.D., FACSM)  
Email: aeneid@unm.edu  
(No relationships reported)

Autophagy is an important cellular process that is responsible for the degradation of long-lived proteins and for the elimination of redundant or damaged cellular structures. Recently, a malfunction of the autophagic pathway has been implicated with impaired glucose metabolism. **PURPOSE:** We investigated a single bout of moderate intensity

exercise to see whether it would induce autophagy in those with impaired fasting glucose compared to a control group. Additionally, we examined the cellular response of rapamycin-induced autophagy between groups.

**METHODS:** Two groups matched for age and sex served as subjects and consisted of five insulin-resistant (IR) (44.4±12.9 yr) and five control (43.6±11.4 yr) adults. Subjects exercised at 50% of VO<sub>2</sub>max for one hour. Peripheral blood mononuclear cells (PBMC) were harvested pre-, immediately after and four-hours post-exercise. Additionally, PBMCs were isolated from whole blood and cells were treated with either rapamycin (RAPA) (0.5 nM) or no treatment (NT) following a 24-hour incubation period. Western blot analysis was used to detect expression of LC3-II normalized to  $\beta$ -actin. All values are expressed as relative quantity (RQ) compared to pre-exercise or RAPA treatment. Statistical significance between mean values were assessed with independent samples t-tests.

**RESULTS:** We found IR individuals to have suppressed autophagy in response to acute exercise stress immediately- (0.90±0.33RQ) and 4 hours-post (1.09±0.10RQ) exercise when compared to age-matched controls (0.94±0.22, 1.18±0.17RQ, respectively;  $p < 0.05$ ). Additionally, a blunted autophagic response was observed in insulin-resistant individuals (1.27±0.29RQ) that was not demonstrated in control subjects (2.57±0.55,  $p < 0.05$ ).

**CONCLUSIONS:** Our findings suggest a blunted autophagic response to exercise and nutrient deprivation (as demonstrated by RAPA treatment) in those with insulin-resistance. This may be attributed to chronically elevated basal autophagy in IR individuals that may lead to a depletion of essential autophagic components and failure to upregulate the autophagy pathway when exposed to acute stress.

1934 Board #86 June 2, 2:00 PM - 3:30 PM  
**Preliminary Results of a Community-Based Education and Group Exercise Program for Type 2 Diabetics**  
Jason R. Jagers<sup>1</sup>, Amelia Dodd<sup>2</sup>, Katy Garth<sup>2</sup>, Lauren Berry<sup>2</sup>, Dina Byers<sup>2</sup>, Michael Kalinski, FACSM<sup>2</sup>, Dana Manley<sup>2</sup>.  
<sup>1</sup>University of Louisville, Louisville, KY. <sup>2</sup>Murray State University, Murray, KY. (Sponsor: Michael Kalinski, FACSM)  
Email: jason.jagers@louisville.edu  
(No relationships reported)

The purpose of this investigation was to test the feasibility of a community-based education and physical activity (PA) program aimed to improve health and well-being for people living with type 2 diabetes mellitus (T2DM). **Methods:** 26 people living with T2DM volunteered to participate in this 8 week community-based clinical trial. Participants in the intervention reported to the local hospital's health and wellness center twice a week for classes lasting approximately one hour. Thirty minutes was devoted to group activity classes, followed by 30 minutes of an educational component. Blood pressure and glucose via glucometer was self-checked before and after group exercise. Clinical assessments were conducted at pre and post intervention consisting of: blood pressure, waist circumference, BMI, PA levels via accelerometer, functional ability, perceived stress, depression, and fasted blood lipid panel. A paired samples t-test was used to test for significance. **Results:** Perceived stress significantly decreased from 16.25 ± 3.20 to 11.38 ± 4.98 ( $p = 0.05$ ) and there was a significant increase in the 2-minute step test ( $p = 0.04$ ). There were no significant changes in blood lipids or body composition. **Conclusion:** These data indicate that an 8 week community-based program for T2DM patients could improve stress and functional ability. Other variables yielded null results possibly due to the lack of changes in PA behavior. If similar interventions successfully increased PA it is possible more health benefits could be obtained to help people living with T2DM better control their glucose and hemoglobin A1C levels.

1935 Board #87  
**Abstract Withdrawn**

1936 Board #88 June 2, 2:00 PM - 3:30 PM  
**Relationships Between Vo<sub>2</sub>peak, Cerebral Hemodynamics During Exercise And Cognitive Function In Type 2 Diabetes Patients.**  
Maxime Boidin<sup>1</sup>, Paula A.B. Ribeiro<sup>1</sup>, Meghann Monnet<sup>1</sup>, Olivier Dupuy<sup>2</sup>, Gabriel Lapierre<sup>1</sup>, Martin Juneau<sup>1</sup>, Anil Nigam<sup>1</sup>, Mathieu Gayda<sup>1</sup>. <sup>1</sup>Montreal Heart Institute, Montréal, QC, Canada. <sup>2</sup>University of Poitiers, Poitiers, France.  
Email: maxime.boidin07@gmail.com  
(No relationships reported)

Purpose: As compared to aged-matched healthy controls (AMHC), type 2 diabetes patients (T2DM) have an impaired aerobic fitness, cardiac hemodynamics, cerebral oxygenation/perfusion (COP) during exercise and an impaired cognitive function. Relationship between fitness, cardiac/cerebral hemodynamics and cognition are poorly studied in T2DM patients. The aim of this work was to study relationship

among VO<sub>2</sub>peak, maximal cardiac index (CI<sub>max</sub>), COP and cognitive function in patients with T2DM. Method: Nineteen T2DM patients (62±7 years) and 23 AMH subjects (62±11 years) were recruited in this study. All subjects underwent a medical examination, blood sample analysis and body composition measurement. Gas exchange (Oxycon Pro; Jaegger, Germany), CI<sub>max</sub> (impedance cardiography: PhysioFlow, France) and left frontal COP (NIRS: Oxycon Mk III, Netherlands) were measured during and after a maximal cardiopulmonary ergocycle test (CPET). For COP, oxyhemoglobin (ΔO<sub>2</sub>Hb), total hemoglobin (ΔtHb) and deoxyhemoglobin (ΔHHb) were assessed. Cognitive functions (CF) were evaluated at rest by a complete neuropsychological test battery (13 different items) assessing perceptual abilities and processing speed, short/long-term/working memory (LTVM) and executive functions (EF). ANOVA was used to test group's differences and Pearson correlation to evaluate the relationship between VO<sub>2</sub>peak, CI<sub>max</sub>, COP and CF (statistical significance for p<0.05). Results: VO<sub>2</sub>peak, CI<sub>max</sub> and EF (Stroop 3 and 4) and LTVM were significantly lower (p<0.05) in T2DM vs. AMH. Left frontal COP (HHb, O<sub>2</sub>Hb and tHb) was not different between groups. VO<sub>2</sub>peak was positively correlated with tHb (R=0.35, p<0.05). Composite scores for EF was negatively correlated with O<sub>2</sub>Hb (R=-0.40, p<0.05) and tHb (R=-0.37, p<0.05). VO<sub>2</sub>peak was positively correlated with substitution (R=0.369, p<0.05), negatively with trail B (R=-0.337, p<0.05). Conclusion: Patients with T2DM had a reduced aerobic fitness, cardiac output, executive functions and LTVM. Moreover, COP and aerobic fitness were related with executive functions and processing speed. It would be interesting to know the effects of training on VO<sub>2</sub>peak, cardiac index, COP and cognitive functions in T2DM patients. Supported by EPIC and Montreal Heart Institute foundations and CNPq.

1937 Board #89 June 2, 2:00 PM - 3:30 PM

### Effect Of Motor Nerve Impairment On Muscle Endurance In Type 2 Diabetes Patients

Giorgio Orlando<sup>1</sup>, Stefano Balducci<sup>2</sup>, Ilenia Bazzucchi<sup>1</sup>, Giuseppe Pugliese<sup>2</sup>, Massimo Sacchetti<sup>1</sup>. <sup>1</sup>University of Rome "Foro Italico", Rome, Italy, Rome, Italy. <sup>2</sup>"La Sapienza" University, and Diabetes Unit, Sant'Andrea Hospital, Rome, Italy, Rome, Italy.  
Email: giorgio.orlando@uniroma4.it  
(No relationships reported)

Type 2 diabetes (T2D) is associated with a high risk of developing physical disability, which is linked to neuromuscular dysfunction. Although the deficit in muscle strength with T2D has been well characterized, the information on the impairment in muscle fatigability is scarce and conflicting.

PURPOSE: To investigate the impact of T2D and motor nerve impairment on muscle endurance in both upper and lower body muscles. METHOD: From a cohort of 120 sedentary T2D males, two groups of patients (n = 15 each) belonging to the first (lower) and fourth (higher) quartile of the peroneal motor nerve conduction velocity (T1 and T4, respectively) were selected and compared with a matched control group (C). The distal latencies, amplitudes, and conduction velocities of the peroneal motor and sural sensory nerves were obtained by electromyography (EMG). Muscle function was evaluated measuring the maximal voluntary isometric contraction (MVIF) and the endurance time at 50% of the MVIF in both upper and lower body muscles. RESULTS: T2D and C groups were similar with respect to age, BMI and body composition. C group had 24% and 30% higher upper and lower body muscle strength than T1 (P<0.05, respectively). T1 had a higher reduction compared with T4 in both upper (24 vs 5%, P<0.05) and lower body (30 vs 18%, P<0.05) muscle strength. T4 group was 18% weaker in lower body muscle strength (P<0.05) compared with C group, whereas no differences were reported in upper body muscle strength. Muscle endurance was significantly lower in T1 than T4 and C group in both upper (26±6.8 vs 33±7 and 40±8.8 s, P<0.05) and lower body muscles (31±7 vs 40.6±8.3 and 62±16 s, P<0.05, respectively). T4 had lower muscle endurance in both upper (33±7 vs 40±8.8 s) and lower body muscles (40.6±8.3 vs 62±16 s) compared to C group (P<0.05, respectively). CONCLUSION: T2D patients are characterized by an increase in muscle fatigability in both upper and lower body muscles, which is further aggravated by the presence of diabetic peripheral neuropathy. However, our data suggest that factors other than motor nerve impairment play a major role in the pathogenesis of muscle fatigability in T2D, and that muscle endurance may be a parameter more sensitive than strength to detect diabetic neuromuscular dysfunction.

1938 Board #90 June 2, 2:00 PM - 3:30 PM

### Home-based And Hospital-based Exercise Interventions Improve Hemoglobin A1c In Diabetic And Pre-diabetic U.S. Veterans

Shakeelah Sutton, Puneet Narayan, Irué Namata-Elangwe, Monica Aiken, Raya Kheirbek, Lauren Korshak, Sheriff Helen, Peter Kokkinos, FACSM. *Veterans Affairs Medical Center, Washington, DC.* (Sponsor: Peter Kokkinos, FACSM)  
Email: shakeelah.sutton2@va.gov  
(No relationships reported)

**PURPOSE:** To assess the effects of a 12-week hospital-based exercise program (supervised) and home-based exercise counseling intervention in diabetic Veterans. **METHODS:** Veterans were enrolled in a 12-week hospital-based exercise program or in a home-based exercise program. The hospital-based exercise component consisted of twice weekly exercise sessions of aerobic and resistance exercise. Exercise intensity was maintained at 50% -80% of heart rate reserve. Participants were instructed to supplement their exercise with daily walks aiming to accumulate at least 150 minutes of exercise/week. Participants enrolled in the home-based component met monthly with the clinical exercise physiologist. They received intensive exercise counseling and were instructed to accumulate 150 minutes/ week of moderate intensity exercise. Patients in both interventions received individualized dietary counseling provided by a registered dietician. Patients were stratified according to baseline hemoglobin A1c (HbA1c): Group 1: HbA1c<7.0%; Group 2: HbA1c 7.0-8.9 % and Group 3: HbA1c ≥10.0%. Peak exercise capacity, blood chemistries, and blood pressure were recorded at baseline and after program completion.

**RESULTS:** Baseline values were similar for all groups. HbA1c improved significantly in both hospital-based and home-based exercise programs, but did not change in non-participants. The degree of improvement was proportional to the baseline values (Table). Similar changes were noted in blood glucose level. **CONCLUSION:** Home exercise counseling and hospital-based exercise were equally effective in improving health outcomes for veterans with Type 2 DM.

**Table**  
HbA1c in Exercise and No-Exercise Groups

| Group 1        | Group 2  |          | Group 3  |          | Pre      | Post     |
|----------------|----------|----------|----------|----------|----------|----------|
|                | Pre      | Post     | Pre      | Post     |          |          |
| Hospital-Based | 6.4±0.42 | 6.5±0.84 | 8.0±0.57 | 7.6±1.0* | 10.6±1.4 | 8.8±1.4* |
| Home-Based     | 6.6±0.41 | 6.5±0.49 | 7.8±0.54 | 7.7±1.0  | 10.7±1.1 | 8.9±2.0* |
| Control        | 6.4±0.54 | 6.4±0.88 | 8.2±5.55 | 8.3±1.3  | 10.6±1.1 | 10.3±1.7 |

1939 Board #91 June 2, 2:00 PM - 3:30 PM

### Examining Predictors of Change in A1c with Exercise in Type 2 Diabetes Mellitus

Devon A. Dobrosielski<sup>1</sup>, Bethany Barone Gibbs<sup>2</sup>, Kerry J. Stewart, FACSM<sup>3</sup>. <sup>1</sup>Towson University, Towson, MD. <sup>2</sup>University of Pittsburgh, Pittsburgh, PA. <sup>3</sup>Johns Hopkins Medicine, Baltimore, MD. (Sponsor: Kerry J Stewart, FACSM)  
Email: ddobrosielski@towson.edu  
(No relationships reported)

**PURPOSE:** Exercise is recommended for improving glycemic control, fitness, and body composition for patients with type 2 diabetes mellitus (T2DM). Yet the relationships among changes in these benefits can vary among individuals and are not always parallel. We examined whether changes in A1c levels following exercise training were associated with changes in fitness or fatness. **METHODS:** Sedentary adults (n=140) with T2DM and mild hypertension were randomized to supervised exercise training or a non-exercising control group for 3 times per week for 6 months. Exercise was based on ACSM guidelines and included moderate-intensity aerobic exercise for 45 minutes and 2 sets of 7 resistance exercises at 50% of 1 repetition maximum (1RM). At baseline and 6 months, A1c was assessed from a fasting blood draw; muscle strength was the total of 1RM from 7 resistance exercises; aerobic fitness was VO<sub>2</sub>peak during treadmill testing; and % body fat was measured by dual energy x-ray absorptiometry. Data analysis consisted of ANOVA on change scores in the main outcome variables and regression analysis to determine predictors of change in A1c. **RESULTS:** Among study completers (exercisers, n=51, control, n=63), the mean age was 55±6 years; 59% were men; and 59% were white. At baseline, mean BMI was 33.1 ± 4.5 kg/m<sup>2</sup> and mean A1c was 6.6 ± 1.4%. There were no group differences in these or any other study outcome at baseline. At 6 months, exercisers versus controls improved A1c (-0.19 ± 1.2 % vs. 0.30 ± 1.4 %, p<0.025), reduced % body fat (-1.5 ± 1.9% vs. 0.4 ± 0.2%, p<0.001), and improved total strength (122 ± 133 lbs vs. -12 ± 107 lbs, p=0.001) and VO<sub>2</sub>peak (3.2 ± 2.9 ml/kg/min vs. 0.5 ± 3 ml/kg/min, p<0.001). After adjustment for A1c at baseline, being in the exercise group but not changes in fitness or fatness predicted A1c at 6 months, such that the exercisers experienced an adjusted -0.24% improvement in A1c versus controls (p<0.01). **CONCLUSION:**

Our findings support recommendations that exercise is an effective therapy for improving glycemic control and fitness and reducing fatness in T2DM. Nonetheless the improvement in glycemic control was independent of changes in total strength,  $VO_{2peak}$  and body fat. These findings highlight that not all health benefits of exercise training should be considered contingent on changes in fitness and fatness.

1940 Board #92 June 2, 2:00 PM - 3:30 PM  
**Blood Glucose Response to an Acute Bout of Aerobic and Resistance Exercise in T2DM Patients**

Jessica D. Black, Samuel Headley, FACSM, Tracey Matthews, John Smith, Richard Wood. *Springfield College, Springfield, MA.* (Sponsor: Samuel Headley, FACSM)  
 Email: jfoster20.jf@gmail.com  
 (No relationships reported)

Achieving and maintaining appropriate blood glucose levels is vital to managing diabetes and has traditionally been achieved through the use of medication, dietary intervention, and exercise. ACSM recommends both aerobic (AE) and resistance exercise (RE) for the diabetic population, yet research to identify which mode of exercise elicits greater acute blood glucose (BG) response is limited when matching energy expenditure, intensity and time. **PURPOSE:** To determine whether a difference exists between an acute bout of AE and RE on the BG response in type II diabetic patients (T2DM). **METHODS:** Sedentary males and females over 30 years of age, diagnosed with T2DM for 1-10 years (N=10) participated in an acute bout of moderate intensity RE, AE and control session. RE protocol consisted of a circuit training regimen, 6 exercises, on plate loaded machines. Subjects performed 2 sets of 12 reps at 60% of estimated 1-RM. The AE protocol consisted of walking on a treadmill at 40-60% HRR. To match energy expenditure, a portable metabolic mask was worn to measure  $VO_2$  and Kcals during exercise and for 30 mins after. BG was checked with a glucometer pre and post exercise. Multiple measures were in place to match pre BG concentrations, energy expenditure and time throughout exercise conditions. During the control session subjects self-checked and reported BG over a specific time period, while going about normal ADLs at home. **RESULTS:** Paired t-tests were conducted to determine if differences existed between testing conditions with respect to  $VO_2$ , R-value, Kcals, MET levels, time, and RPE. Analyses revealed significant ( $p < .05$ ) mean differences across the conditions for all the metabolic variables, except amount of time exercising. Average  $VO_2$  (ml/kg/min) for RE  $9.8 \pm 1.7$  and AE  $11.9 \pm 2.6$ . Kcals burned for RE  $194.1 \pm 51.95$  and AE  $222.0 \pm 59.3$ . No significant interaction ( $p > .05$ ) existed for condition and time, however, results revealed a significant main effect for time with respect to BG. The average pre and post exercise BG values (mg/dl) for AE was  $179.8 \pm 65.90$ ;  $160.6 \pm 58.41$  and RE was  $187.7 \pm 68.93$ ;  $172.9 \pm 79.17$ . **CONCLUSION:** Both AE and RE reduce BG similarly when matched for caloric expenditure. Given the difficulty controlling and matching energy expenditure between the modes of exercise, the current findings should be interpreted with caution.

1941 Board #93 June 2, 2:00 PM - 3:30 PM  
**The Association between Sleep Quality, Physical Activity, and Risk of Developing Metabolic Syndrome**

Matthew Scott<sup>1</sup>, M. Kent Todd<sup>2</sup>, Elizabeth S. Edwards<sup>2</sup>, Trent A. Hargens, FACSM<sup>2</sup>. <sup>1</sup>Virginia Commonwealth University, Richmond, VA. <sup>2</sup>James Madison University, Harrisonburg, VA.  
 (No relationships reported)

Physical inactivity and poor sleep quality have been shown to increase the risk for Metabolic Syndrome (MetS) in middle-aged and older adults. High levels of sedentary time, independent of physical activity (PA) amount, has also shown a relationship. Whether these relationships manifest at an earlier age has not been well explored. **PURPOSE:** To determine the independent effects of sedentary time, sleep quality, and physical activity (PA) on risk factors for MetS in young adults. **METHODS:** 40 young adults (age  $20.2 \pm 1.7$ ; BMI  $21.2 \pm 2.6$ ) underwent waist circumference (WC) and blood pressure (BP) measurements. Fasted blood glucose, Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), and Triglycerides (TG) were also assessed (Cardiochek Portable Blood Test System). Objective PA and sleep were measured for 7 days with an Actigraph GT3X accelerometer. Pearson correlations examined the relationship between sedentary (number of sedentary bouts, time in sedentary bouts, number of sedentary breaks, time per sedentary break, and daily average sedentary time), sleep quality (sleep onset latency, sleep efficiency, time in bed, sleep time, wake after sleep onset, number of awakenings, and time per awakening), and PA (energy expenditure, step counts, and time spent in light, moderate, moderate-vigorous, vigorous, and very vigorous PA intensities) variables with MetS risk factors (WC, BP, LDL, HDL, TG). Stepwise linear regression was used to determine the best predictors for each MetS risk factor. **RESULTS:** Time per sedentary bout (TSB), time per awakening (TA), step counts (SC), and moderate-vigorous PA (MVPA) were determined to have the strongest correlation with MetS variables. SC and TSB were significant predictors of WC ( $R^2 = .41$ ;  $p < 0.01$ ). TA was a significant predictor of systolic BP ( $R^2 = 0.49$ ;  $p < 0.01$ ) and total MetS risk factors ( $R^2 = 0.28$ ;  $p = .002$ ). SC was

the only significant predictor of HDL ( $R^2 = 0.13$ ;  $p = 0.025$ ). **CONCLUSION:** Sedentary time, PA, and sleep quality are predictive of risk factors for MetS in young adults. Therefore, interventions to decrease sedentary time as well as improve PA and sleep quality should be implemented at younger ages as well as older.

1942 Board #94 June 2, 2:00 PM - 3:30 PM  
**Post-Exercise Hypotension: Effects of Angiotensin II Receptor Blocker in Hypertensive Metabolic Syndrome Patients**

Ricardo Mora-Rodriguez, Juan Fernando Ortega, Valentin Emilio Fernandez-Elias, Felix Morales-Palomo, Nassim Hamouti, Maria del Valle Guio de Prada. *University of Castilla La-Mancha, Toledo, Spain.*  
 Email: Ricardo.Mora@uclm.es  
 (No relationships reported)

Hypertension is a modifiable risk factor for cardiovascular morbidity and mortality. Exercise has a blood pressure lowering effect in the short (i.e., post-exercise hypotension) and long term. The pharmacological treatment of hypertension could enhance exercise hypotension, although the interaction between hypotensive medicine and exercise is not well described. **PURPOSE:** To study the interaction between exercise and hypotensive medication (i.e., angiotensin II receptor type 1 blocker; ARB) in metabolic syndrome patients. **METHODS:** Sixteen metabolic syndrome patients medicated with ARB underwent two trials in a randomized order after an overnight fast. One trial was conducted 2 h after taking their habitual dose of ARB (MED) and another after 36 h of ARB withdrawal (NO MED). Before and 60 min after maximal cycling ramp exercise we measure arm and central blood pressures, pulse wave velocity and post-occlusion reactive hyperemia (PORH). **RESULTS:** Medication withdrawal increased systolic blood pressure by 2.6% ( $128.2$  to  $131.5$  mmHg;  $p = 0.25$ ;  $ES = 0.27$ ) although non-significantly. Post-exercise hypotension was similar in the MED and NO MED trials with a lowering of 8 mmHg in systolic and 4.5 mmHg in diastolic pressure ( $P < 0.05$ ). However, in the MED trial post-exercise pulse wave velocity (PWV) was lower than in the NO MED trial ( $7.72 \pm 2.1$  vs.  $8.67 \pm 1.8$  m·s<sup>-1</sup>;  $P = 0.029$ ;  $ES = 0.49$ ) and PORH only increase after exercise in the MED trial ( $3.6 \pm 1.7$  to  $4.4 \pm 2.4$  ΔmV;  $P = 0.033$ ;  $ES = 0.412$ ). **CONCLUSIONS:** Although ARB intake does not enhance post-exercise hypotension in hypertensive patients, it reduces arterial stiffness (PWV as an index) likely thru enhanced vasodilatory nitric oxide actions (PORH as an index). Supported by a Grant from the Spanish Ministry of Economy and Competitivity (DEP2014-52930-R)

1943 Board #95 June 2, 2:00 PM - 3:30 PM  
**Resting  $VO_2$  Significantly Lower in Non-alcoholic Fatty Liver Disease Than General Population Estimate**

Jillian K. Price<sup>1</sup>, Patrick Austin<sup>2</sup>, Carey Eschick<sup>2</sup>, Lynn Gerber<sup>2</sup>, Zobair Younossi<sup>2</sup>. <sup>1</sup>George Mason University, Fairfax, VA. <sup>2</sup>Inova Health System, Falls Church, VA. (Sponsor: Randall Keyser, FACSM)  
 Email: jprice12@masonlive.gmu.edu  
 (No relationships reported)

**Recent evidence suggests that oxygen consumption rate ( $VO_2$ ) at rest may vary with different populations from the commonly accepted 3.5 ml/kg/min. While sedentary behavior, low physical activity, fatigue, and low self-reports of quality of life are well-documented in patients with chronic liver disease (CLD), cardiorespiratory and metabolic function abnormalities which may underlying these symptoms has not been well described.** **PURPOSE:** Characterize resting oxygen consumption in patients with CLD and either hepatitis C (HCV) or non-alcoholic fatty liver disease (NAFLD). **METHODS:** Resting cardiorespiratory measures were gathered as part of two prospective research protocols in patients with CLD undergoing cardiopulmonary exercise testing [N=17, age=45.0 ± 11.2 years, 52.9% male, 58.8% Caucasian, 11.8% African American, 23.5% Latin American, 5.9% Asian, body mass index (BMI)=32.2 ± 5.8, Waist=39.7 ± 6.0, 52.9% NAFLD, 47.1% HCV (genotype 1a=60%, 3a=40%), diabetes= 3, hypertension=4, hyperlipidemia=2, hypocholesteremia= 2, ALT=53.5 ± 22.1, AST=41.9 ± 18.5, cirrhosis=3,  $VO_2 = 3.26 \pm .59$  mL/kg/min]. Age and BMI were co-varied as predictors in subsequent regression analyses comparing resting  $VO_2$  in subjects with HCV and NAFLD due to previously documented confounding effects. **RESULTS:** T-test comparisons showed that the NAFLD group had significantly higher % fat mass (39.2% vs. 27.4%,  $p = .014$ ) and significantly lower  $VO_2$  (2.87 vs. 3.54,  $p = .017$ ) than subjects with HCV. Subjects with NAFLD and HCV did not differ significantly from one another on age ( $p = .233$ ), BMI ( $p = .110$ ), or waist circumference ( $p = .061$ ). Regression modeling of  $VO_2$  controlling for age and BMI ( $R = .239$ ,  $R$  Square = .057,  $SEE = .616$ ) found no significant differences between CLD subjects and population norms for resting  $VO_2$  ( $p = .663$ ).

**CONCLUSIONS:** This preliminary pilot analysis suggests patients with NAFLD show a significantly lower resting  $\text{VO}_2$  than both patients with HCV and the general population. Age and BMI explain the majority of the variance in  $\text{VO}_2$ . These findings in patients with CLD are novel and may suggest resting  $\text{VO}_2$  as a variable of interest in studying commonly reported symptomatology in NAFLD and CLD.

1944 Board #96 June 2, 2:00 PM - 3:30 PM  
**Short-Term Resistance Training Improves  
 Cardiometabolic Health In Caucasian And South Asian  
 Males.**

Allan Knox, Nicholas Sculthorpe, Fergal Grace. *University of the West of Scotland, Hamilton, United Kingdom.* (Sponsor: Gareth Davison, FACSM)  
 Email: allan.knox@uws.ac.uk  
 (No relationships reported)

South Asian (SOU) individuals are recognised as having excess cardiovascular risk in comparison to Caucasian (CAUC) individuals due to unfavourable risk factor prevalence's. Resistance training (RT) has been shown to improve risk factor profiles; however recent evidence has shown that the magnitude of improvements may be racially specific. No data exist concerning the effects of RT on cardiometabolic health between CAUCs and SOUs. **PURPOSE:** To evaluate the effects of RT on biomarkers of cardiometabolic health in CAUC and SOU males. **METHODS:** CAUC (n=15, 25 ± 4 yrs) and SOU (n=13, 25 ± 7 yrs) males completed a progressive RT protocol 3 x week<sup>-1</sup> for 6 weeks. Glucose, insulin, insulin sensitivity (HOMA-%S, HOMA-%B), triglycerides (TRIGS), low density lipoprotein (LDL), high density lipoprotein (HDL), total cholesterol (TC) and C-reactive protein (CRP) were established at baseline and following RT. The linear progressive protocol involved 5 compound exercises to achieve maximum increases in muscular strength. Differences between groups, time points and their interaction were established by mixed methods repeated measures ANOVA. Statistical significance was set at  $P < 0.05$ . All data are presented as percentage difference ( $\Delta$ ) ± SD. **RESULTS:** No difference in baseline glucose, insulin, TRIGS, LDL, HDL, TC or CRP ( $P > 0.05$ ) were evident between groups. Fasting glucose concentrations significantly reduced in the CAUC ( $\Delta -15 \pm 13.9\%$ ,  $P < 0.05$ ), without any change in the SOU group ( $\Delta -7 \pm 6.8\%$ ,  $P < 0.05$ ) following RT. Insulin concentrations, HOMA-%S, HOMA-%B, TRIGS, or CRP remained unchanged in both groups following RT ( $P > 0.05$ , for all measures). LDL decreased significantly in the CAUC ( $\Delta -32 \pm 19.3\%$ ,  $P < 0.05$ ) and the SOU group ( $\Delta -35 \pm 17.8\%$ ,  $P < 0.05$ ) following RT. HDL significantly increased in both the CAUC ( $\Delta +27 \pm 29.3\%$ ,  $P < 0.05$ ) and SOU group ( $\Delta +24 \pm 26.5\%$ ,  $P < 0.05$ ) following RT. TC significantly decreased in the CAUC ( $\Delta -18 \pm 16.3\%$ ,  $P < 0.05$ ) and the SOU group ( $\Delta -23 \pm 14.3\%$ ,  $P < 0.05$ ) following RT. No significant differences in any measure were evident between groups at any time point ( $P > 0.05$ ). **CONCLUSION:** Short-term RT has a positive impact on some cardiometabolic risk factors in young Caucasian and South Asian males.

1945 Board #97 June 2, 2:00 PM - 3:30 PM  
**Effects of Postmeal Walking on Postprandial Glucose  
 Control and Oxidative Stress**

Jessica R. Knurick<sup>1</sup>, Carol S. Johnston<sup>2</sup>, Glenn A. Gaesser, FACSM<sup>2</sup>. <sup>1</sup>University of Nevada, Las Vegas, Las Vegas, NV. <sup>2</sup>Arizona State University, Phoenix, AZ. (Sponsor: Glenn Gaesser, FACSM)  
 Email: jessica.knurick@unlv.edu  
 (No relationships reported)

Postprandial hyperglycemia can increase levels of oxidative stress and is an independent risk factor for complications associated with type 2 diabetes. **PURPOSE:** To evaluate the acute effects of a 15-minute postmeal walk on glucose control and markers of oxidative stress following a high-carbohydrate meal. **METHODS:** Ten obese subjects (55.0 ± 10.0 yrs) with impaired fasting glucose (107.1 ± 9.0 mg/dL) participated in this repeated measures trial. All subjects underwent three conditions: 1) Test meal with no walking or fiber (CONTROL), 2) Test meal with 10g fiber and no walking (FIBER), 3) Test meal with no fiber followed by a 15-min treadmill walk at preferred walking speed (WALK). Blood samples were taken over four hours. A repeated measures ANOVA was used to compare all outcome variables. **RESULTS:** The 2hr and 4hr iAUC for glucose was lower in both FIBER (2hr: -93.59 mmol·120 min<sup>-1</sup>·L<sup>-1</sup>,  $p = 0.006$ ; 4hr: -92.59 mmol·240 min<sup>-1</sup>·L<sup>-1</sup>;  $p = 0.041$ ) and WALK (2hr: -77.21 mmol·120 min<sup>-1</sup>·L<sup>-1</sup>,  $p = 0.002$ ; 4hr: -102.94 mmol·240 min<sup>-1</sup>·L<sup>-1</sup>;  $p = 0.005$ ) conditions respectively, compared with CONTROL. There were no differences in 2hr or 4hr iAUC for glucose between FIBER and WALK (2hr:  $p = 0.493$ ; 4hr:  $p = 0.783$ ). The 2hr iAUC for insulin was significantly lower in both FIBER (-37.15  $\mu\text{U} \cdot \text{h} / \text{mL}$ ;  $p = 0.021$ ) and WALK (-66.35  $\mu\text{U} \cdot \text{h} / \text{mL}$ ;  $p < 0.001$ ) conditions, compared with CONTROL, and was significantly lower in the WALK (-29.2  $\mu\text{U} \cdot \text{h} / \text{mL}$ ;  $p = 0.049$ ) condition, compared with FIBER. The 4hr iAUC for insulin in the WALK condition was significantly lower than both CONTROL (-104.51  $\mu\text{U} \cdot \text{h} / \text{mL}$ ;  $p = 0.001$ ) and FIBER (-77.12  $\mu\text{U} \cdot \text{h} / \text{mL}$ ;  $p = 0.006$ ) conditions. Markers of oxidative stress were not significantly different between conditions.

ACSM May 31 – June 4, 2016

**CONCLUSIONS:** A moderate 15-minute postmeal walk is an effective strategy to reduce postprandial hyperglycemia. However, it is unclear if this attenuation leads to improvements in postprandial oxidative stress.

1946 Board #98 June 2, 2:00 PM - 3:30 PM

**The Effect of Acute Hyperglycemia on Muscular  
 Strength, Power and Endurance.**

Jeffrey Vigil<sup>1</sup>, Franklin Lime-Ma<sup>2</sup>, Evan E. Schick<sup>1</sup>. <sup>1</sup>California State University, Long Beach, Long Beach, CA. <sup>2</sup>Linfield College, McMinnville, OR.  
 (No relationships reported)

Chronic hyperglycemia has been shown to cause skeletal muscle dysfunction, however, there is a paucity of understanding on the effect of acute hyperglycemia on skeletal muscle function.

**Purpose:** The purpose of this study is to better understand the impact of acute hyperglycemia on skeletal muscle strength, power, and endurance. **Methods:** Ten male collegiate athletes (age 21.5 ± 1.5 years, height 186 ± 2.03 cm, body mass 108.8 ± 7.6 kg, % body fat (7-site skinfold) 22.5 ± 3.09%) participated in 2 testing sessions, separated by 7 days and randomized for either high glucose (HG) or control (C) treatment groups. The HG group consumed a high glucose drink (2 g glucose/kg body weight) while controls consumed an isocaloric nutrition bar with an energy provision of 40% protein, 30% fat, and 30% carbohydrate. Blood glucose (BG) levels for HG and C were tested at 0 (basal) and 30, 60, 90, and 120 minutes (mins) post consumption. At 30 mins post consumption, muscular strength in the HG and C groups was assessed by a 1RM bench press (BP) test followed by lower body power at 60 mins via vertical jump test. Muscular endurance was examined with a 3-set-to-failure BP test at 90 mins. **Results:** The HG group exhibited significantly greater BC values ( $p < 0.05$ ) at the 30, 60, 90, and 120 minute time points. Additionally, HG glucose area under the curve was significantly greater ( $p < 0.05$ ) than C and was positively correlated with %body fat, a finding that trended towards significance,  $r = 0.587$ ,  $n = 10$ ,  $p = 0.074$ . There were no between group differences in maximal strength, power or muscular endurance. **Conclusion:** Although performance measures were unaffected by acute hyperglycemia, we provide evidence that acute hyperglycemia can be induced and maintained in healthy, active and young subjects which may provide a valuable platform for future research on the etiological time course of metabolic diseases.

1947 Board #99 June 2, 2:00 PM - 3:30 PM

**Non-obese Young Adults Have a High Prevalence of  
 Metabolic Syndrome Components.**

Paul B. Nolan<sup>1</sup>, Graeme Carrick-Ranson<sup>1</sup>, James Stinear<sup>1</sup>, Stacey Reading<sup>1</sup>, Borja de Pozo Cruz<sup>1</sup>, Lance C. Dalleck<sup>2</sup>. <sup>1</sup>The University of Auckland, Auckland, New Zealand. <sup>2</sup>Western State Colorado University, Gunnison, CO.  
 Email: p.nolan@auckland.ac.nz  
 (No relationships reported)

Although obesity is a central component of the metabolic syndrome (MetS) diagnostic criteria, it is also recognized that normal-weight obesity in which body mass index is in the normal range yet adiposity is elevated and other risk factors are present can also lead to adverse health outcomes. This scenario may be more prevalent in young adults. Thus, the identification of MetS components in non-obese young adults is an important strategy to understanding the development of chronic disease later in life.

**PURPOSE:** To quantify the prevalence of MetS components in non-obese young adults and determine self-reported weekly physical activity (PA), sedentary behaviour times (SB) and the ratio of PA/SB (the proportion of active to sedentary time) are associated with having one or more MetS components. **METHODS:** 77 young (20 ± 2yrs), non-obese (BMI 22.5 ± 3.0kg·m<sup>-2</sup>) adults were assessed for MetS components, PA and SB. Participants were grouped as either having no components or one or more components of the MetS. A one-way ANOVA was used to establish differences in participant characteristics with and without MetS components and logistic regression was performed to determine the relationship between PA, SB and PA/SB with having one or more MetS component. **RESULTS:** 30 participants (39%) had at least one MetS component. The most prevalent MetS component was low HDL (n=21), followed by high blood pressure (n=18), large waist circumference (n=3), high triglycerides (n=3) and high fasting blood glucose (n=2). Participants with a MetS component had higher blood pressure, BMI, waist circumference, triglycerides and a lower level of HDL (all  $p < 0.05$ ). There was no significant relationships between having a MetS component and PA, SB or PA/SB ratio (all  $p > 0.05$ ). **CONCLUSION:** Two out of five young, non-obese participants had at least one MetS component and this was not influenced by levels of weekly PA and SB. These findings highlight that MetS components are established early in adulthood and can occur independently of obesity, PA, SB or PA/SB.

1948 Board #100 June 2, 2:00 PM - 3:30 PM

### Improvements In Liver Fat And Endothelial Function Following Supervised Exercise Training Are Not Sustained One-Year After The Cessation Of Supervision In Non-Alcoholic Fatty Liver Disease

Christopher Pugh<sup>1</sup>, Helen Jones<sup>2</sup>, Victoria Sprung<sup>3</sup>, Paul Richardson<sup>4</sup>, Fariba Shojaee-Moradie<sup>5</sup>, A. Margot Umpleby<sup>5</sup>, Andrew Irwin<sup>3</sup>, Daniel Green<sup>6</sup>, N. Timothy Cable<sup>2</sup>, Graham Kemp<sup>3</sup>, Daniel Cuthbertson<sup>3</sup>. <sup>1</sup>Cardiff Metropolitan University, Cardiff, United Kingdom. <sup>2</sup>Liverpool John Moores University, Liverpool, United Kingdom. <sup>3</sup>University of Liverpool, Liverpool, United Kingdom. <sup>4</sup>Royal Liverpool University Hospital, Liverpool, United Kingdom. <sup>5</sup>University of Surrey, Surrey, United Kingdom. <sup>6</sup>University of Western Australia, Perth, Australia. Email: cjpugh@cardiffmet.ac.uk

(No relationships reported)

Supervised exercise training reduces liver fat and improves endothelial function, a surrogate of cardiovascular disease risk, in non-alcoholic fatty liver disease (NAFLD). **Purpose:** To investigate whether exercise-mediated improvements in liver fat and endothelial function are sustained 1-year following the cessation of supervision in NAFLD patients. **Methods:** Ten NAFLD patients (5 males, 51±13yrs, 31±3kg.m<sup>2</sup>) underwent a 16-week supervised exercise intervention. Brachial artery flow-mediated dilation (FMD), cardiorespiratory fitness, liver fat and MRI-derived abdominal fat volume were assessed at baseline, following supervised exercise training and 1-year following the cessation of supervision. **Results:** Exercise-mediated improvements in cardiorespiratory fitness [6.5ml.kg<sup>-1</sup>.min<sup>-1</sup> (2.6, 10.3); *P*=0.005] and waist circumference [-5cm (-8, -2); *P*=0.004] reversed 1-year following the cessation of supervision [-5.6ml.kg<sup>-1</sup>.min<sup>-1</sup> (-9.0, -2.1); *P*=0.005; & 4cm (1, 8); *P*=0.04 respectively]. FMD [2.8% (1.2, 4.5); *P*=0.004] improved following supervised exercise training but returned to baseline values 1-year following cessation of supervision [-2.9% (-5.1, -0.63); *P*=0.02]. Exercise-mediated reductions in liver fat [-10.4% (-20.6, -0.1); *P*=0.04], reversed 1-year following the completion of supervision [11.9% (0.05, 23.8); *P*=0.04]. There was no difference in visceral, subcutaneous or total abdominal fat between the three time points (*P*>0.20). **Conclusion:** Improvements in liver fat and endothelial function following supervised exercise training are not sustained 1-year following the cessation of supervision in NAFLD patients. This finding that continuous exercise supervision appears necessary to sustain the cardio-metabolic benefits of intervention presents a significant public health challenge.

1949 Board #101 June 2, 2:00 PM - 3:30 PM

### Cardiorespiratory Fitness Evolution After 16-Weeks Of High Intensity Interval Training In Metabolic Syndrome Patients

Juan F. Ortega, María del Valle Guío, Felix Alberto Morales-Palomo, Valentín Emilio Fernández-Eliás, Nassim Hamouti, Ricardo Mora-Rodríguez. *University of Castilla-La Mancha, Toledo, Spain.*

Email: juan.fdo.ortega@gmail.com

(No relationships reported)

**PURPOSE:** To evaluate the progression of cardiorespiratory fitness (CRF) in metabolic syndrome (MS) patients enrolled in a program of endurance training.

**METHODS:** During 16 weeks, 161 MS patients (54±9 yrs; 99 male and 62 female) participate in a stationary cycling training program based on 3 session per week of high intensity interval training (HIIT) which consisted in four 4-min intervals at 90% of the peak heart rate (HRPEAK) interspersed with 3-min intervals at 70% HRPEAK. Before and after training, CRF and body composition were compared. CRF was assessed during a graded exercise test in cycle-ergometer from peak values of oxygen consumption (VO<sub>2</sub>PEAK), power output (POPEAK), and heart rate (HRPEAK), as well as registers of VO<sub>2</sub>, PO, and HR at anaerobic threshold (VT1) and ventilatory threshold of compensation for metabolic acidosis (VT2). Body composition was assessed by dual-energy X-ray absorptiometry. Data was analyzed using split plot ANOVA to compare time and gender-related differences.

**RESULTS:** After training, both VO<sub>2</sub> and PO, improved by 12% and 19% at POPEAK, 17% and 27% at VT1, and 12% and 17% at VT2 respectively (all *P*<0.001). VO<sub>2</sub>PEAK, and VO<sub>2</sub> at VT1, and VT2 were higher in men (*P*=0.022, *P*=0.016, and *P*=0.013). However, when VO<sub>2</sub> was expressed relative to free fat mass (FFM) the gender differences disappeared in all three parameters (all *P*>0.05). PO improved without gender differences in all three parameters. HRPEAK improved (*P*<0.001), but not HR at VT1 and VT2 (*P*=0.105 and *P*=0.157, respectively). When VO<sub>2</sub> and PO at VT1 and VT2 were expressed as a percentage of VO<sub>2</sub>PEAK and POPEAK respectively, there was no significant improvement in any parameter (all *P*>0.05).

**CONCLUSIONS:** Sixteen weeks of HIIT in previously sedentary MS patients improved VO<sub>2</sub> and PO at POPEAK, VT1 and VT2. However the percent of the post-training VO<sub>2</sub>PEAK and POPEAK at which VT1 and VT2 occurred did not

change. Women's lesser improvements in cardiorespiratory fitness disappeared when normalized by FFM, suggesting that training improved muscle aerobic capacity similarly in both genders. Lastly, HR at VT1 and VT2 did not vary with training, which allows target HR maintenance during training despite increasing intensity. Supported by a Grant from the Spanish Ministry of Economy and Competitiveness (DEP2014-52930-R)

1950 Board #102 June 2, 2:00 PM - 3:30 PM

### Hypotensive Effects of Interval vs. Continuous Aerobic Exercise in Metabolic Syndrome Patients.

Felix Morales Palomo, Miguel Ramirez-Jimenez, Juan F. Ortega, Ricardo Mora-Rodríguez. *University of Castilla-La Mancha, Toledo, Spain.*

Email: felixmoralespalomo@gmail.com

(No relationships reported)

It is unclear which exercise intensity and mode elicits the largest blood pressure reduction post-exercise. This knowledge is especially relevant for people with elevated cardiovascular risk factors (e.g., obesity and hypertension).

**OBJECTIVE:** To compare the hypotensive effects of a bout of high intensity interval exercise in comparison to a bout of moderate continuous exercise.

**METHODS:** Twenty metabolic syndrome patients underwent 3 trials in a randomized order. In one trial subjects completed an interval high-intensity exercise session (INT; 90-70% of heart rate maximal during 43 min) while in a different day subjects exercised continuously at a moderate intensity (CONT; 60% HRmax during 65 min). Trials were matched for total work. We measured the acute reductions in blood pressure 15 min after exercise and during the rest of the day using ambulatory blood pressure monitors. Data were compared to a non-exercise control day (CTR).

**RESULTS:** Compared with CTR, INT and CONT acutely reduced systolic blood pressure 15 min after exercise (-7.6 ± 8.1 and -2.2 ± 6.3 mmHg, respectively; *P*<0.05). However, ambulatory systolic blood pressure was not reduced by exercise (139 ± 14, 143 ± 17 and 144 ± 20 mmHg for INT, CONT and CTR respectively). When we analyzed subjects with high systolic blood pressure values during the CTR trial (PAS ≥ 140 mmHg; n=11) only INT reduced systolic blood pressure below CTR values (144 ± 15 vs. 157 ± 16 mmHg; *P*=0.025).

**CONCLUSIONS:** In summary, one exercise bout lead to immediate post exercise hypotension (15 min) regardless of exercise intensity. However, intense interval aerobic exercise is more effective on reducing systolic pressure in the long term (14 hours) only in hypertensive subjects.

Supported by a Grant from the Spanish Ministry of Economy and Competitiveness (DEP2014-52930-R)

1951 Board #103 June 2, 2:00 PM - 3:30 PM

### Sprint Interval versus Moderate Intensity Training and Effects on Framingham Risk Score in Prediabetic Women

Joan A. Mandelson, Nicole M. Gilbertson, Kathryn L. Hilovsky, Jeremy D. Akers, Elizabeth S. Edwards, David L. Wenos, Trent A. Hargens, FACSM. *James Madison University, Harrisonburg, VA.*

(No relationships reported)

The Framingham Risk Score (FRS) was developed to determine the likelihood of developing cardiovascular disease (CVD) in the next 10 years. Run-Sprint Interval Training (RSIT) has shown improvements in various health and blood markers while reducing exercise time. To date there has not been a study that examines the effects of R-SIT and Moderate Intensity Training (MIT) on FRS of prediabetic women.

**PURPOSE:** To examine the effects of 16-weeks of RSIT and MIT training on FRS of sedentary prediabetic women.

**METHODS:** Participants were randomized into RSIT (n=6) or MIT (n=9) groups and required to attend 3 weekly training sessions and 1 weekly Diabetes Prevention Program session for 16-weeks. During the first 4 weeks, RSIT performed 4x30s maximal sprints on a treadmill at a self-selected speed and incline, followed by a 4-min active recovery between intervals. Intervals increased by 2 every 4 weeks. MIT walked continuously at 45-55% Heart Rate Reserve for 30-mins during the first 4 weeks, and increased by 10-mins every 4 weeks. FRS markers were measured at baseline, mid, and post intervention.

**RESULTS:** There were no significant changes within groups for FRS, SBP, HDL-C, and TC. At baseline significant differences were observed in FRS (RSIT 2.39+0.97, MIT 6.41+0.75%) and Vascular Age (VA) (RSIT 43.33+5.95, MIT 59.33+3.06 yr). At 16-weeks there were significant differences between groups (RSIT, MIT respectively) in TC (167.12±8.14, 218.91±18.37 mg/dL), triglycerides (TGs) (101.33±10.38, 152.56±14.30 mg/dL), VLDL-C (18.67±2.02, 30.55±2.83 mg/dL), FRS (2.73±0.65, 6.74±0.96%), and VA (39.50±11.18, 60.55±3.79 yr), with RSIT significantly decreasing TGs from mid to post (124.67±13.39, 101.33±10.38 mg/dL, respectively). When evaluating change scores, there were significant differences between groups for LDL-C (RSIT -8.81±6.98, MIT 10.88±6.0 mg/dL) and a trend for VA (RSIT -3.83±1.93, MIT 1.38±1.68 yr, *p*=0.063).

Abstracts were prepared by the authors and printed as submitted.

**CONCLUSION:** There were no significant within group changes in FRS during a 16-week intervention, however, following the intervention, RSIT had better FRS, TC, VLDL-C and TG when compared to MIT. Additionally, RSIT demonstrated greater change in LDL-C and VA. Further research is needed to determine if RSIT or MIT will improve FRS.

1952 Board #104 June 2, 2:00 PM - 3:30 PM

**Post-exercise Recovery Among HIV+ And HIV-Hispanic Adults: Role Of Metabolic Syndrome And Lipodystrophy Status**

Maria C. Pacheco-Pares<sup>1</sup>, Jorge Santana-Bagur<sup>2</sup>, Michael J. Joyner, FACSM<sup>3</sup>, Jorge Rodriguez-Zayas<sup>2</sup>, Farah A. Ramirez-Marrero, FACSM<sup>1</sup>. <sup>1</sup>University of Puerto Rico-Rio Piedras Campus, San Juan, Puerto Rico. <sup>2</sup>University of Puerto Rico-Medical Sciences Campus, San Juan, Puerto Rico. <sup>3</sup>Mayo Clinic, Rochester, MN.

Email: maria\_pacheco13@hotmail.com

(No relationships reported)

Cardiovascular and metabolic responses to graded exercise tests (GXT) and exercise recovery have been used as markers of cardiovascular disease risk in HIV infection; however, the comparison by metabolic syndrome (metsyn) and lipodystrophy (lipo) status has not been explored.

**Purpose:** To compare VO<sub>2</sub>, heart rate (HR), minute ventilation (VE), and lactate (Lac) change from peak exercise 6-min recovery in a group of Hispanic adults by metsyn status (yes vs. no) according to the NCEP-ATPIII, and HIV-lipodystrophy status (HIV-lipo, HIV-no-lipo, and HIV-).

**Methods:** A group of 32 HIV-lipo (22 with, 10 without metsyn), 29 HIV-no-lipo (11 with, 18 without metsyn), and 30 HIV- (11 with, 19 without metsyn) completed a GXT using the modified Bruce protocol and 6 min recovery (3 min slow walking and 3 min sitting) while measurements of VO<sub>2</sub>, HR, VE, RER, and lactate were obtained. Two-way ANOVAs were conducted to detect differences by metsyn and lipo status, and logistic regressions to determine the influence of lipo and metsyn on exercise recovery.

**Results:** Percent change from peak to 6-min recovery in VO<sub>2</sub>, VE, and lactate were not different by metsyn and lipo status. HR recovery was not different by metsyn (39.6 vs. 42.7 %, P=0.13); however, HIV-lipo and HIV-no-lipo had a slower HR recovery compared to HIV- (39.0, 39.3 vs. 47.7 %, respectively, P=0.01) only in the group without metsyn.

**Conclusion:** Similar to other studies, HR recovery appeared impaired in HIV+ Hispanic adults regardless of lipodystrophy status. However, different from other studies, our results do not support the influence of metsyn on HR recovery in this population. Supported in part by: NIH/CTSA KL2-RR024151, NIH/NCRR U54 RR026139, NIH/NIMHHD 8U54MD 007587-03, NIH/DAIDS ZUM1A1069415-10.

**D-30 Basic Science World Congress/Poster - Energy Balance: Body Composition, Muscle, and Weight Regulation**

Thursday, June 2, 2016, 1:00 PM - 6:00 PM

Room: Exhibit Hall A/B

1953 Board #105 June 2, 3:30 PM - 5:00 PM

**Regional Body Composition Changes with Weight Loss**

Philip R. Stanforth, Anna E. Talley, Victoria A. Jarzabkowski, Dixie Stanforth. *The University of Texas at Austin, Austin, TX.* (Sponsor: Hiro Tanaka, FACSM)

Email: p.stanford@austin.utexas.edu

(No relationships reported)

**PURPOSE:** To examine regional body composition changes with weight loss and the effects of age, gender, ethnicity, initial total body fat % (TBF%), and rate of change in TBF% on these changes.

**METHODS:** Participants were 723 men (M) and 1,802 women (W) 20-74 yrs of age who participated in a 12-wk, 3 days/wk instructor-led exercise and weight loss program which included pre- and post- DXA scans. After completing one 12-wk session, participants could continue and receive a DXA scan at the end of each subsequent session. The mean time between the first and last scan was 1.2 yrs (range = 10 wks to 5.4 yrs). A series of latent growth curve models were used to assess TBF% and android (An), arms (A), gynoid (G), legs (L), and trunk (Tr) fat % (F%) change over time and the effects of age, ethnicity, gender, initial TBF%, and change in TBF%. The level of significance was set at p < .05.

**RESULTS:** Unrestricted models, without any co-variables, showed that TBF% and F% for each region had a significant rate of decrease and that this rate of decrease

slowed over time (quadratic slope). The initial F%, F% rate of change per month and F% quadratic slope were as follows: TBF% (35.8, -0.226, 0.004), AF% (34.3, -0.170, 0.004), AnF% (40.1, -0.350, 0.007), GF% (38.9, -0.217, 0.004), LF% (35.5, -0.180, 0.003), and TrF% (38.1, -0.287, 0.006). At baseline, when controlling for initial TBF%: 1) M had significantly lower TBF% (37.4 vs 31.3), F% in the A (36.4 vs 28.8), G (40.5 vs 34.5), and L (37.5 vs 30.3) regions, but higher F% in An (37.0 vs 46.1) and Tr (36.0 vs 41.7) regions than W; 2) older individuals had higher TBF%, but lower F% in the G and L regions; and 3) Whites had more AF% than Blacks, but less An, A, and Tr F% than Asians (AS). The mean change in TBF% was greater in M than W (-4.73 vs -5.69%). In examining rate of change while controlling for initial TBF%: 1) M lost at a faster rate for TBF%, AnF%, GF%, LF%, and TrF% than W; 2) AS lost at a faster rate for TBF%, AnF%, GF%, and TrF%; and 3) older individuals lost at a faster rate for LF%, but a slower rate for GF%. However, when controlling for simultaneous rate of change in TBF% the only slope differences were that M lost LF% faster and TrF% slower than W.

**CONCLUSION:** When controlling for rate of change in TBF%, regional rate of change was not affected by age or ethnicity and the only gender differences were that M lost faster in the L and slower in the Tr than W.

1954 Board #106 June 2, 3:30 PM - 5:00 PM

**The Effects of Succinate Treatment on Obesity, Insulin Resistance, and Skeletal Muscle Mitochondrial Respiration**

Daniella Escudero, Cheyanne Slocum, Gabe O'Brien, Cassandra Eddy, Lauren Gorstein, Caitlin Sheridan, Saada Legesse, Sarita Lagalwar, Stephen J. Ives, Thomas H. Reynolds. *Skidmore College, Saratoga Springs, NY.* (Sponsor: Paul Arciero, FACSM)

Email: treynold@skidmore.edu

(No relationships reported)

Obesity is a major public health problem that affects approximately 35% of US adults. Identifying novel interventions that can reduce adiposity are essential to decrease the burden of obesity on our health care system. Since obesity is associated with mitochondrial dysfunction, interventions targeting the mitochondria may be effective anti-obesity treatments. **PURPOSE:** We sought to determine the effect of succinate, a mitochondrial complex II electron donor, on adiposity, insulin resistance, and muscle mitochondrial respiration. **METHODS:** C57B6 male mice were assigned to a low fat diet (LFD) or a high fat diet (HFD) for 20 weeks. After 14 weeks of the dietary intervention, mice from were assigned to a control or succinate (0.75 mg/ml in drinking water) group. Caloric intake and body mass were assessed weekly, while glucose tolerance (GT), insulin tolerance (IT), and pyruvate tolerance (PT) were assessed during the last 2 weeks of succinate treatment. Measurements of mitochondrial respiration in soleus muscle were performed using permeabilized fiber respirometry. **RESULTS:** The HFD significantly increased body mass (48.5±0.9 vs. 31.0±0.6 g), epididymal white adipose tissue (EWAT) mass (1.9±0.2 vs. 0.87±0.2 g), and reduced the area under the curve (AUC) for GT (59732±1741 vs. 47119±1308), IT (26547±2214 vs. 15425±1650), and PT (37846±1972 vs. 25470±540). The HFD did not significantly alter soleus muscle mitochondrial respiration. Succinate treatment had no effect on caloric intake and body mass, but significantly reduced EWAT mass (1.9±0.2 vs. 1.3±0.1) in HFD mice. Although succinate treatment did not improve GT or IT, PT was significantly improved in HFD mice (AUC: 37846±1972 vs. 32513±1252). Finally, there was a trend for succinate treatment to increase complex I-II driven state 3 respiration, and complex IV activity, but these changes did not reach statistical significance. **CONCLUSION:** We observed no effect of succinate treatment on body mass; however, EWAT mass was significantly lower in mice treated with succinate. In the soleus muscle, there was a tendency for increased state 3 respiration, owed to greater mitochondrial content, suggestive of a succinate-induced mitochondrial biogenesis. Furthermore, succinate treatment significantly improve PT, indicating a reduction in hepatic gluconeogenesis.

1955 Board #107 June 2, 3:30 PM - 5:00 PM

**Regional Skin Temperature Responses to Warm vs. Cold in Healthy Lean and Obese Young Men**

Brooks P. Leitner, Shan Huang, Courtney J. Duckworth, Suzanne McGehee, Sarah A. Smyth, Jacob D. Hattenbach, Kong Y. Chen, Robert J. Brychta. *National Institutes of Health, Bethesda, MD.* (Sponsor: J. Carson Smith, FACSM)

Email: brooks.leitner@nih.gov

(No relationships reported)

Recent interest in cold-induced thermogenesis as a potential mechanism to regulate energy balance underlies the need to study dynamic thermoregulatory responses in obese and lean individuals.

**PURPOSE:** To quantify skin temperature (Tsk) changes at different body regions between obese (O) vs. lean (L) healthy young male volunteers at a warm vs. cold environmental temperature. **METHODS:** Thermistors were applied to skin surface sites including the torso (pectoralis), dorsal hand, and deltoid, in 12 L (23.1±4.9yr,

BMI 23.5±1.8, 20.2±5.2 %fat) and 8 O (28.7±4.7yr, BMI 34.8±3.2, 38.4±5.1 %fat) subjects. Body composition was obtained by Dual-energy X-ray Absorptiometry. From the hours of 0800 to 1300, subjects were fasted and wore a sleeveless T-shirt and tight-fitting shorts and stayed in a climate-controlled whole-room indirect calorimeter at randomized temperature conditions 26.7±0.5C (warm) and 21.3±0.5C (cold). Regional Tsk was continuously recorded, averaged in 15-minute intervals, and compared using independent t-tests. **RESULTS:** At 27C, deltoid Tsk were similar between L and O (p=0.28), hand Tsk was about 2C lower (p<0.01) in the lean in the first hour, but similar afterwards. Pectoral Tsk in L was consistently higher than the O at all time-points (0.7C, p<0.05). At 21C, deltoid Tsk was similar at all time points between L and O (p=0.92). However, hand Tsk was significantly lower in lean than in O at the onset of cooling (29.5±1.5 vs. 31.8±1.2C, p<0.05), and remained different until t=1.5 hr (25.2±1.6vs. 27.8±1.4C, p<0.01). Hand Tsk in O gradually decreased in a linear trend over the study duration, whereas it rapidly dropped and stabilized in L, resulting similar Tsk at t=4.5 hr (24.2±2.9 vs. 25.0±1.4C, p=0.48). Pectoral Tsk in L was higher than O at the onset of cooling (33.1±0.6vs. 32.3±0.6C, p<0.05), and remained steady over time (t=4.5 hr: 32.8±0.8C). Pectoral Tsk in O reduced linearly with time and reached 31.2±0.9C at t=4.5 hr. **CONCLUSION:** Our data showed different regional skin temperature responses in the lean vs. obese healthy young men at warm vs. cold ambient temperatures, thus suggesting adipose tissue thickness may serve as a heat insulator in the torso which delays the need for peripheral vasoconstriction. Such differences may play a role in altering cold-induced thermogenesis between lean and obese men.

(WL-M). **METHODS:** Forty obese men (n = 21) and women (n = 19) participated in this study. This experiment was split into two consecutive phases: (a) 12-week HP-IF-LC diet (WL, Phase 1); (b) a 1-year WL maintenance comparing HP-IF with a heart healthy (HH) diet (WL-M, Phase 2). We assessed body mass index (BMI), waist circumference, circulating lipids, and arterial function at baseline (week 0), post-Phase 1 (week 12), post-Phase 2 (week 64). Two way ANOVA with repeated measures was used to determine the main effects and Post hoc test was performed if there was an interaction. **RESULTS:** Body composition, arterial function, blood lipids were all significantly improved following 12-week WL phase (BMI: 37.5 ± 0.9 vs. 33.7 ± 0.8 kg/m<sup>2</sup>; waist circumference: 116.3 ± 2.3 vs. 100.8 ± 2.0 cm, p < 0.001); (LDL: 145.9 ± 11.5 vs. 96.6 ± 7.0 mg/dL; total cholesterol: 116.9 ± 4.6 vs. 102.7 ± 4.2 mg/dL, p < 0.01); (HR: 64.9 ± 1.6 vs. 60.4 ± 1.5 bpm, p < 0.01; systolic BP: 125.2 ± 1.7 vs. 116.1 ± 1.8 mmHg; diastolic BP: 79.5 ± 1.8 vs. 70.3 ± 1.2 mmHg, p < 0.001), respectively. For Phase 2, HP-IF diet group showed less weight gain relapse and enhanced arterial function compared to the HH diet. **CONCLUSION:** A 12 week HP-IF-LC WL diet effectively improved body composition, lipid profile, and arterial function in obese men and women. Furthermore, HP-IF diet demonstrated an advantage in minimizing weight relapse and improvement of cardiovascular health compared to HH diet during 1 year WL-M. Funding was provided to PJA from Isagenix International LLC (#1307-347)

1956 Board #108 June 2, 3:30 PM - 5:00 PM  
**Associations Between Parent BMI And Obesity Related Parenting Behaviors**  
 Joel E. Williams, Sarah F. Griffin. *Clemson University, Clemson, SC.*  
 Email: joel2@clemson.edu  
*(No relationships reported)*

**PURPOSE:** The purpose of this study was to examine the relationship between parental BMI and the family environment and determine if differences exist in child diet and physical activity parenting behaviors by parental BMI in a community sample. **METHODS:** Parents from 10 elementary schools in a county adjacent to our university provided family demographic information including: parent/child age, parent/child gender, parent educational attainment, marital status, family household income, child free or reduced price lunch status, self-reported height and weight. The Family Nutrition and Physical Activity (FNPA) measure was used to examine family diet, physical activity, screen time, sleep, and family schedule and provide a comprehensive evaluation of the "healthiness" of the family environment. An additional validated measure was used to assess parental behavior related to child diet and physical activity. **RESULTS:** Recruitment packets were sent to all 2,392 elementary students in the school district via school-home folders. Two hundred sixty six parents who indicated interest were then sent surveys. A total of 148 surveys were returned to us; 143 had complete data. We found an association between parental BMI category and FNPA score ( $\chi^2 = 5.247, p = 0.022$ ). Families with an underweight or normal weight parent (n = 70) had a larger proportion (64.3%) of high FNPA scores ("more healthy" environment) and families with an overweight or obese parent (n = 73) had a smaller proportion (45.2%) of high FNPA scores. Families with a parent who was overweight or obese had 2.18 times the odds (95% CI = 1.11 - 4.27) of being in the low FNPA ("less healthy" environment) group. Further, underweight/normal weight parents reported higher levels of monitoring of child diet (t = 3.6719, p = 0.0003), higher levels of parental monitoring of child physical activity (t = 2.1204, p = 0.0387), and higher levels of parental limit setting related to child sedentary activities compared to overweight/obese parents (t = 3.2364, p = 0.0015). **CONCLUSION:** Parent BMI and parenting behaviors are known to have a major impact on child weight status. In this study, lower parent BMI and authoritative parenting behaviors were associated with a less obesogenic home environment and a more positive parenting style related to child eating and physical activity behaviors.

1957 Board #109 June 2, 3:30 PM - 5:00 PM  
**High-Protein, Intermittent-Fasting Intervention is Effective in Weight Loss and Improving Arterial Function in Obese Adults**  
 Feng He<sup>1</sup>, Li Zuo, FACSM<sup>2</sup>, Benjamin Pannell<sup>3</sup>, Emery Ward<sup>3</sup>, Paul Arciero, FACSM<sup>2</sup>. <sup>1</sup>California State University, Chico, CA. <sup>2</sup>The Ohio State University, Columbus, OH. <sup>3</sup>Skidmore College, Saratoga Springs, NY. (Sponsor: Paul J. Arciero, FACSM)  
 Email: fhe@csuchico.edu  
*(No relationships reported)*

Weight loss (WL) interventions have been shown to benefit fat mass loss. However, adverse cardiovascular complications may be associated with WL. **PURPOSE:** To examine the effects of a high-protein, intermittent-fasting, low-calorie (HP-IF-LC) diet on blood lipids and arterial function during WL and weight-loss maintenance

1958 Board #110 June 2, 3:30 PM - 5:00 PM  
**The Effect Of Interval Training On Body Composition And Visceral Adipose Tissue**  
 Joseph White, Gabriel Dubis, Robert Hickner, FACSM. *East Carolina University, Greenville, NC.*  
 Email: whitejos13@students.ecu.edu  
*(No relationships reported)*

Exercise is a component of physical activity that can combat and treat metabolic disease despite little to no weight loss, however, exercise is effective at reducing fat storage in the visceral adipose tissue (VAT) depot. The distribution of body fat may be more important for the development of metabolic disease than overall adiposity as evidence suggests that the amount of VAT is more closely related to morbidity and mortality. **PURPOSE:** To determine the effect of interval training on body composition and VAT in overweight and obese men and women. **METHODS:** Overweight and obese men and women (n = 6) performed interval training 3x/wk for 8wks. Each training session was performed on a treadmill and included a 10min warm-up at 70% heart rate max (HRM) and 4 intervals at 88-92% HRM for 4min followed by 3min at 70% HRM. VO2max, body composition (DXA), and VAT mass/volume (DXA) were measured at baseline and after the interval training program. **RESULTS:** Interval training resulted in a significant increase in VO2max (31.7±3.2 to 33.6±3.1 ml/kg/min, p = 0.022). Body fat percentage (34.5±4.1 to 34.3±4.2 %, p = 0.1174) and android fat mass (2545.5±469 to 2570.8±527.9 g, p = 0.8048) did not change significantly with interval training; however, there was a trend towards a reduction in VAT mass (770.7±191.5 to 668.7±193.5 g, p = 0.0505) and VAT volume (817±203 to 708.8±205.1 cm<sup>3</sup>, p = 0.0503). **CONCLUSION:** 8wks of interval training in overweight and obese men and women does not result in a decrease in overall body fat but may provide a stimulus for a reduction in VAT storage.

1959 Board #111 June 2, 3:30 PM - 5:00 PM  
**Regional Distribution of Body Composition: Associations with Metabolic Health in Overweight and Obese Adults**  
 Katie R. Hirsch, Meredith G. Mock, Eric T. Trexler, Malia N.M. Blue, Abbie E. Smith-Ryan. *University of North Carolina at Chapel Hill, Chapel Hill, NC.*  
 Email: ktrose23@live.unc.edu  
*(No relationships reported)*

Despite associations between excess body fat and metabolic dysfunction, there is growing recognition of metabolically healthy obese individuals. Assessment of other indicators of metabolic health beyond excess fat may provide further insight into understanding metabolic health. **PURPOSE:** To assess associations between total and regional body composition (fat mass [FM], lean mass [LM], percent body fat [%fat], visceral adipose tissue [VAT], and abdominal subcutaneous adipose tissue [SAT]), resting metabolic rate (RMR), fuel utilization at rest (RER) and blood markers in overweight and obese (OW/OB) adults. **METHODS:** Forty-nine OW/OB adults (Mean ± SD; Age=35.0 ± 8.9 yrs; Body mass index=33.6 ± 5.2 kg·m<sup>-2</sup>) volunteered to participate. Body composition was calculated using a 4-compartment model. B-mode ultrasound was used to quantify VAT and SAT. Indirect calorimetry was used to determine RMR and RER during a 30-minute resting test and during a steady-state cycle ergometer ride at 50-60% heart rate reserve. Fasted blood samples were analyzed for total cholesterol (TC), high-density lipoproteins (HDL), low-density lipoproteins (LDL), triglycerides (TRG), and glucose (GLUC). **RESULTS:** When controlling for sex in partial correlations, FM was significantly correlated with

VAT ( $p=0.031$ ,  $r=0.371$ ), RMR ( $p=0.000$ ,  $r=0.648$ ), and GLUC ( $p=0.005$ ,  $r=0.467$ ). When also controlling for LM, relationships with VAT and RMR were non-significant ( $p>0.05$ ); the relationship with GLUC remained significant ( $p=0.007$ ,  $r=0.459$ ). Lean mass significantly correlated with FM ( $p<0.001$ ,  $r=0.736$ ), RMR ( $p<0.001$ ,  $r=0.800$ ), and RER ( $p=0.008$ ,  $r=0.445$ ); relationships with RMR and RER remained significant ( $p<0.05$ ) when also controlling for FM. Percent fat was significantly correlated with GLUC ( $p=0.006$ ,  $r=0.462$ ). There were no associations between fat distribution and metabolic rate, fuel utilization, or blood markers. **CONCLUSIONS:** Excess FM, increased VAT, low RMR, and increased reliance on carbohydrate metabolism are all potential indicators of poor metabolic health. Results indicate that, while excess FM may be related to higher glucose levels, greater LM in the presence of excess FM may benefit metabolic health by increasing resting energy expenditure. Supported by Scivation Inc.

1960 Board #112 June 2, 3:30 PM - 5:00 PM  
**Programming Resistance Training Required For Positive Effects On Body Composition In Community Programmes**

Steven Mann<sup>1</sup>, Alfonso Jimenez<sup>2</sup>, Sarah Domone<sup>1</sup>, Matthew Wade<sup>1</sup>, Chris Beedie<sup>3</sup>. <sup>1</sup>ukactive Research Institute, London, United Kingdom. <sup>2</sup>Coventry University, Coventry, United Kingdom. <sup>3</sup>University of Essex, Colchester, United Kingdom. Email: stevenmann@ukactive.org.uk  
 (No relationships reported)

**Purpose.** Many sedentary adults possess not only a high body fat percentage (BFP), but also low lean body mass (LBM). The latter may predispose metabolic disease such as Type-2 Diabetes. The majority of public health messaging around physical activity centers on habitual (e.g., walking) or purposeful (e.g., jogging) aerobic activity. However, few positive effects on muscle mass result from such activities. Whilst resistance training (RT) is an obvious solution, its effectiveness in public health settings is not demonstrated. We report two community-based RT studies, Study 1 delivered to a sedentary population, Study 2 to overweight and pre-diabetic patients. **Methods:** In Study 1 (48-weeks), participants ( $n=364$ ) were allocated to either programmed-exercise (PROG), un-programmed use of a community gym (FREE), or monthly physical activity counseling (PAC). A wait-list control (CONT) was employed. In Study 2 (12-weeks), overweight and pre-diabetic patients ( $n=141$ ) were randomly assigned to 12 sessions of either supervised exercise (SUP), PAC, or the two combined (COMB). A wait list control was employed. **Results.** In Study 1, ANOVA indicated significant differences between treatments. PROG performed significantly better than CONT on strength ( $p=.048$ ) and LBM ( $p=.009$ ). FREE performed significantly better than CONT on strength ( $p=.029$ ). Paired-sample t-tests indicated that PROG improved significantly pre-post on strength ( $p=.001$ ), LBM ( $p=.036$ ) and BFP ( $p=.006$ ), whilst improvements in strength only were observed in FREE ( $p=.01$ ) and PAC ( $p=.014$ ). In Study 2 ANOVA indicated no significant differences between treatments. However paired-sample t-tests indicated that SUP improved significantly pre-post on strength ( $p=.01$ ) and BFP ( $p=.027$ ), with a clear trend also in LBM ( $p=.074$ ), whilst significantly improved strength only was observed in COMB ( $p=.026$ ) and PAC ( $p=.016$ ). **Conclusions.** In both studies, whilst statistically significant increases in strength were observed across all treatments, significant improvements in both strength and body composition were observed only in programmed and/or supervised conditions. Collectively data suggest that the programming and supervision of resistance training is beneficial in community settings when improvements in body composition are desired.

1961 Board #113 June 2, 3:30 PM - 5:00 PM  
**Exercise-induced FNDC5/Irisin Activation Drives Brown-like Adipocyte Phenotype in Visceral Adipose Tissue from Obese Rats**

Silvia Rocha-Rodrigues<sup>1</sup>, Alexandra M Gouveia<sup>2</sup>, Inês O Gonçalves<sup>1</sup>, Emanuel Passos<sup>1</sup>, António A Ascensão<sup>1</sup>, José Magalhães<sup>1</sup>. <sup>1</sup>Faculty of Sport Sciences, Porto, Portugal. <sup>2</sup>Faculty of Medicine, Porto, Portugal. Email: silviadarocharodrigues@gmail.com  
 (No relationships reported)

Exercise-stimulated myokines have pleiotropic effects in several tissues, including white adipose tissue (WAT). The recently discovered FNDC5/irisin is secreted into circulation in response to exercise and might induce brown adipocytes-in-WAT, which has been associated with greater whole-body energy expenditure. However, the role of exercise on FNDC5/irisin levels remains unclear. **PURPOSE:** To investigate whether voluntary physical activity (VPA) and endurance training (ET) induce brown-adipocyte phenotype in visceral WAT from obese rats. **METHODS:** Sprague-Dawley rats were allocated into sedentary, VPA and ET groups fed with a standard (STD, 35%Kcal-derived fat) or high-fat diet (HFD, 71% Kcal-derived fat) during 17 wks. VPA-animals had free access to running wheel during the study. After 9 wks of hypercaloric-diet feeding, ET-animals were submitted to 8-wks treadmill while maintained dietary

treatments. Gastrocnemius muscle was removed for FNDC5 protein determination by Western Blot. Visceral WAT depots were weighted and epididymal (eWAT) was used to determine mRNA levels of Bmp7, Tmem26 and Cidea by qPCR. Diet and exercise effects were performed using two-way ANOVA. **RESULTS:** The caloric intake and body weight did not differ significantly between diet groups ( $p>0.05$ ). HFD-induced increase in visceral adiposity ( $9\pm 0.2$  vs.  $10.8\pm 0.4\%$ ,  $p<0.05$ ). VPA had no impact either on gastrocnemius FNDC5 protein or on eWAT Bmp7, Tmem26 and Cidea gene expression ( $p>0.05$ ). Although no alterations in Bmp7 and Tmem26, ET induced an increase of Cidea expression in obese animals ( $43.2\pm 17.7$  vs.  $216.9\pm 20.1\%$ ,  $p<0.01$ ), which was positively associated with gastrocnemius FNDC5 ( $p<0.001$ ;  $r=0.7$ ) and negatively associated with visceral adiposity ( $p<0.001$ ;  $r=-0.79$ ). **CONCLUSIONS:** Taken together, ET-related increase in skeletal muscle FNDC5 protein could, at least, mediate brown-like adipocyte phenotype in eWAT from obese rats, which was also associated with reduced visceral fat accumulation.

1962 Board #114 June 2, 3:30 PM - 5:00 PM  
**Impact of Birth Weight on DXA-Measured Body Composition in Young Adults**

Kristen M. Metcalf, Elena M. Letuchy, Steven M. Levy, Kathleen F. Janz, FACSM. The University of Iowa, Iowa City, IA. Email: Kristen-metcalf@uiowa.edu  
 (No relationships reported)

**PURPOSE:** Low birth weight has been linked to adult obesity and poor metabolic profiles, as well as abdominal adiposity in later childhood. However, the lasting impact of low birth weight on adult body composition is unclear. Few studies have prospectively examined this relationship into adulthood using criterion measures of body composition. The purpose of this study was to assess whether birth weight influences adult adiposity and fat free mass (FFM).

**METHODS:** We prospectively examined the relationship between birth weight and adult body composition in a cohort of Iowa Bone Development Study participants at age 19. Participants ( $n=147$  females; 116 males) were recruited at birth. Birth weight and gestational age were verified from participant medical records at the time of recruitment. Covariates and body composition measures were collected at age 19. DXA was utilized to measure body composition (kg fat mass (fat); kg FFM; g visceral adipose tissue (VAT)). Gender-specific linear regression was used to assess the association between birth weight (exposure) and adult body composition (outcomes). Models controlled for age, height, fat or FFM, gestational age, and lifestyle factors including Healthy Eating Index and objectively measured moderate-to-vigorous intensity physical activity (MVPA). Fat, VAT, and MVPA were transformed due to non-normal distributions.

**RESULTS:** Participants had an average birth weight of 3.51 kg (range: 0.65 - 5.17). Low birth weight, independent of gestational age, is associated with high VAT ( $B = -0.070$ ;  $SE = 0.027$ ;  $p < 0.01$ ), and low FFM ( $B = 4.188$ ;  $SE = 1.174$ ;  $p < 0.01$ ) in males. In females, low birth weight, independent of gestational age, is associated with high FFM ( $B = -2.216$ ;  $SE = 0.728$ ;  $p < 0.01$ ).

**CONCLUSIONS:** Males born of lower birth weight may have rapid weight gain during the first years of life. This catch-up weight gain may alter the bodies' ability to store fat, ultimately leading to higher adiposity and lower FFM in adulthood. Results for females suggest other factors may be more influential on body composition, such as genetics or lifestyle factors.

1963 Board #115 June 2, 3:30 PM - 5:00 PM  
**Effects Of 8-week Bed Rest With Resistance Training On Intramuscular And Subcutaneous Adipose Tissues In Humans**

Madoka Ogawa<sup>1</sup>, Akito Yoshiko<sup>1</sup>, Gabriele Armbecht<sup>2</sup>, Tanja Miokovic<sup>2</sup>, Dieter Felsenberg<sup>2</sup>, Daniel Belavy<sup>3</sup>, Hiroshi Akima<sup>1</sup>. <sup>1</sup>University of Nagoya, Nagoya, Japan. <sup>2</sup>Freie und Humboldt Universitäten, Berlin, Germany. <sup>3</sup>Deakin University, Burwood, Victoria, Australia. (Sponsor: Katsumi Asano, FACSM)  
 (No relationships reported)

Muscle atrophy of lower limbs is induced by bed rest; however, it is not well known how adipose tissue adapts to unloading with and without resistance training under caloric intake controlled situation. There are a few types of adipose tissue in lower limb. In this study, we focused on intramuscular adipose tissue (IntraMAT) and subcutaneous adipose tissue (SAT). (Manini et al. showed significant increase in IntraMAT after 4-week of lower limb unloading, but no information on SAT in uncontrolled caloric intake.) **PURPOSE:** The purpose of this study was to quantify the effect of exercise during 8-week bed rest on IntraMAT, SAT and the skeletal muscle of the thigh.

**METHODS:** Twenty-one men participated in 8-week bed rest and were randomly assigned to either resistance training group (TR,  $n=13$ ) or control group (CTR,  $n=8$ ). The training was performed 3 days a week and consisted of bilateral leg press, single and double leg heel raises, and back and forefoot raise. Axial images of the mid-thigh

were taken before, 1 day after (R+1) and 14 days after (R+14) the bed rest using magnetic resonance imaging. The cross-sectional area (CSA) of IntraMAT, SAT and skeletal muscle were measured. IntraMAT and skeletal muscle were consists of quadriceps, adductors and hamstrings.

**RESULTS:** After the bed rest, IntraMAT CSA was significantly decreased in the TR group (before:  $25.8 \pm 10.5 \text{ cm}^2$  vs. R+1:  $15.1 \pm 6.2 \text{ cm}^2$ ,  $p=0.010$ ) and unchanged in CTR group. SAT CSA after the bed rest was not changed in TR and CTR groups. Skeletal muscle CSA after bed rest was significantly decreased in the CTR group and unchanged in TR group. SAT CSA at R+14 increased compared to measurements taken immediately following the before bed-rest in CTR (before:  $47.5 \pm 18.6 \text{ cm}^2$  vs. R+14:  $57.2 \pm 17.7 \text{ cm}^2$ ,  $p=0.009$ ) and TR groups (before:  $42.8 \pm 24.5 \text{ cm}^2$  vs. R+14:  $48.5 \pm 24.7 \text{ cm}^2$ ,  $p=0.021$ ), but was unchanged for IntraMAT and skeletal muscle CSA.

**CONCLUSIONS:** Resistance training during 8-week bed rest decreased IntraMAT, prevented muscle atrophy and had no effect on SAT. These results demonstrate that resistance training has a depot location specific effect on adipose tissue in bed rest.

1964 Board #118 June 2, 3:30 PM - 5:00 PM  
**Fatty Hydrocarbon Redistribution In Human Skeletal Muscle During Detraining**

Chia-Hua Kuo, FACSM. *University of Taipei, Taipei, Taiwan.*  
Email: kuochiahua@gmail.com  
(No relationships reported)

**PURPOSE:** To investigate the evolution of intramyocellular lipid (IMCL) and extramyocellular lipid (EMCL) storages in exercise trained versus untrained legs after 6-weeks of strength training followed by 4-weeks of detraining. **METHODS:** Eight male participants (aged  $21.4 \pm 1.4$  years) trained the quadriceps and hamstring muscle groups in one leg using a dynamometer for 6 weeks, whereas the contralateral leg served as untrained control. IMCL, EMCL, total creatine of extensor (vastus lateralis) and flexor (biceps femoris) were assessed using <sup>1</sup>H-magnetic resonance spectra (MRS) before training, 3 days after and 28 days after the last bout of training. **RESULTS:** Muscle cross-sectional area and total creatine pool (creatine+phosphocreatine) of the trained muscles increased significantly above pre-trained baseline and was well-maintained despite training stopped for 28 days. One leg training significantly increased IMCL of both trained and untrained legs above pre-trained level. Following 28 days of detraining, only the untrained leg showed a reversal in IMCL storage towards baseline ( $p<0.05$ ). Extramyocellular lipid (EMCL) and total creatine contents of trained extensor (vastus lateralis) and flexor (biceps femoris) continued to increase while the contralateral untrained leg exhibited a reciprocal decrease during the 28-day detraining ( $p<0.05$ ). **CONCLUSION:** Despite isokinetic training benefit on muscle mass and strength can maintain for 4 weeks following the last exercise training bout, our results suggest that the fatty hydrocarbon source of skeletal muscle is dynamically redistributed across the limbs as well as across between myocytes and adipocytes of skeletal due to changed physical demand, influenced by both systemic and local factors.

1965 Board #117 June 2, 3:30 PM - 5:00 PM  
**PPAR $\delta$  Is Required For IL-15-induced Mitochondrial Activity In C2C12 Skeletal Muscle Cells**

Marcia J. Abbott, James E. Krolopp, Shantae M. Thornton, Allison Kawata. *Chapman University, Orange, CA.*  
(No relationships reported)

Obesity is an ever growing epidemic in our society and shows no signs of decelerating in prevalence. Lifestyle interventions have proven successful in the short-term, however, maintenance has proven to be a major roadblock. As such, multiple efforts have turned to molecular regulators of metabolism as likely therapies for obesity. The exercise induced myokine, interleukin-15 (IL-15), has been established as an activator of mitochondrial activity, through induction of expression of transcriptional regulators of metabolism. One downstream target of IL-15 is PPAR $\delta$ , a well-known mediator of mitochondrial activity in skeletal muscle (SKM). However, the relative importance of IL-15 induced increases in PPAR $\delta$  expression has yet to be fully established. **Purpose:** To examine the role of PPAR $\delta$  signaling as a downstream effector of IL-15 action in SKM cells. **Methods:** The SKM cell line, C2C12, was cultured and cells were induced to differentiate into mature myotubes. Upon induction of differentiation, cells were treated every other day, for 6 days, with vehicle (DMSO), IL-15 (100 ng/ml), a PPAR $\delta$  inhibitor (GSK), or IL-15 + GSK. Western blotting was carried out to measure PPAR $\delta$  protein expression. RNA was extracted, reverse transcribed to cDNA, and real-time qPCR was performed to assess expression of mitochondrial associated genes (PPAR $\delta$ , PPAR $\alpha$ , PGC1 $\alpha$ , PGC1 $\beta$ , UCP-2, and Nrf1). To directly examine mitochondrial activity, a citrate synthase (CS) activity assay was performed. **Results:** As verified via western blotting and qPCR, IL-15 effectively induced (200%;  $P<0.05$ ) PPAR $\delta$  expression and these effects were abolished with GSK treatment. IL-15 dramatically increased ( $P<0.05$ ) mRNA levels of PPAR $\alpha$ , PGC1 $\alpha$ , PGC1 $\beta$ , UCP-2, and Nrf1 (40-fold, 1.3-fold, 6-fold, 25-fold, and 10-fold, respectively), when compared to DMSO, and these increases were not detected ( $P>0.05$ ) with GSK in the presence of IL-15.

Similarly, IL-15 stimulated ( $P<0.05$ ) mitochondrial activity, as indicated by increases in CS activity (43%), and GSK combined with IL-15 stimulation blunted these effects.

**Conclusions:** Here we show, for the first time, that inhibition of PPAR $\delta$  blocks the positive effects of IL-15 signaling on mitochondrial activity in SKM cells. Overall, it is clear that the IL-15-PPAR $\delta$  signaling axis holds potential as a treatment for obesity.

1966 Board #118 June 2, 3:30 PM - 5:00 PM  
**The Effect Of Exercise In Gastrocnemius Muscle Alterations-induced By Obesity: Biogenesis And Oxidative Stress Mechanisms.**

Jorge Belezza, Inês Marinho, Sílvia Rocha-Rodrigues, Inês O. Gonçalves, António Ascensão, José Magalhães. *Faculty of Sports, University of Porto, Porto, Portugal.*  
(No relationships reported)

In the management of obesity, exercise has been proposed as one of the first line strategies and skeletal muscle a key organ in energy expenditure. However, the role of exercise in biogenesis and oxidative stress, both key mechanisms in obesity development, remain unclear.

**PURPOSE:** Analyze the effect of exercise on mitochondrial biogenesis and oxidative stress alterations-induced by obesity in gastrocnemius muscle.

**METHODS:** Male Sprague-Dawley rats (n=24) were divided in two groups: a standard diet (SS, n=11) and a high-fat diet sedentary group (HS, n=13). Following 9 weeks of diet treatment, half of SS and HS group were engaged in an exercise program on treadmill for 8 weeks, 5 days/week and 1hour/day (ST, n=5 and HT, n=7). Skeletal muscle oxidative damage markers (MDA and SH) and pro-oxidant signaling proteins (SIRT3 and P66shc) content were evaluated. The content of biogenesis-related proteins (Tfam and PGC-1 $\alpha$ ) and mitochondrial complex sub-units were also assessed.

**RESULTS:** High-fat diet treatment (HT) induced an increase of thiol groups ( $0.041 \pm 0.003$  vs.  $0.031 \pm 0.003$  mmol.mg protein<sup>-1</sup>,  $p<0.05$ ), Sirt3 ( $161 \pm 19.99$  vs.  $100 \pm 33.01$ ,  $p<0.05$ ), PGC-1 $\alpha$  ( $195.4 \pm 41.04$  vs.  $100 \pm 28.57$ ,  $p<0.05$ ) and complex III ( $195.70\% \pm 13.43$  vs.  $100 \pm 48.43$ ,  $p<0.05$ ) content compared to SS. The HT animals showed a decreased Sirt3 ( $85.41 \pm 10.65$  vs.  $161 \pm 19.99$ ,  $p<0.05$ ), PGC-1 $\alpha$  ( $85.10 \pm 21.66$  vs.  $195.4 \pm 41.04$ ,  $p<0.05$ ) and complex III content ( $99.35 \pm 18.39$  vs.  $195.7 \pm 13.43$ ,  $p<0.05$ ) compared to HS, whereas complex IV was significantly increased ( $242.40 \pm 38.94$  vs.  $93.14 \pm 7.1$ ,  $p<0.05$ ). No changes were observed in MDA levels or P66shc and Tfam content.

**CONCLUSIONS:** Obesity might induce skeletal muscle mitochondrial biogenesis as an attempt to increase fatty acid oxidation, ultimately contributing to ameliorate redox pressure. In turn, the increased expression of complex IV in HT group, might have contributed to improve the oxidation of mitochondrial substrates.

1967 Board #119 June 2, 3:30 PM - 5:00 PM  
**Effects Of Estrogen Deficiency And Isoflavone On Skeletal Muscle Adaptation In Response To Physical Activity**

Wenya Zheng, Jonas Hengevoß, Patrick Diel. *Cardiovascular Research and Sports Medicine, Cologne, Germany.*  
(No relationships reported)

The decrease of skeletal muscle performance is a major health risk in postmenopausal women. Loss of skeletal muscle mass is associated with a loss of strength but also with the development of metabolic syndrome. Isoflavone (ISO) supplementation and physical activity have shown some beneficial effects on muscle maintenance.

**PURPOSE:** To determine functional and metabolic adaptations of the skeletal muscle to a specific high-intensity exercise in ovary intact and ovariectomized (OVX) animals as well as its combination with an ISO-enriched diet. **METHODS:** Female Wistar rats were assigned to five groups: (1) sham-operated (SHAM); (2) SHAM with exercise (SHAM+EX); (3) OVX; (4) OVX+EX; (5) OVX with EX and an ISO-enriched diet (OVX+EX+ISO). A high intensity exercise protocol was designed for the exercise groups. Rats were trained 10 min/time, twice/day, a rest day every four days on a treadmill with an incline of 25° for 61 days and a gradually increasing velocity from 12 to 20 m/min. Lipid (cholesterol and LDL) and leptin levels in serum were measured. Gene expression in soleus muscle was investigated by Real-time PCR. **RESULTS:** Body weight, visceral fat mass and serum leptin level were about 54%, 20% and 87% increased by OVX compared with SHAM ( $p<0.05$ ). Exercise significantly decreased all three parameters both in SHAM (37%, 28% and 40%) and in OVX (42%, 31% and 55%) groups ( $p<0.05$ ). ISO supplementation showed no additive effects. The values of cholesterol and LDL in OVX were about 59% and 64% higher than those of the SHAM rats. Exercise or ISO resulted in no additional effect. Exercise increased PPAR $\gamma$  and MyoD mRNA expressions both in SHAM and OVX groups in soleus muscle. In OVX rats, the gene expression of IGF-1 was also up-regulated by exercise. Additionally, the highest expressions of MyoD and IGF-1 in OVX rats were observed in OVX+EX+ISO group ( $p<0.05$ ). **CONCLUSION:** Estrogen deficiency resulted in effects like increasing body weight, visceral fat mass, leptin, cholesterol and LDL. The designed exercise antagonized all increasing effects except for the lipid levels.

In soleus muscle, the exercise enhanced gene expressions of PPAR $\gamma$  as a marker for regulation of insulin sensitivity. MyoD and IGF-1 gene expressions, as markers for myogenesis, were increased by exercise and its combination with ISO in OVX rats. Supported by DFG Di 716/12-1

1968 Board #120 June 2, 3:30 PM - 5:00 PM

### The Effects Of A High-fat Diet And Exercise On The Pgc-1 $\alpha$ -fnDC5/irisin Pathway In C57bl/6 Mice

Brianne L. Guilford<sup>1</sup>, Jake C. Parson<sup>1</sup>, Stephanie N. Vick<sup>1</sup>, Caleb W. Grote<sup>2</sup>, Janelle M. Ryals<sup>2</sup>, Douglas E. Wright<sup>2</sup>. <sup>1</sup>*Southern Illinois University Edwardsville, Edwardsville, IL.* <sup>2</sup>*University of Kansas Medical Center, Kansas City, KS.*

(No relationships reported)

Irisin has recently been identified as a novel protein that stimulates the “browning” of white adipose by inducing thermogenesis via increased uncoupling protein 1 (UCP1). Exercise, in a peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1 $\alpha$ ) dependent manner, increases the release of the irisin precursor, fibronectin type III domain-containing protein 5 (FNDC5) from muscle. Irisin holds potential as a novel pharmacotherapeutic that could be used in the treatment of obesity. Prior studies have assessed the effects of exercise on irisin and proteins upstream and downstream of its activation, but the effects of diet on irisin have not been investigated.

**PURPOSE:** The aim of this study was to evaluate the effects of diet and exercise on FNDC5 and associated proteins.

**METHODS:** C57BL/6 mice were randomized into three groups for the 4 wk intervention: Mice were fed a standard diet (Std,  $n = 12$ ), a high-fat diet (HF,  $n = 14$ ), or fed a high-fat diet and housed individually with free access to a running wheel (HFEX,  $n = 14$ ). At end study, mice were sacrificed, the gastrocnemius was harvested, and FNDC5, UCP1, and PGC-1 $\alpha$  levels were measured by western blot and normalized to  $\alpha$ -tubulin and reported as integrated density units.

**RESULTS:** Body weight was greater in HF compared to Std ( $p < 0.001$ ) and HFEX ( $p < 0.001$ ) after the 4 wk intervention. (Std:  $27.1 \pm 1.7$ ; HF:  $30.4 \pm 2.3$ ; HFEX:  $27.1 \pm 1.9$  g). There was a trend ( $p = 0.09$ ) toward increased FNDC5 levels in HF compared to HFEX (HF:  $0.73 \pm 0.08$  vs. HFEX:  $0.51 \pm 0.08$ ). UCP1 levels were significantly lower ( $p < 0.05$ ) in the HFEX ( $0.66 \pm 0.11$ ) compared to both Std ( $1.2 \pm 0.19$ ) and HF ( $1.1 \pm 0.24$ ). There were no significant differences among groups in PGC-1 $\alpha$  (Std:  $0.93 \pm 0.17$ , HF:  $0.77 \pm 0.13$ , HFEX:  $1.2 \pm 0.36$ ).

**CONCLUSION:** Although there were no statistically significant differences in FNDC5 levels, the trend toward increased FNDC5 in HF compared to HFEX suggests increased FNDC5 may be a compensatory mechanism to offset HF diet-induced weight gain by increasing energy expenditure. Exercise prevented excess weight gain in HF fed mice, but these effects do not appear to be mediated by increased FNDC5 levels. Further investigation, including assessment of FNDC5, PGC-1 $\alpha$ , and UCP1 levels in adipose from these mice will be performed to confirm the effects of HF feeding on the FNDC5/irisin pathway.

1969 Board #121 June 2, 3:30 PM - 5:00 PM

### Effect Of Reduced Energy Availability By Either Diet Or Exercise On Muscle Force.

Daniel E. Martin<sup>1</sup>, Maria Papageorgiou<sup>1</sup>, Hannah Colgan<sup>1</sup>, William D. Fraser<sup>2</sup>, Julie P. Greeves<sup>3</sup>, Craig Sale<sup>1</sup>, Simon B. Cooper<sup>1</sup>, Kirsty J. Elliott-Sale<sup>1</sup>. <sup>1</sup>*Nottingham Trent University, Nottingham, United Kingdom.* <sup>2</sup>*University of East Anglia, Norwich, United Kingdom.* <sup>3</sup>*Headquarters Land Forces, Andover, United Kingdom.*

Email: daniel.martin@ntu.ac.uk

(No relationships reported)

Athletes often undergo periods of low energy availability (EA) and it is important to know whether muscle function is compromised as a consequence. **Purpose:** To determine the differential effects on muscle force production when low EA is attained by reduced dietary energy intake (DEI) or increased exercise energy expenditure (EEE). **Methods:** Using a randomised, counterbalanced design, 22 females (mean  $\pm$  SD age:  $26 \pm 5$  y; 11 oral contraceptive [OC] users, 11 eumenorrheic [EU]) were assessed for body composition using DXA. They then completed three 3-day experimental conditions consisting of: controlled energy balance (EB); dietary-induced energy restriction (ER-D); and exercise-induced energy restriction (ER-E). EB was achieved by a DEI of  $45 \text{ kcal} \cdot \text{kg} \cdot \text{LBM}^{-1} \cdot \text{day}^{-1}$  with  $0 \text{ kcal} \cdot \text{kg} \cdot \text{LBM}^{-1} \cdot \text{day}^{-1}$  EEE. ER-D was achieved by a DEI of  $15 \text{ kcal} \cdot \text{kg} \cdot \text{LBM}^{-1} \cdot \text{day}^{-1}$  and an EEE of  $0 \text{ kcal} \cdot \text{kg} \cdot \text{LBM}^{-1} \cdot \text{day}^{-1}$ , resulting in an EA of  $15 \text{ kcal} \cdot \text{kg} \cdot \text{LBM}^{-1} \cdot \text{day}^{-1}$ . The same level of EA was achieved in ER-E with DEI of  $45 \text{ kcal} \cdot \text{kg} \cdot \text{LBM}^{-1} \cdot \text{day}^{-1}$  and treadmill running at 70% aerobic capacity until  $30 \text{ kcal} \cdot \text{kg} \cdot \text{LBM}^{-1} \cdot \text{day}^{-1}$  was expended. Body mass and maximal voluntary isometric force (MVIF) of the quadriceps and first dorsal interosseus (FDI) muscles were measured in the morning prior to and following each 3 day condition. Muscle force data were analysed using three way mixed-model ANOVA and body mass %change from pre to post in each condition was analysed using a one-way

repeated measures ANOVA, with Bonferroni adjusted *post hoc* t-tests. **Results:** There was no group (OC vs. EU) effect for any measure ( $P > 0.05$ ). ER-D ( $-1.8 \pm 0.6\%$ ) and ER-E ( $-0.9 \pm 0.6\%$ ) resulted in a greater reduction in body mass than EB ( $-0.6 \pm 0.5\%$ ), with ER-D resulting in a greater reduction in body mass than ER-E ( $P \leq 0.05$ ). MVIF of the FDI muscle was maintained from pre to post in the EB, ER-D and ER-E conditions ( $P > 0.05$ ). Quadriceps MVIF was maintained from pre to post in the EB and ER-D conditions, however there was a 13.1% decline in quadriceps MVIF from pre ( $372.6 \pm 84.7\text{N}$ ) to post ( $323.9 \pm 99.2\text{N}$ ) ER-E ( $P = 0.017$ ). **Conclusion:** Low EA achieved through dietary restriction had no effect on MVIF of the quadriceps or FDI muscle, however low EA caused by increased EEE resulted in a decline in MVIF of the fatigued quadriceps, which was not observed in the fresh FDI muscle. These effects were similar for both the OC and EU groups.

## D-31 Basic Science World Congress/Poster - Energy Balance: Methodology

Thursday, June 2, 2016, 1:00 PM - 6:00 PM

Room: Exhibit Hall A/B

1970 Board #122 June 2, 2:00 PM - 3:30 PM

### Differences In Peak Mets Calculated Using Standard Mets Or Rmr In Normal And Overweight/obese Adults

Mark A. Sarzynski<sup>1</sup>, Clemens Drenowatz<sup>1</sup>, Madison Demello<sup>1</sup>, Gregory A. Hand, FACSM<sup>2</sup>, Steven N. Blair, FACSM<sup>1</sup>.

<sup>1</sup>*University of South Carolina, Columbia, SC.* <sup>2</sup>*West Virginia University, Morgantown, WV.* (Sponsor: Steven N. Blair, FACSM)

Email: sarz@mailbox.sc.edu

(No relationships reported)

**PURPOSE:** To examine differences in peak metabolic equivalents (METs) achieved calculated using standard METs (1 MET =  $3.5 \text{ ml/kg/min}$ ) or resting metabolic rate (RMR; in  $\text{ml/kg/min}$ ) in a large sample of adults.

**METHODS:** Participants were 419 healthy adults (51% female, 67% white, mean age 27.6 yrs) from the Energy Balance Study. RMR was measured using indirect calorimetry and fitness via maximal treadmill test with recorded gas exchange. We analyzed males and females stratified by weight status (overweight/obese: BMI  $\geq 25 \text{ kg/m}^2$ ; normal weight: BMI  $< 25 \text{ kg/m}^2$ ) separately.

**RESULTS:** Irrespective of sex, overweight/obese participants had significantly ( $p < 0.0001$ ) lower mean values of RMR,  $\text{VO}_{2\text{peak}}$ , and peak standard METs achieved compared to normal weight participants (Table). However, when peak METs was calculated using measured RMR ( $\text{VO}_{2\text{peak}}/\text{RMR}$ ; both in  $\text{ml/kg/min}$ ), no difference ( $P = 0.10$ ) in peak METs was observed between overweight/obese ( $14.2 \pm 2.3$ ) and normal weight males ( $14.7 \pm 2.3$ ); whereas peak RMR-based METs remained lower in overweight/obese compared to normal weight females (Table). The difference between peak METs measured via RMR or standard METs was significantly larger in overweight/obese participants, reflecting their lower RMR values (Table).

**CONCLUSIONS:** As expected, overweight individuals had lower mean values of RMR,  $\text{VO}_{2\text{peak}}$ , and peak standard METs achieved than normal weight individuals. However, when using RMR to calculate peak METs achieved, mean values were higher in all groups and similar between normal and overweight/obese males, but not females. These results highlight the limitations of quantifying maximal exercise capacity using the standard MET value.

Supported by a grant from the Coca-Cola Company.

Table. Mean values for resting metabolic rate and maximal exercise capacity across sex and weight groups.

|  | Males            |               |         | Females          |               |         |
|--|------------------|---------------|---------|------------------|---------------|---------|
|  | Overweight/obese | Normal weight | p-value | Overweight/obese | Normal weight | p-value |
| N  | 109 (79/30)      | 95            |         | 101 (57/44)      | 114           |         |
| RMR (ml/kg/min)                                | 2.9 (0.3)        | 3.19 (0.3)    | <0.0001 | 2.66 (0.3)       | 3.08 (0.3)    | <0.0001 |
| Delta MET-RMR (ml/kg/min)                      | 0.61 (0.3)       | 0.31 (0.3)    | <0.0001 | 0.84 (0.3)       | 0.43 (0.3)    | <0.0001 |
| $\text{VO}_{2\text{peak}}$ (ml/kg/min)         | 41.0 (7.4)       | 46.9 (8.0)    | <0.0001 | 29.4 (6.5)       | 35.9 (7.7)    | <0.0001 |
| Peak standard METs                             | 11.7 (2.2)       | 13.4 (2.3)    | <0.0001 | 8.4 (1.9)        | 10.3 (2.2)    | <0.0001 |
| Peak RMR-based METs                            | 14.2 (2.3)       | 14.7 (2.5)    | 0.10    | 11.0 (2.1)       | 11.7 (2.2)    | 0.02    |
| Delta peak RMR-based METs - peak standard METs | 2.5 (1.4)        | 1.3 (1.1)     | <0.0001 | 3.1 (1.2)        | 1.6 (1.2)     | <0.0001 |

1 MET =  $3.5 \text{ ml/kg/min}$ . Peak standard METs =  $\text{VO}_{2\text{peak}}/3.5$  (both in  $\text{ml/kg/min}$ ). Peak RMR-based METs =  $\text{VO}_{2\text{peak}}/\text{RMR}$  (both in  $\text{ml/kg/min}$ ). Data shown as mean (SD). P-values derived by student's t-test.

1971 Board #123 June 2, 2:00 PM - 3:30 PM  
**Effects of Changing ActiGraph Bandpass Filter Width For Detecting Walking and Running**  
 Samuel R. LaMunio, David R. Bassett, Jr., FACSM, Scott E. Crouter, FACSM. *University of Tennessee, Knoxville, TN.*  
 (Sponsor: Dr. Scott Crouter, FACSM)  
 Email: slamunio@vols.utk.edu  
 (No relationships reported)

**Effects of Changing ActiGraph Bandpass Filter Width For Detecting Walking and Running**

Samuel R. LaMunio, David R. Bassett, Jr. FACSM, and Scott E. Crouter FACSM. The University of Tennessee, Knoxville, TN

**Purpose:** The ActiGraph accelerometer, when worn on the hip, is known to have a plateau in vertical axis (VA) counts at speeds >9.6 km/hr. Currently, it is not known if the counts plateau at other wear locations. Thus, this study examined if a plateau is seen at other wear locations and how changing the bandpass filter frequency width of the ActiGraph GT3X+ affects the device output for both the VA and the vector magnitude (VM; i.e. counts per 5-s) at various walking and running speeds. **Methods:** Twenty participants completed 30-s of treadmill walking and running at 10 different speeds while wearing a GT3X+ on the right hip and left wrist. Data were downloaded using a beta version of the ActiLife software that included broadened bandpass filter frequencies (upper limit of 5.0 and 9.0 Hz vs. default setting of 2.5 Hz). Acceleration was converted to 5-s epochs and the average counts from 5 to 25-s were used for each speed for both the VA and VM. **Results:** The table shows the average counts per 5-s for each wear location and filter used, as well as the correlation between speed and counts for both the VA and VM.

|              | Speed (km/hr) |     |      |      |      |      |      |      |      |      | R <sup>2</sup> |
|--------------|---------------|-----|------|------|------|------|------|------|------|------|----------------|
|              | 3             | 5   | 7    | 8    | 10   | 12   | 14   | 16   | 18   | 20   |                |
| <b>Hip</b>   |               |     |      |      |      |      |      |      |      |      |                |
| Default VA   | 94            | 268 | 417  | 663  | 728  | 735  | 707  | 664  | 604  | 544  | 0.39           |
| 5.0 Hz VA    | 190           | 475 | 866  | 1742 | 2022 | 2160 | 2208 | 2237 | 2211 | 2157 | 0.73           |
| 9.0 Hz VA    | 246           | 550 | 990  | 2037 | 2368 | 2258 | 2663 | 2755 | 2786 | 2802 | 0.80           |
| Default VM   | 185           | 328 | 484  | 698  | 769  | 783  | 761  | 731  | 690  | 658  | 0.49           |
| 5.0 Hz VM    | 306           | 600 | 1024 | 1841 | 2135 | 2288 | 2360 | 2408 | 2420 | 2417 | 0.78           |
| 9.0 Hz VM    | 378           | 714 | 1213 | 2180 | 2536 | 2766 | 2920 | 3063 | 3188 | 3341 | 0.87           |
| <b>Wrist</b> |               |     |      |      |      |      |      |      |      |      |                |
| Default VA   | 196           | 315 | 414  | 1166 | 1388 | 1631 | 1889 | 2110 | 2439 | 2741 | 0.97           |
| 5.0 Hz VA    | 291           | 491 | 744  | 1803 | 2099 | 2462 | 2791 | 3128 | 3530 | 3727 | 0.96           |
| 9.0 Hz VA    | 300           | 499 | 707  | 1833 | 2131 | 2492 | 2524 | 3150 | 3553 | 3927 | 0.96           |
| Default VM   | 279           | 445 | 692  | 1604 | 1813 | 2068 | 2317 | 2524 | 2867 | 3197 | 0.95           |
| 5.0 Hz VM    | 366           | 597 | 954  | 2995 | 3422 | 3818 | 4196 | 4525 | 4982 | 5375 | 0.91           |
| 9.0 Hz VM    | 396           | 632 | 1033 | 3353 | 3813 | 4230 | 4610 | 4966 | 5436 | 5836 | 0.90           |

**Conclusions:** When using the ActiGraph default bandpass filter, neither the VA nor the VM counts plateau at the wrist location. Increasing the bandpass filter frequency to 9 Hz attenuates the plateau seen at the hip location and yields a more linear increase in VA and VM counts for walking and running between 3 and 20 km/hr.

1972 Board #124 June 2, 2:00 PM - 3:30 PM  
**Exercise Training Impact On The Accuracy Of The ACSM's Equations To Estimate Energy Expenditure**  
 Neil Johannsen<sup>1</sup>, Melissa N. Harris<sup>2</sup>, Keely Hawkins<sup>2</sup>, John Apolzan<sup>2</sup>, Catrine Tudor-Locke, FACSM<sup>3</sup>, Conrad P. Earnest, FACSM<sup>4</sup>, Corby Martin<sup>2</sup>, Timothy S. Church<sup>2</sup>. <sup>1</sup>*Louisiana State University, Baton Rouge, LA.* <sup>2</sup>*Pennington Biomedical Research Center, Baton Rouge, LA.* <sup>3</sup>*University of Massachusetts-Amherst, Amherst, MA.* <sup>4</sup>*Texas A&M, College Station, TX.*  
 Email: njohan1@lsu.edu  
 (No relationships reported)

The ACSM metabolic equations are used to estimate energy expenditure (EE) in longitudinal aerobic exercise trials. While the equations are adequate when dose and/or the difference between doses are constant, their accuracy is vital when examining EE effects on weight loss. **Purpose:** To compare EE estimated by ACSM's equation with measured values using indirect calorimetry before and after 6 months of aerobic exercise at 8 or 20 kcal/kg body weight/week. **Methods:** Overweight/obese (N=101, age=48.9±12.0) men and women (71% women) from the EMECHANIC study (NCT01264406) who were compliant (>70% of sessions) and completed baseline and follow-up measures for resting metabolic rate (RMR), graded exercise test for maximal oxygen uptake (VO<sub>2</sub>peak), and submaximal exercise tests at absolute (ABS, 2mph, 0%) and relative (REL, 65-85% VO<sub>2</sub>peak)

intensities were included in this study. The 3 equation components of the treadmill equation, RMR, horizontal (ABS), and horizontal/vertical (REL and VO<sub>2</sub>peak), were compared by percent difference from measured values. **RESULTS:** Mean (95%CI) RMR was overestimated by 45.3% (40.7, 49.8%) at baseline and was reduced at follow-up to 41.3% (36.8, 45.8%; Time P=0.02). For ABS, measured and estimated EE were similar at baseline (0.9%; 95%CI, -1.3, 3.1%); however, at follow-up, the equations overestimated EE by 5.8% (3.6, 8.0%; P<0.001). REL and VO<sub>2</sub>peak estimated EE increased significantly with exercise training (baseline vs. follow-up; 7.1, 95%CI, 6.7, 7.5 kcal/min vs. 9.7, 95%CI, 9.3, 10.1kcal/min and 13.0, 95%CI, 12.4, 13.6kcal/min vs. 14.4, 95%CI, 13.8, 15.0kcal/min. P<0.001 for both, resp). EE was overestimated by 10.5% (8.5, 12.4%) and 15.1% (13.2, 17.1%; P<0.001) in REL and 26.9% (24.0, 29.8%) and 29.5% (26.6, 32.4%; P=0.17) in VO<sub>2</sub>peak at baseline and follow-up, resp. When ABS was corrected for RMR, EE was underestimated by 14.7% (12.3, 17.2%) and 7.5% (5.1, 10.0%) at baseline and follow-up, resp (P<0.001). Exercise dose tended to impact training effects on accuracy at ABS (interaction P=0.07) with a higher dose promoting greater error in EE when corrected for RMR. **CONCLUSIONS:** EE at rest, and at REL and VO<sub>2</sub>peak was overestimated by the ACSM equation. These results have significant implications when conducting exercise trials examining training effects on caloric balance.

1973 Board #125 June 2, 2:00 PM - 3:30 PM  
**The Relationship Between Accelerometer-measured Sedentary Behaviors And Physical Activity Energy Expenditure Measured By Doubly-labeled Water**  
 Stephanie E. Bonn<sup>1</sup>, Eric B. Rimm<sup>1</sup>, Charles E. Matthews, FACSM<sup>2</sup>, Jennifer Rood<sup>3</sup>, Junaidah B. Barnett<sup>4</sup>, Walter C. Willett<sup>1</sup>, Andrea K. Chomistek<sup>5</sup>. <sup>1</sup>*Harvard T.H. Chan School of Public Health, Boston, MA.* <sup>2</sup>*National Cancer Institute, Bethesda, MD.* <sup>3</sup>*Pennington Biomedical Research Center, Baton Rouge, LA.* <sup>4</sup>*Jean-Mayer Human Nutrition Research Center on Aging at Tufts University, Boston, MA.* <sup>5</sup>*School of Public Health at Indiana University-Bloomington, Bloomington, IN.*  
 Email: sbonn@hsph.harvard.edu  
 (No relationships reported)

**Purpose:** The aim was to study the association between accelerometer determined total sedentary time (ST) and breaks in ST with physical activity energy expenditure (PAEE) from doubly-labeled water (DLW). Further, results based on accelerometer counts from only the vertical axis (VT) and from all three axes (VM3) were compared. **Methods:** Data from 748 women and 659 men (43-83 years) were analyzed. Participants wore the Actigraph GT3X accelerometer on the hip during waking hours for seven days twice during the study about 6 months apart. Using the average of the two measurements, total ST was estimated using cut-points of 100 (VT) and 200 (VM3) counts/min. A break in ST was defined as at least one minute of a higher activity count within a sedentary bout. PAEE (kcal/day) was estimated by subtracting resting metabolic rate and the thermic effect of food from total energy expenditure derived from one DLW measurement, with a small subsample having a repeat. Partial Spearman correlations and linear regression models were used to determine associations between total ST and breaks per sedentary hour with PAEE. Correlations and models were adjusted for age, weight, fat free mass, accelerometer wear time and moderate-to-vigorous physical activity (MVPA). **Results:** Mean total ST using VT and VM3 were 9.0 and 7.9 h/day of wear time, respectively, in women and 9.3 and 8.5 h/day in men. Corresponding mean breaks per sedentary hour were 10.4 and 11.0 in women and 9.2 and 9.4 in men. Partial Spearman correlation coefficients between ST and PAEE ranged from -0.34 to -0.44 and correlations between breaks per sedentary hour and PAEE from 0.27 to 0.34. After adjustment for within-person variation in PAEE, correlations for ST ranged from -0.38 to -0.68 and correlations for breaks per sedentary hour from 0.35 to 0.51. In adjusted models, each hour of ST was associated with lower PAEE ( $\beta = -66$  to  $-103$  kcal,  $p < .0001$ ) and each break per sedentary hour was associated with higher PAEE ( $\beta = 21$  to  $39$  kcal,  $p < .0001$ ). Estimates were slightly higher for VT vs. VM3. **Conclusions:** This study found that total ST was inversely associated and breaks in ST was positively associated with PAEE in both men and women independent of body composition and MVPA. Replacing ST with light physical activity and more frequent movement throughout the day may have an impact on an individual's PAEE.

1974 Board #126 June 2, 2:00 PM - 3:30 PM  
**Predicted Versus Measured Caloric Cost During Prolonged Exercise Using Various Work To Rest Cycles**  
 Carina M. Pautz, Douglas M. Jones, Michael J. Buono, FACSM. *San Diego State University, San Diego, CA.*  
 (No relationships reported)

**Purpose:** The purpose of this study was to compare the measured versus predicted caloric cost of prolonged exercise using various work to rest cycles.

**METHODS:**

Ten subjects performed 2 hours of exercise on a treadmill using six different work to rest cycles. Subjects performed in a random order the following six isocaloric protocols:

A: 3.0 mph, 1.7% grade; 30 min rest, 30 min work

B: 3.5 mph, 3.8% grade; 20 min work, 40 min rest

C: 3.0 mph, 1.7% grade; 30 min work, 30 min rest

D: 2.5 mph, 1% grade; 40 min work, 20 min rest

E: 2.0 mph, 1% grade; 50 min work, 10 min rest

F: 1.5 mph, 1.7% grade; 60 min work, 0 min rest

Oxygen consumption was measured every minute using a metabolic cart.

**RESULTS:**

The measured caloric cost for protocols A and F were not significantly different than predicted ( $p > .05$ ). However, in protocols B, C, D, and E the measured caloric cost was significantly greater than predicted. Specifically, the measured caloric cost for the 2 hour exercise bouts were 7-15% higher than predicted from ACSM metabolic equations. When the total caloric cost for each two hour period was separated into working and resting components, the measured versus predicted working components were not significantly different. However, the measured resting components were significantly higher than the predicted values by 24-46% for protocols B, C, D, and E ( $p < .05$ ).

**CONCLUSIONS:**

The increased caloric cost during the resting component is believed to be due to excess post-exercise oxygen consumption. These results suggest that predictive formulas significantly underestimate the total caloric cost during work/rest exercise. Work/rest cycles utilized in an occupational setting may underestimate the total amount of work performed and result in chronic caloric deficits.

| Comparison of Measured versus Predicted energy expenditure during 2 hours of work and rest |                                    |                                     |
|--|------------------------------------|-------------------------------------|
| Workload   | Measured Energy Expenditure (kcal) | Predicted Energy Expenditure (kcal) |
| A  | 402.7 ± 101.3                      | 388.18 ± 76.1                       |
| B  | 436.38 ± 100.4                     | 387.7 ± 74.8                        |
| C  | 432.6 ± 101.1                      | 385.26 ± 77.0                       |
| D  | 414.4 ± 99.4                       | 386.22 ± 77.0                       |
| E  | 445 ± 113.2                        | 386.0 ± 77.5                        |
| F  | 414.3 ± 114.3                      | 387.8 ± 77.4                        |

1975 Board #127 June 2, 2:00 PM - 3:30 PM

### Accuracy of Accelerometers during High Intensity Body Weight Resistance Training

BethAnne Clayton, Paige Wessel, Nuha Shaker, Battogtokh Zagdsuren, Brooke Grimes, Jill Maples. *Western Kentucky University, Bowling Green, KY.* (Sponsor: Matt Green, FACSM)  
Email: bethanne.dickens630@topper.wku.edu

(No relationships reported)

Accelerometers have been found to accurately measure steps and caloric expenditure during walking and running activities. They may fail to detect small, quick movements during agility exercises leading to underestimated energy expenditure. Circuit-style body-weight resistance training (BWRT) has become increasingly popular because it is inexpensive and effective in improving muscular strength and cardiovascular fitness. However, there is lack of evidence that accelerometers can accurately detect energy expenditure during this exercise modality. Additionally, little is known regarding the extent to which participants can accurately estimate caloric expenditure in the absence of an objective physical activity monitor.

**PURPOSE:**

To evaluate the accuracy of five accelerometers (2 wrist-, 1 waist-, and 2 hip-mounted) in estimating energy expenditure while performing an acute bout of BWRT, and to assess individuals' perceived estimated caloric expenditure during the bout.

**METHODS:**

Participants (N=8) underwent baseline testing (resting heart rate, blood pressure, body composition, and VO<sub>2</sub> max). At least 48 hours later, each participant completed the main test: a 15 minute workout consisting of 12 repetitions each of air squats, sit-ups, push-ups, lunges, pull-ups, steps-ups, and high knees; performed circuit-style by completing as many rounds as possible. During the main test, each participant wore a portable metabolic analyzer (PMA) and five different accelerometers. Intensity was standardized (60-80% of VO<sub>2</sub> max) by monitoring breath-by-breath VO<sub>2</sub>.

**RESULTS:**

Four of the five accelerometers reported lower ( $p < 0.01$ ) total caloric expenditure values compared to the PMA during the acute bout of BWRT. The waist-mounted accelerometer (175.38 kcal ± 16.06 SEE) most closely mimicked caloric expenditure compared to the PMA (154.78 kcal ± 8.84 SEE) as indicated by an insignificant  $p$  value (0.056). Participants over-estimated their caloric expenditure by ~38% (participants estimation = 215.00 kcal ± 32.69 SEE).

**CONCLUSIONS:**

The wrist- and hip-mounted accelerometers do not accurately assess energy expenditure during BWRT exercise.

Supported by: WKU Graduate School and NIH NIGMS 2P20GM103436-14.

1976 Board #128 June 2, 2:00 PM - 3:30 PM

### Validation Of The Equivital Lifemonitor For Physiological Monitoring In An Equine Environment

Giles Warrington, FACSM<sup>1</sup>, Adrian McGoldrick<sup>2</sup>, David Stephenson<sup>3</sup>, SarahJane Cullen<sup>4</sup>. <sup>1</sup>University of Limerick, Limerick, Ireland. <sup>2</sup>Turf Club, The Curragh, Ireland. <sup>3</sup>Dublin City University, Dublin, Ireland. <sup>4</sup>Waterford Institute of Technology, Waterford, Ireland.

Email: giles.warrington@ul.ie

(No relationships reported)

The physiological demands of horse racing remain relatively unknown, causing difficulty when prescribing specific nutrition and training guidelines for these unique weight category athletes. Physiological devices that are valid and reliable yet light in weight and robust are essential for the assessment of the physiological demands in a horse racing environment. Limited information is available on valid and reliable physiological monitoring devices to use in a real-life horse racing environment.

**PURPOSE:** To determine the validity of the Equivital physiological monitoring system for the assessment of heart rate (HR) and estimated energy expenditure (EE) in a horse racing environment. **METHODS:** Ten male trainee jockeys (age 17 ± 1yr; height 1.74 ± 0.04m; body mass 60.4 ± 4.6kg; BMI 19.9 ± 0.9kg·m<sup>-2</sup>; sum of skinfolds 44 ± 7.1mm; body fat percentage 7.8 ± 1.2%; VO<sub>2</sub> max 55.26 ± 4.14 ml/kg/min; HR<sub>max</sub> 191 ± 8 beats/min) completed a race simulation trial on a horse racing simulator for the typical time duration to cover a race distance of 1600m. Participants wore the portable gas analysis system (Cosmed K4b<sup>2</sup>) and the Equivital simultaneously during the trial in which mean and peak HR and total estimated EE were assessed and compared.

**RESULTS:** During the simulated race over 1600m, peak oxygen consumption (VO<sub>2</sub> peak) was 62 ± 9% of VO<sub>2</sub> max while peak heart rate (HR<sub>peak</sub>) was 85 ± 5% HR<sub>max</sub> as previously assessed during a maximal incremental test on a cycle ergometer. No significant differences were apparent between the portable gas analysis system and the Equivital for the measures of mean HR (133 ± 9 vs. 131 ± 18 beats/min,  $p=0.492$ ), peak HR (163 ± 11 vs. 161 ± 24 beats/min,  $p=0.086$ ) and total estimated EE (9.2 ± 1.2 vs. 11.3 ± 2.7 kcal;  $p=0.070$ ) during the simulated race. **CONCLUSION:** The Equivital device provides a viable means of assessing HR and estimated EE in a horse racing environment. This may allow for the assessment of the physiological demands in real-life horse racing environments including riding out and competitive racing. Further research is required to assess the physiological demands of various racing conditions and horses to gain a greater understanding of the specific demands of the sport.

1977 Board #129 June 2, 2:00 PM - 3:30 PM

### Resting Metabolic Rate Of Specific Population Subgroups In Comparison To The Standard Metabolic Equivalent (MET)

Katarina Melzer<sup>1</sup>, Juliane Heydenreich<sup>1</sup>, Yves Schutz<sup>2</sup>, Anne Renaud Renaud<sup>1</sup>, Bengt Kayser<sup>3</sup>, Urs Mäder<sup>1</sup>. <sup>1</sup>Federal Institute of Sport, Macolin, Switzerland. <sup>2</sup>Faculty of Biology and Medicine, Fribourg, Switzerland. <sup>3</sup>Faculty of Biology and Medicine, Lausanne, Switzerland.

Email: katarina.melzer@baspo.admin.ch

(No relationships reported)

**PURPOSE:** Metabolic equivalent (MET) represents a standard amount of oxygen consumed by the body under resting conditions that is 3.5 mlO<sub>2</sub>/kg/min or ~1kcal/kg/h. It is used to express the energy cost of physical activity in multiples of MET. However, universal application of the 1-MET standard was questioned, as it does not apply well to all individuals. We compared resting metabolic rate (RMR) of several population subgroups to the standard 1-MET value.

**METHODS:** Height, weight and RMR (indirect calorimetry) were measured in: adolescent males (n=50) and females (n=50) (15±2 yr), women (31±5yr) during pregnancy (35-41 gestation week) (n=46) and 24-53 weeks postpartum (n=27) and active (physical activity level (PAL) = 1.9) men (30±7yr) (n=30). PAL (physical activity level=total energy expenditure (TEE)/RMR) was estimated analyzing 7 full day (24h) recordings of heart rate and body movement.

**RESULTS:** The RMR of adolescent males (1.28 kcal/kg/h (95% CI=1.24-1.33)) was significantly higher than that of adolescent females (1.11 kcal/kg/h (95% CI=1.07-1.14)), with or without the effects of puberty stage and PAL (all  $p < 0.0001$ ). The RMR of adolescent males and females were significantly higher than the RMR of any other adult subgroup (all  $p < 0.01$ , respectively), or the 1-MET-value ( $p < 0.0001$ , respectively). The RMR of both, underweight and normal weight male adolescents were significantly higher than the 1-MET-value ( $p < 0.0001$ ). The RMR of the normal weight female

adolescents were found to be significantly higher ( $p < 0.0001$ ), and those from the overweight female adolescents were found to be similar ( $p = 0.63$ ) to the 1-MET-value. The RMR of the pregnant female subjects was not different of that of the post-pregnant female subjects (1.01 kcal/kg/h (95%CI: 0.98-1.04) vs. 1.00 kcal/kg/h (95% CI: 0.95-1.04),  $p = 0.997$ ). The RMR of pregnant and post-pregnant women were similar to the 1-MET-value ( $p = 0.58$  and  $p = 0.86$ , respectively). The RMR of the active normal weight (0.92 kcal/kg/h (95% CI= 0.87-0.97) and overweight (0.89 kcal/kg/h (95% CI= 0.87-0.97)) adult males were significantly lower than the 1-MET-value ( $p = 0.006$  and  $p = 0.0001$ , respectively).

**CONCLUSION:** An uncritical use of the 1-MET standard value, without taking into account individual characteristics (body composition, sex and age), leads to considerable error.

1978 Board #130 June 2, 2:00 PM - 3:30 PM

### Validation of Physical Activity Estimated Using Wearable Devices under Free-living Conditions

Haruka Murakami<sup>1</sup>, Ryoko Kawakami<sup>2</sup>, Satoshi Nakae<sup>1</sup>, Yosuke Yamada<sup>1</sup>, Yoshio Nakata<sup>3</sup>, Kazuko Ishikawa-Takata<sup>1</sup>, Shigeo Tanaka<sup>1</sup>, Motohiko Miyachi<sup>1</sup>. <sup>1</sup>NIBIOHN, National Institute of Health and Nutrition, Tokyo, Japan. <sup>2</sup>Waseda University, Saitama, Japan. <sup>3</sup>University of Tsukuba, Ibaraki, Japan.  
Email: haruka-m@nih.go.jp

(No relationships reported)

**PURPOSE:** Higher physical activity (PA) in daily life is associated with a decrease in the risk of all-cause mortality and in prevalence of non-communicable diseases (NCDs). Thus, accurate estimation of PA is important for increasing PA and promoting the NCDs prevention. This study was performed to examine the validity of PA energy expenditure (PAEE) and PA level (PAL) estimated using twelve wearable devices under free-living conditions.

**METHODS:** Nineteen healthy adults (9 men and 10 women) aged 21-50 years wore 12 wearable devices simultaneously (five wearable devices on the waist, five on the wrist and two in the pocket including those for the consumer and the research) for consecutive 15 days in a free-living condition. PAEEs were calculated by subtracting the basal metabolic rate (BMR) from the total energy expenditure (TEE) obtained from each device application. PALs were calculated by dividing the TEE by BMR. Because some devices did not show BMR in device applications, TEE values in a day when the devices were stationary were used as BMRs. The reference PAEE and PAL were calculated by using the TEE measured by doubly labeled water (DLW) method during 15 days worn 12 wearable devices and the BMR estimated on the sleeping metabolic rate (SMR) by the metabolic chamber method on a different day.

**RESULTS:** The mean value of reference PAEE and PAL for 15 days were  $1064 \pm 196$  kcal/d (696 to 1541 kcal/d) and  $1.88 \pm 0.21$  (1.51 to 2.23), respectively. Spearman's rank correlation coefficients between the reference PAEE and the estimated PAEE were significant in four wearable devices ( $r = 0.498-0.579$ ,  $p < 0.05$ ), those for PAL were significant in neither wearable devices.

**CONCLUSIONS:** The accurate ranking among individuals based on PAEE and PAL seems difficult. These results suggest that the estimation of PA using wearable devices needs to be cautiously considered.

This research was supported by the Japan Agency for Medical Research and Development (AMED).

1979 Board #131 June 2, 2:00 PM - 3:30 PM

### Evaluation Of Energy Intake At A Range Of Energy Flux Derived From Self-report, Doubly Labeled Water, And Activity Monitors

Robin Shook<sup>1</sup>, Gregory Hand, FACSM<sup>2</sup>, Daniel O'Connor<sup>3</sup>, Clemens Drenowatz<sup>4</sup>, Gregory Welk, FACSM<sup>1</sup>, Daniel Reis<sup>1</sup>, Alicia Carriquiry<sup>1</sup>, Steven Blair, FACSM<sup>4</sup>. <sup>1</sup>Iowa State University, Ames, IA. <sup>2</sup>West Virginia University, Morgantown, WV. <sup>3</sup>University of Houston, Houston, TX. <sup>4</sup>University of South Carolina, Columbia, SC. (Sponsor: Steven Blair, FACSM)  
Email: rshook@iastate.edu

(No relationships reported)

**Purpose:** Self-report estimates of energy intake (EI) are adversely affected by measurement error. Recently, a simple equation has been developed and validated to estimate EI based on the energy balance equation (EI = energy storage + energy expenditure). Our goal was to compare self-report estimates of EI against two alternative values calculated from the energy balance equation.

**Methods:** Body composition of participants (N=195, mean age= 27.9 years, 46% female) was measured at the beginning and end of a two-week assessment period using dual-energy X-ray absorptiometry. Resting metabolic rate (RMR) was measured by indirect calorimetry. Energy expenditure (EE) was assessed using the doubly-labeled water technique and an arm-based activity monitor (Sensewear® Mini, SWA). Self-reported EI was calculated using dietician-administered 24-hour dietary recalls (three days, including at least one weekend day). Two estimates of EI were calculated using

a validated equation: energy equivalent of changes in fat mass and fat-free mass occurring over the assessment period, plus EE from either DLW or SWA. To evaluate estimates of EI, reporting bias ((estimated EI - EE from DLW)/EE from DLW x 100) and Goldberg Cut-offs (estimated EI/RMR) were calculated.

**Results:** Mean±SD EE values from DLW and SWA were  $2731 \pm 494$  and  $2729 \pm 559$  kcal/day, respectively. Self-reported EI was  $2113 \pm 638$  kcal/day, EI derived from DLW was  $2723 \pm 469$ , and EI derived from SWA was  $2720 \pm 730$ . Reporting bias for self-reported EI, DLW EI, and SWA EI are as follows:  $-21.5 \pm 22.2\%$ ,  $-0.7 \pm 18.5\%$ , and  $0.2 \pm 20.8\%$ , respectively. Goldberg Cut-offs for self-reported EI, DLW EI, and SWA EI are as follows:  $1.39 \pm 0.39$ ,  $1.77 \pm 0.38$ ,  $1.77 \pm 0.38$ , respectively. When examined by tertiles of EE, bias of EI derived from self-report, DLW, and SWA varied between low ( $-17.4 \pm 27.5\%$ ,  $-2.9 \pm 18.1\%$ , and  $4.5 \pm 22.3\%$ , respectively) and high groups ( $-25.6 \pm 19.5\%$ ,  $0.4 \pm 17.5\%$ ,  $-4.4 \pm 17.6\%$ , respectively).

**Conclusion:** These results suggest that estimates of EI based on the energy balance equation can provide reasonable estimates of group mean EI. When compared by different levels of energy flux, estimates from all methods varied by EE level, indicating a potential source of bias that requires further investigation.

1980 Board #132 June 2, 2:00 PM - 3:30 PM

### The Need To Redefine Age- And Gender-specific Overweight And Obese Body Mass Index (bmi) Cut-off Points.

Alan M. Nevill, George S. Metsios. University of Wolverhampton, Walsall, West Midlands, United Kingdom.

(Sponsor: Prof Colin Boreham, FACSM)

Email: a.m.nevill@wlv.ac.uk

(No relationships reported)

For convenience, health practitioners and clinicians are inclined to classify people/patients as overweight or obese based on body mass index (BMI) cut-off points of 25 and 30 kg/m<sup>2</sup> respectively, irrespective of age and gender. **PURPOSE:**

To identify whether, for the same levels of adiposity, BMI is the same across different age groups and gender. **METHODS:**

A random sample of 4316 healthy participants were selected, aged 16 years and over, from thirty English parliamentary constituencies. A sub-sample took part in a physical appraisal yielding BMI (kg/m<sup>2</sup>) and estimates of BF% data for 2993 healthy people (male n=1420; female n=1573). Estimates of BF% were determined using the methods based on skin fold thicknesses at four sites; the biceps, triceps, sub-scapular and supra-iliac. **RESULTS:**

A two-way ANCOVA revealed significant differences in BMI between different age groups and gender (plus an interaction), using body fat (%) as the covariate. Younger males in their 20's had greater BMI's (by 4 kg/m<sup>2</sup>) than older males in their 50's for the same levels of adiposity. Similarly, younger females in their 20's had greater BMI's (by 3 kg/m<sup>2</sup>) than females in their 50's also for the same levels of adiposity. **CONCLUSIONS:**

If BMI thresholds for overweight (BMI=25 kg/m<sup>2</sup>) and obese (BMI=30 kg/m<sup>2</sup>) are to reflect the same levels of adiposity across all gender and age groups within a population, age- and gender-specific BMI adjustments outlined above are necessary to more accurately/fairly reflect the same critical levels of adiposity.

1981 Board #133 June 2, 2:00 PM - 3:30 PM

### Best Measure Of Adiposity: Body Mass Index, Corpulence Index, Or Waist Circumference

Sultan M. Babar, Brent Messick, Kevin Burroughs. Carolinas Healthcare System, Concord, NC.

(No relationships reported)

**PURPOSE:**

Body mass index (BMI), since its introduction by Quetlet in 1869, has become a popular method for determining one's adiposity. It is used a surrogate marker of adiposity. Over the course of last century, similar indices have been proposed. Earlier studies had demonstrated that BMI was most fit for clinical use. However, none of those studies used percent body fat as the gold standard. My previous study evaluated BMI and Corpulence index (CI) against percent body fat as calculated by bioelectrical impedance, and showed that CI is a better predictor of adiposity than is BMI. The purpose of this study is to evaluate Body Mass Index, Corpulence Index, and waist circumference against a gold standard. Percent body mass was measured using a DXA scanner.

**METHODS:**

Data from Centers for Disease Control and Prevention (CDC's) National Health and Nutrition Examination Survey (NHANES) datasets from 2003-2004 (n=7,002) was used for this study. Percent body fat, as calculated by a DXA scanner, and the corresponding height, weight, and waist circumference were used to compare Waist circumference (WC), BMI and CI to percent body fat. Linear correlation was used to assess the relationship between these three markers and percent body fat. The analysis was repeated after the data was broken down by gender and race. Using the ASBP percent body fat guidelines, the diagnostic performance of BMI and CI was evaluated.

**RESULTS:**

In the overall analysis, CI had the better R2 value than BMI and WC. After it was broken down by gender, in males, CI's better correlation was better than both BMI and WC. In females, no statistical significant was noted. After the male dataset was broken down by race, CI also proved to better to have a better correlation with percent body fat in blacks, whites, and Mexican-Americans. However, in Hispanics and other/multi-racial they was no statistically significant difference. Female dataset was broken down by race, and again there was not statistical difference between the measures. CI had a higher sensitivity in both males and females. If females, It also had

**CONCLUSIONS:**

CI had a better performance for diagnosing obesity than did BMI or WC.

1982 Board #134 June 2, 2:00 PM - 3:30 PM  
**Impact Of Standardised Versus Non-standardised Athlete Presentation On Technical And Biological Error In Physique Assessment Methods**

Ava Kerr<sup>1</sup>, Gary J. Slater<sup>1</sup>, Nuala Byrne<sup>2</sup>. <sup>1</sup>University of the Sunshine Coast, Sippy Downs, Australia. <sup>2</sup>Bond University, Robina, Australia.  
 Email: akerr@usc.edu.au  
 (No relationships reported)

Two compartment (2C) models of physique assessment contain assumptions that can be overcome by a three compartment (3C) model, where total body water (TBW) is measured rather than assumed, or a four compartment (4C) model, where both TBW and bone mineral content (BMC) are measured. However, as TBW is the most variable component of fat free mass (FFM) the impact of athlete presentation on measurement error in 2C models has not been established.

**PURPOSE:** To evaluate the impact of standardised versus non-standardised athlete presentation on technical and biological error on 2C and 3C models of physique assessment compared with the reference 4C model, over thirty six hours.

**METHODS:** Thirty two athletic males underwent five test sessions using dual energy x-ray absorptiometry (DXA), bioelectrical impedance spectroscopy (BIS) and air displacement plethysmography (BOD POD) to measure body composition, with combinations of these used to establish 3C and 4C models. Tests were conducted after an overnight fast (in duplicate) and ~7 hrs later after *ad libitum* food/ fluid and physical activity, then repeated at 24 hrs replicating the initial test, and finally ~15 min after ingestion of a standardised meal. Magnitudes of changes in the mean and typical errors of measurement were assessed by standardisation.

**RESULTS:** Mean change scores for TBW assessment were trivial for standardised presentation tests (0.2%, -0.3%) and large for non-standardised test (~7 hrs post *ad libitum*) (3.4%). Standardised presentation mean change scores for fat mass (FM) were trivial for all models but substantially large for non-standardised tests (~7 hrs post *ad libitum*) in BIS, 3C, and 4C models (-15.1%, -6.9% and -6.7%) and post meal (9.8%, 5.7% and 5.2%). For FFM, mean change scores for standardised presentation tests were trivial for all models but non-standardised test (~7 hrs post *ad libitum*) produced large changes for BIS, 3C and 4C models (3.4%, 2.3% and 2.2%), small for DXA (1%) and trivial for BOD POD (0.9%).

**CONCLUSIONS:**

Models that included a measured TBW value from BIS (3C and 4C) were more sensitive to TBW changes in non-standardised conditions than 2C models in FM and FFM measurements. Biological error via acute hydration change in FFM is minimised in physique assessment models if athletes present in an overnight fasted state.

1983 Board #135 June 2, 2:00 PM - 3:30 PM  
**A New Specific Equation for the Assessment of Body Fat Percentage in Adolescent Soccer Players**

Gabriel Lozano-Berges, Ángel Matute-Llorente, Alejandro Gómez-Bruton, Jorge Marín-Puyalto, Alejandro González-Agüero, Germán Vicente-Rodríguez, José A. Casajús.  
 UNIVERSITY OF ZARAGOZA, ZARAGOZA, Spain.  
 (No relationships reported)

**PURPOSE:** To determine whether the commonly used anthropometric equations or a new developed specific anthropometric equation are adequate to estimate body-fat percentage (BF%) in adolescent soccer players.

**METHODS:** Ninety-eight players (65 males / 33 females; 13.4 ± 0.6 years) from different Spanish soccer clubs participated in the present study. Following the recommendations of the International Society of the Advancement of Kinanthropometry (ISAK), biceps, triceps, subscapular, supraspinale, iliac-crest, abdominal, front thigh and medial calf skinfolds were measured and inserted in the following prediction equations to estimate BF%: Johnston et al., Slaughter et al., Carter et al., Faulkner et al. and Deurenberg et al. Dual energy X-ray absorptiometry (DXA) was used as a reference method to evaluate BF%. Several 2-paired samples t-test were used to compare BF% from DXA and the different equations. The validity and presence of heteroscedasticity of these equations was assessed by Bland-Altman

analyses. Stepwise linear-regression was used to develop the soccer-specific equation. A cross-validation for the new anthropometric equation was performed using Stein's equation.

**RESULTS:** The developed equation resulted as follows: %BF = 11.115 + 0.775\*(triceps skinfold) + 0.193\*(iliac-crest skinfold) - 1.606\*(sex; being sex=0 for female and sex=1 for male). The present study showed that Johnston et al. equation was the only one without differences with DXA, but with tendency towards heteroscedasticity. However, the proposed equation demonstrated high cross-validation prediction power (R2=0.85).

**CONCLUSIONS:** The specific equation developed in the present study may be the most appropriate for estimating BF% in adolescent soccer players.

1984 Board #136 June 2, 2:00 PM - 3:30 PM  
**Discrepancies Between Cross-calibrated DXA Scanners: Pediatric And Adult Female Body Composition**

Jodi N. Dowthwaite<sup>1</sup>, Kristen A. Dunsmore<sup>2</sup>, Paula F. Rosenbaum<sup>1</sup>, Tamara A. Scerpella<sup>3</sup>. <sup>1</sup>SUNY Upstate Medical University, Syracuse, NY. <sup>2</sup>Syracuse University, Syracuse, NY. <sup>3</sup>University of Wisconsin, Madison, Madison, WI. (Sponsor: Jill Kanaley, FACSM)  
 Email: dowthwaj@upstate.edu  
 (No relationships reported)

**PURPOSE:** Consistency of DXA scan results is critical for data integrity. For pediatric subjects, the extent to which cross-calibration of DXA scanners alleviates model to model scanner differences is unclear. This study compared body composition measurements from cross-calibrated DXA scanners to test for systematic inter-scanner differences.

**METHODS:** In the current study, DXA body composition outcomes were compared for same-day whole body scans (132 females, age range: 8yrs to 24 yrs), using cross-calibrated Hologic Discovery A (DISCO) and QDR4500W (QDR) scanners. Whole body and regional lean mass (LM), non-bone lean mass (nbLM), fat mass (FM) and percent fat (PF) were evaluated (regions: sub-head, trunk, arm, leg, sum arms, sum legs). Spearman Rank tests evaluated inter-scanner correlations. Wilcoxon Signed Rank tests evaluated inter-scanner differences. Bland-Altman plots evaluated patterns of overall agreement between scanner results.

**RESULTS:** Spearman rank correlations were excellent (rho= 0.957 to 0.998, p<0.001). Compared to Discovery A results, QDR scans systematically underestimated LM and nbLM for all regions of interest (Wilcoxon signed rank, Z= -5.52 to -9.93, p<0.001); QDR scans systematically underestimated single arm (Z= -6.43) and leg FM (Z= -7.63) but overestimated trunk FM (Z=7.93) (p<0.001). QDR and Discovery A results were not significantly different for whole body or sub-head FM (p>0.40). Accordingly, QDR scans systematically underestimated whole body, sub-head and trunk PF, relative to Discovery A scans (Z= 2.30 to 7.90, p≤0.02). Despite systematic differences, Bland-Altman plots indicated excellent overall agreement between scan results for whole body and sub-head LM, nbLM and FM. Agreement was weaker for smaller sub-regions (single arm or single leg LM, nbLM, FM; trunk FM); summing data for both limbs improved agreement (sum arms, sum legs). Percentage fat results did not agree as strongly as raw mass data.

**CONCLUSIONS:** In pediatric and young adult subjects, systematic differences were noted between body composition results obtained on DISCO and QDR scanners, despite cross-calibration. Although inter-scanner agreement is good to excellent for most variables, most outcomes are systematically higher for Discovery A than QDR4500W.

Funding: NIAMS R01 AR54145; UW Madison

1985 Board #137 June 2, 2:00 PM - 3:30 PM  
**A Novel Equation to Assess Percent Body Fat in Human**

Yair Lahav<sup>1</sup>, Yoram Epstein, FACSM<sup>2</sup>. <sup>1</sup>Sheba Medical Center, Tel Hashomer; the Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel. <sup>2</sup>Sheba Medical Center, Tel Hashomer; the Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel.  
 Email: yair@lahavcenter.co.il  
 (No relationships reported)

Assessing correctly body fat (BF) content is important for the risk assessment of patients with cardio-metabolic diseases and important for athletes, who have to tightly control body composition. Various methods to assess BF are practiced by clinical dietitians, sports physiologists and sports physicians. Most of them are equipment dependent or need to be measured by an experienced personnel. **PURPOSE:** To suggest a validated simple equation to assess %BF that is based on basic anthropometric measures. **METHODS:** A database of 476 non-athletes individuals (61% males, 39% female), age 20-58 years, whose anthropometric and demographic parameters were available to us served to construct the equation. Additionally, all the participants' had

their body composition measured by DEXA (LUNAR, General Electric), which served as a gold standard for BF, to which we compared our equation. Multicollinearity and Durbin-Watson for residuals analysis with Hierarchical regression were used to define the parameters that will best fit the model. RESULTS: The suggested models, for both male and females, are based on height (H) and circumferences of the abdomen (A) and neck (N) (all measurements are taken in cm) :

For males: %BF= 10.111-0.239\*H+0.808\*A-0.518\*N

For females: %BF = 19.197-0.239\*H+0.808\*A-0.518\*N

These linear models in the range of 10-50 %BF highly correlate with %BF measured by DEXA (adjusted r<sup>2</sup>=0.79); no better results have been achieved with a polynomial model. The validity of the models was tested on a group of 66 individuals who registered to a health club and the measurements were taken as part of their registration protocol. The group mean (±SD) of %BF based on DEXA measurements was 33.87±10.44%. The calculated %BF was 33.71±10.44 and highly correlated with the DEXA values (r=0.921, p<0.001). In comparison to DEXA values the suggested equations assessed %BF better than calculated by 4 sites skin-folds measurements (r=0.895), waist-to-hip ratio (r=-.126), bioelectrical impedance (r=0.916) and is good as 3 or 7 sites skin-folds measurements (r=0.927, r=0.936, respectively), and Bod-Pod (r=0.929) CONCLUSION: A novel valuable and very simple tool to assess accurately %BF was developed that can be applied very easily at any clinic or field studies.

1986 Board #138 June 2, 2:00 PM - 3:30 PM  
**Thoracic Gas Volume Changes after Weight Loss and Regain Associated with Body-Fat Measurement in Wrestlers**

Emi Kondo<sup>1</sup>, Keisuke Shiose<sup>2</sup>, Keiko Motonaga<sup>2</sup>, Takuya Osawa<sup>2</sup>, Hiroyuki Sagayama<sup>3</sup>, Yosuke Yamada<sup>4</sup>, Kohei Nakajima<sup>2</sup>, Akiko Kamei<sup>2</sup>, Hideyuki Takahashi<sup>2</sup>. <sup>1</sup>Osaka University of Health and Sport Sciences, Osaka, Japan. <sup>2</sup>Japan Institute of Sports Sciences, Tokyo, Japan. <sup>3</sup>University of Wisconsin, Madison, WI. <sup>4</sup>National Institute of Health and Nutrition, Tokyo, Japan.  
 (No relationships reported)

**PURPOSE:** The measurement of the thoracic gas volume (V<sub>TG</sub>) affects the accuracy of body composition estimation using air displacement plethysmography (ADP). A previous study reported that the V<sub>TG</sub> increased after 16-month mild weight loss (WL) program in overweight and obese women. However, little is still known about the effects of rapid WL and weight regain (WR) on the V<sub>TG</sub>, regarding body composition assessment in athletes who have low body fat. We examined the effect of rapid WL and WR on the V<sub>TG</sub> and investigated the accuracy of ADP after rapid WL and WR in wrestlers.

**METHODS:** Eight male collegiate wrestlers completed 53-hour rapid WL (6% of body weight, BW) based on each wrestler's own method, and followed by 13-hour WR with a prescribed diet. The BW, V<sub>TG</sub>, body volume (BV), body density (D) were assessed by ADP, and the % body fat, fat mass (FM), fat free mass (FFM) were calculated by Siri's equation at baseline (BL), post-WL and post-WR. The body composition was estimated by measuring the V<sub>TG</sub> at each time point, with the V<sub>TG</sub> measured at the baseline (V<sub>TG-BL</sub>) or the V<sub>TG</sub> being predicted using a software program (predicted V<sub>TG</sub>). **RESULTS:** The BW significantly decreased at post-WL (from 73.7 ± 8.0 to 69.0 ± 7.7 kg, P < 0.001) and significantly increased at post-WR (from 69.0 ± 7.7 to 71.8 ± 7.7 kg, P < 0.001). At the baseline, the predicted V<sub>TG</sub> (3.51 ± 0.16 L) was not significantly different from the measured V<sub>TG</sub> (3.56 ± 0.69 L), although no significant correlation between these two values was observed. The measured V<sub>TG</sub> significantly increased at post-WL (from 3.56 ± 0.69 to 3.96 ± 0.70 L, P < 0.05) and then decreased at post-WR (from 3.96 ± 0.70 to 3.67 ± 0.69 L, P < 0.01), but the predicted V<sub>TG</sub> did not significantly change. Compared with FM estimated using actual V<sub>TG</sub>, the reduction in the FM during WL was significantly overestimated 0.8 ± 0.6 kg (P < 0.05) when either the V<sub>TG-BL</sub> or the predicted V<sub>TG</sub> was used. The overestimated change in the FM was beyond the physiological adaptation of energy imbalance during the short-term experiment.

**CONCLUSIONS:** The V<sub>TG</sub> changes during rapid weight loss and regain in wrestlers. The changes in FM were overestimated when either the V<sub>TG-BL</sub> or the predicted V<sub>TG</sub> was used. Therefore, the V<sub>TG</sub> should be measured with ADP during weight loss or gain programs.

This work was supported by JISS internal funding sources for research.

D-32 Free Communication/Poster - Epidemiology of Physical Activity and Health in Older Adults

Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
 Room: Exhibit Hall A/B

1987 Board #139 June 2, 3:30 PM - 5:00 PM  
**Muscle-Strengthening Activity and Mortality in Older Women: A Prospective Cohort Study**

Masamitsu Kamada<sup>1</sup>, Eric J. Shiroma<sup>2</sup>, I-Min Lee, FACSM<sup>1</sup>. <sup>1</sup>Brigham & Women's Hospital, Harvard Medical School, Boston, MA. <sup>2</sup>National Institute on Aging, National Institutes of Health, Bethesda, MD.  
 (No relationships reported)

Few data exist on the association between muscle-strengthening activity (MSA) and mortality rates.

**PURPOSE:** To examine prospectively the association between muscle-strengthening activity and mortality from all causes, cardiovascular disease (CVD), and cancer in older women, and to evaluate the shape of any dose-response.

**METHODS:** In 2001, 28,882 women (average (SD) age, 62.2 (6.8) years) from the Women's Health Study who were free of CVD, diabetes, and cancer reported their physical activities, including MSA. They were followed through 2014 for mortality. Cox proportional hazards models estimated hazard ratios for mortality and restricted cubic splines were used to investigate dose-response.

**RESULTS:** During an average follow-up of 11.6 years, 2591 deaths occurred (360 from CVD and 706 from cancer). After adjusting for covariables including time in moderate to vigorous aerobic activities, the cumulative average time per week in MSA showed a quadratic association with all-cause mortality (P, linear trend=0.14; P, quadratic trend<0.001); hazard ratios across 5 categories of time in MSA (0; 1 to 19; 20 to 59; 60 to 149; 150+ minutes/week) for all-cause mortality were 1.0 (referent), 0.76 (95% confidence interval 0.68 to 0.86), 0.72 (0.62 to 0.84), 0.77 (0.63 to 0.95), and 1.04 (0.70 to 1.52). A significant quadratic association was also observed for CVD death (P, linear trend=0.42; P, quadratic trend=0.01) but not cancer death (P, linear trend=0.98; P, quadratic trend=0.37). Spline models also indicated a J-shaped non-linear association for all-cause mortality (P=0.02); hazard ratios of <1.00 were observed between 1 to 142 min/week of MSA, compared with none, while hazard ratios of >1.00 were seen with >142 min/week of MSA.

**CONCLUSIONS:** Time in MSA showed a J-shaped association with all-cause mortality in older women.

Funded by NIH grants CA047988, CA182913, HL043851, HL080467, and HL099355.

1988 Board #140 June 2, 3:30 PM - 5:00 PM  
**Is Cardiorespiratory Fitness Still as Relevant for Mortality Risk in the Statin Era?**

Stephen W. Farrell, FACSM<sup>1</sup>, Nina B. Radford<sup>2</sup>, Laura F. DeFina<sup>1</sup>, David S. Leonard<sup>1</sup>, Carrie E. Finley<sup>1</sup>, Carolyn E. Barlow<sup>1</sup>, Benjamin L. Willis<sup>1</sup>, William L. Haskell, FACSM<sup>3</sup>. <sup>1</sup>The Cooper Institute, Dallas, TX. <sup>2</sup>The Cooper Clinic, Dallas, TX. <sup>3</sup>Stanford University, Palo Alto, CA.  
 Email: sfarrell@cooperinst.org  
 (No relationships reported)

**Risk factor prevalence, screening guidelines, and the treatment milieu for various causes of mortality have changed significantly over the past several decades.**

**PURPOSE:** To determine if the relationship between cardiorespiratory fitness (CRF) and all-cause mortality has changed over this time period

**METHODS:** Participants in the present study included 44,063 apparently healthy men between the ages of 20 and 80 years who completed a baseline examination including a maximal treadmill exercise test at the Cooper Clinic in Dallas, Texas between 1971 and 2005. Participants were divided into two groups: Men in Cohort 1 were examined during 1971-1987 and followed for mortality through 1992 (pre-statin era), while men in Cohort 2 were examined during 1988-2005 and followed for mortality through 2010 (statin era). All-cause mortality incidence curves across CRF levels (maximal METS) for both cohorts were developed.

**RESULTS:** The distributions of maximal MET level were very similar in both cohorts. Additionally, an inverse relation between CRF and mortality incidence was observed in both cohorts. However, smoking and BMI-adjusted mortality incidence was significantly higher in the earlier cohort for men who achieved 5-15 METS (p<0.05). Beyond 15 METS, there was no significant difference in mortality incidence between the cohorts. **CONCLUSION:** Despite significant changes in risk factor prevalence, screening guidelines, and the treatment milieu for various causes of mortality, CRF remains a strong and independent risk factor in men. All men are urged to maintain a healthy level of CRF by meeting public health guidelines for physical activity.

Abstracts were prepared by the authors and printed as submitted.

1989 Board #141 June 2, 3:30 PM - 5:00 PM  
**Longitudinal Associations Between BMI, Physical Activity And Mortality Among Subjects With Coronary Heart Disease.**

Trine Moholdt, Javaid Nauman. *NTNU, Trondheim, Norway.*  
 Email: trine.moholdt@ntnu.no  
*(No relationships reported)*

**PURPOSE**

Obesity is a risk factor for coronary heart disease (CHD), but studies indicate that for subjects with established CHD the mortality risk is lower when body mass index (BMI) is above normal. Few studies exist on the joint effect of BMI and physical activity level on mortality in CHD. Our aim was to examine the independent and joint association of body mass index and physical activity with mortality in subjects with CHD, as well as the impact of longitudinal changes in BMI or physical activity on mortality risk.

**METHODS**

We did a prospective cohort study with data from 5385 subjects with CHD from the Nord-Trøndelag Health study (HUNT) in 1984-1986, 1995-1997, or 2006-2008. Of these, 3515 participated in two or more HUNT waves. BMI was classified into 3 groups: normal weight (18.5-24.9 kg/m<sup>2</sup>), overweight (25.0-29.9 kg/m<sup>2</sup>), and obese ( $\geq 30$  kg/m<sup>2</sup>). Change in BMI (in kg/m<sup>2</sup>/year) was categorized as loss ( $< -0.10$ ), stable ( $-0.10$  to  $0.09$ ), and gain ( $\geq 0.10$ ). Physical activity level was categorized as inactive, low, or high. Low and high were merged in some analyses. Changes in physical activity were categorized as stable inactive, stable active, inactive-active, and active-inactive. The first five years of follow-up were excluded from the analysis.

**RESULTS**

There were 2649 deaths during 25 (median 15.1) years of follow up. Compared to normal weight, the hazard ratio (HR) with 95% confidence interval (CI) for mortality was for overweight 0.91 (0.83-0.99), and for obese 0.95 (0.85-1.02). Low and high physical activity was associated with reduced mortality (HR: 0.88 (0.81-0.96) and 0.82 (0.74-0.92)), respectively. Compared to normal weight+inactive, obese+high had a HR of 0.62 (0.48-0.81). Overall, the HR for weight loss was 1.25 (1.07-1.44), compared to stable weight. For obese subjects, loss was not associated with increased risk, whereas weight gain was (HR: 1.38 (1.06-1.79)). Compared to stable active, stable inactive (HR: 1.47 (1.28-1.69)) and active-inactive (HR: 1.25 (1.08-1.44)) had increased risk, whereas inactive-active (HR: 1.13 (0.96-1.32)) had not.

**CONCLUSION**

Maintained or increased level of physical activity associated with improved survival in subjects with CHD. In obese, further weight gain was associated with increased risk, while for normal weight and overweight subjects weight loss was associated with risk.

1990 Board #142 June 2, 3:30 PM - 5:00 PM  
**Accelerometer-assessed Physical Activity, Sedentary Behavior And All-cause Mortality In The Women's Health Study**

I-Min Lee, FACSM<sup>1</sup>, Eric Shiroma<sup>2</sup>, Masamitsu Kamada<sup>3</sup>.  
<sup>1</sup>Harvard Medical School, Boston, MA. <sup>2</sup>National Institute on Aging, Bethesda, MD. <sup>3</sup>Brigham and Women's Hospital, Boston, MA.  
 Email: ilee@rics.bwh.harvard.edu  
*(No relationships reported)*

A large body of epidemiologic data shows that higher levels of physical activity (PA) are associated with lower mortality rates, and an emerging body of literature suggests that higher levels of sedentary behavior (SB) are related to higher mortality rates. However, almost all these studies assessed PA and SB using self-reports.

**PURPOSE:** To investigate the associations of accelerometer-assessed PA and SB with all-cause mortality.

**METHODS:** Between 2011 and 2014, 17,418 women from the Women's Health Study wore an accelerometer (ActiGraph GT3X+) on the hip during waking hours for 7 days. Of these, 15,632 had data on at least 4 days, of at least 10 hours wear each day. Women were categorized into quartiles of time in light-intensity (LPA) and moderate-to-vigorous intensity PA (MVPA), as well as SB, using vector magnitude cutpoints developed by Sasaki et al and Aguilar-Farias et al. They were followed through 2014 for mortality, and Cox proportional hazards regression estimated hazard ratios (95% confidence intervals) associated with PA and SB.

**RESULTS:** Women (mean age, 72 y) were followed for an average of 1.6 years, during which 102 died. After adjusting for potential confounders and mutually adjusting for PA and SB, the hazard ratios (95% confidence intervals) for all-cause mortality associated with quartiles of time in LPA from lowest to highest were 1.00 (referent), 0.83 (0.46-1.48), 0.99 (0.53-1.82), and 0.96 (0.47-1.97),  $p$  trend = 0.75; for time in MVPA, they were 1.00 (referent), 0.55 (0.32-0.97), 0.77 (0.43-1.37), and 0.32 (0.14-0.74),  $p$  trend = 0.02. For quartiles of time in sedentary behavior, the hazard ratios were 1.00 (referent), 1.09 (0.54-2.18), 1.72 (0.86-3.41), and 1.43 (0.67-3.05);  $p$  trend = 0.35.

**CONCLUSION:** While longer follow-up is desirable (and planned), these data show clear benefits of MVPA for all-cause mortality, but no significant effect of SB, when using objective assessments.

Funded by NIH grants CA154647, CA047988 and CA182913

1991 Board #143 June 2, 3:30 PM - 5:00 PM  
**Television Viewing Time and 12 Year Mortality from Inflammatory Causes: the AusDiab Study**

Megan S. Grace, Francis Dillon, Elizabeth Barr, Parmet Sethi, Neville Owen, David W. Dunstan. *Baker IDI Heart and Diabetes Institute, Melbourne, VIC, Australia.*  
 Email: megan.grace@bakeridi.edu.au  
*(No relationships reported)*

**PURPOSE:** Television (TV) viewing time is associated with increased risk of all cause, cardiovascular disease (CVD) and cancer mortality. However, a large proportion of deaths are due to non-cancer or CVD causes. Prolonged sitting time is associated with high C-reactive protein levels, suggesting that sitting may be associated with chronic inflammation. We examined the associations of TV viewing time with non-cancer or CVD, inflammatory-related mortality in Australian adults.

**METHODS:** Baseline (1999/2000) TV viewing time in relation to inflammatory-related mortality (with an inflammatory, oxidative or infectious component as the predominant underlying pathophysiology<sup>1</sup>) was examined among 9290 adults from the Australian Diabetes, Obesity and Lifestyle Study, who at baseline were  $\geq 25$  years of age and did not report previous myocardial infarction or stroke. Baseline data was used to categorise participant smoking status.

**RESULTS:** Over a median of 7.5 years, 99 of 705 deaths were classified as non-cancer or CVD, inflammatory-related. In the fully adjusted model (age, sex, education, fasting lipids, angina, hypertension, lipid medication, diabetes status, diet quality, waist circumference, energy intake, alcohol, smoking status and physical activity) the inflammatory-related mortality hazard ratios (HRs) compared to TV viewing of  $< 2$  h/d were: 1.25 (95% CI 0.78 to 2.01) for  $\geq 2$  to  $< 4$  h/d, and 2.07 (1.18 to 3.61) for  $\geq 4$  h/d. A sensitivity analysis was performed, removing ex-smokers and smokers. A significant effect of high TV viewing time on inflammatory-related mortality remained for non-smokers ( $n=5016$ ; 51 deaths): compared to  $< 2$  h/d of TV viewing time, the fully adjusted HRs for inflammatory-related mortality were 1.65 (95% CI 0.85 to 3.19) for  $\geq 2$  to  $< 4$  h/d and 3.10 (1.36 to 7.03) for  $\geq 4$  h/d.

**CONCLUSION:** TV viewing time was significantly associated with increased risk of non-cancer or CVD, inflammatory-related mortality in the overall study population, and in non-smokers. This is consistent with the hypothesis that high TV viewing is associated with a chronic inflammatory state, and provides further observational evidence that, in addition to promoting physical activity, chronic disease prevention strategies should focus on reducing prolonged sitting time.

<sup>1</sup> Andersen et al., 2006. *Am J Clin Nutr*, 83:1039-46

1992 Board #144 June 2, 3:30 PM - 5:00 PM  
**Associations of Healthy Lifestyle Behaviors with Cardiovascular Disease and Chronic Disease Mortality and Life Expectancy in Men and Women**

Tongyu Ma, Chong Lee, FACSM. *Arizona State University, Phoenix, AZ.*  
 Email: tongyuma@asu.edu  
*(No relationships reported)*

Although physical inactivity, cigarette smoking, and an unhealthy diet are significant underlying risk factors for cardiovascular disease (CVD), the favorable effects of not having these risk factors on CVD and chronic disease mortality in the US populations remains less explored.

**PURPOSE:** We investigated the combined effects of a healthy lifestyle behavior (never smoking, physically active, and healthy diet) on CVD and chronic disease mortality in US men and women.

**METHODS:** We followed up 15,060 men and women, aged 20 to 80 years, who participated in the Third National Health and Nutrition Examination Survey. All participants completed baseline lifestyle behavior questionnaires. A healthy lifestyle profile was defined as never smoking, physically active, and a healthy diet defined by the American Heart Association. There were a total of 1868 chronic disease deaths (967 CVD) during an average of 14.1 years of follow-up (211,667 person years). **RESULTS:** After adjustment for age, sex, race, and multiple risk factors, there was an inverse association between a greater number of healthy-lifestyle behaviors and CVD mortality ( $P$ -value for trend  $< 0.001$ ) and chronic disease mortality ( $P$ -value for trend  $< 0.001$ ). Persons who were physically active, never smoked, and had a healthy diet had a 54% lower risk of CVD mortality (95% CI: 37% to 64%) and a 60% lower risk of chronic disease mortality (95% CI: 48% to 67%) compared with persons with none of these healthy lifestyle behaviors. Persons with all 3 healthy lifestyle behaviors had a 7.8 year (95% CI: 4.8 to 10.4) and a 9.8 year (95% CI: 7.5 to 11.9) longer life expectancy from CVD and chronic disease mortality, respectively, compared with

persons with zero healthy lifestyle behaviors. Approximately 37% (95% CI: 15% to 53%) of CVD deaths and 41% (95% CI: 26% to 53%) of chronic disease deaths might have been avoided if they had maintained all 3 healthy lifestyle behaviors.

**CONCLUSION:** Eating a healthy diet, being physically active, and never smoking is associated with lower risk of dying from CVD and chronic diseases in US men and women. Public health agencies should emphasize the importance of developing these healthy lifestyle behaviors across the lifespan.

1993 Board #145 June 2, 3:30 PM - 5:00 PM

### Daily Physical Activity And Mortality Risk In The Very Old: Age, Gene/Environment-Reykjavik Study

Tamara B. Harris<sup>1</sup>, Kong Y. Chen<sup>2</sup>, Robert Brytcha<sup>2</sup>, Paolo Caserotti<sup>3</sup>, Eric J. Shiroma<sup>1</sup>, Dane Van Domelen<sup>4</sup>, Lenore J. Launer<sup>1</sup>, Vilundur Gudnason<sup>5</sup>, Nanna Y. Arnardottir<sup>6</sup>, Thorarinn Sveinsson<sup>6</sup>, Erlingur Johannsson<sup>7</sup>, Gudny Eiriksdottir<sup>8</sup>, Annemarie Koster<sup>9</sup>. <sup>1</sup>National Institute on Aging, Bethesda, MD. <sup>2</sup>NIDDK, Bethesda, MD. <sup>3</sup>University of Southern Denmark, Odense, Denmark. <sup>4</sup>Emory University, Atlanta, GA. <sup>5</sup>Icelandic Heart Association, Kopavogur, Iceland. <sup>6</sup>University of Iceland, Reykjavik, Iceland. <sup>7</sup>Iceland University of Education, Laugarvatn, Iceland. <sup>8</sup>Icelandic Heart Association, Reykjavik, Iceland. <sup>9</sup>CAPHRI School for Public Health and Primary Care, Maastricht, Netherlands.  
Email: harris99@mail.nih.gov  
(No relationships reported)

**Purpose:** The lack of longitudinal studies has left open the question as to whether greater accelerometry-based assessment of physical activity would be shown to be protective even in very old persons. We used data from the Age, Gene, Environment (AGES)-Reykjavik Study to assess the association of mortality with total counts, measures of activity type (sedentary time, count intensity), and distribution of counts over the day.

**Methods:** Data were collected from a hip worn Actigraph GT3X accelerometer; 589 subjects had 4 or more days of data. Covariates included age, sex, reported health status, coronary calcium, smoking status, depression, health conditions, cognitive score, C-reactive protein, BMI, walking speed, and leg strength.

**Results:** The sample (age=80±4.8) consisted of 226 men and 363 women followed for 5 years for mortality (116 deaths). Multiple measures of activity including total counts (per standard deviation, OR=1.74, 95% CI 1.23, 2.46), proportion of time sedentary, and volume of moderate or vigorous activity were all associated with mortality risk in adjusted models. However, once other measures were adjusted for total counts, none of the other measures remained statistically significant while the odds ratio for total counts remained relatively unchanged. Over the day, those who died had proportionately more counts from noon to 4 PM (P<.005) but fewer counts from 8 to 12 PM (P=.01); after adjustment for total counts, only the relationship from noon to 4 PM was significant.

**Conclusions:** These longitudinal data support the importance of total physical activity to health risk in older persons. Further, they suggest that not only are there differences in the pattern of energy expenditure over the day, but that these patterns may be associated with increased risk.

1994 Board #146 June 2, 3:30 PM - 5:00 PM

### Pedometer-determined Physical Activity And All-cause Mortality In Japanese Elderly Individuals: A Cohort Study

Naofumi Yamamoto<sup>1</sup>, Hiroshi Nagayama<sup>2</sup>, Mieko Shimada<sup>3</sup>, Naoki Nakagawa<sup>4</sup>, Susumu S. Sawada, FACSM<sup>5</sup>, Mamoru Nishimuta<sup>6</sup>, Yasuo Kimura<sup>7</sup>, Hidenori Asai<sup>1</sup>, Hideo Miyazaki<sup>8</sup>, I-Min Lee, FACSM<sup>9</sup>, Steven N. Blair, FACSM<sup>10</sup>, Yutaka Yoshitake<sup>11</sup>. <sup>1</sup>Ehime University, Matsuyama, Japan. <sup>2</sup>Fukuoka University, Fukuoka, Japan. <sup>3</sup>Chiba Prefectural University of Health Sciences, Chiba, Japan. <sup>4</sup>SANNO University, Isehara, Japan. <sup>5</sup>National Institute of Health and Nutrition, Tokyo, Japan. <sup>6</sup>Toyo University, Itakura, Japan. <sup>7</sup>Research Center for Fitness & Health Sciences, Tokyo, Japan. <sup>8</sup>Niigata University, Niigata, Japan. <sup>9</sup>Harvard Medical School, Boston, MA. <sup>10</sup>University of South Carolina, Columbia, SC. <sup>11</sup>National Institute of Fitness and Sports in Kanoya, Kanoya, Japan. (Sponsor: Susumu S. Sawada, FACSM)  
Email: nyamamoto@ed.ehime-u.ac.jp  
(No relationships reported)

Previous epidemiologic studies have shown that physical activity is associated with a lower risk of mortality among elderly individuals. However, most of these studies

measured physical activity using self-reports, and limited data are available on the associations between objectively measured physical activity and mortality in the elderly, particularly in Asian populations.

**PURPOSE:** The purpose of this study was to examine the associations between pedometer-assessed steps/day and all-cause mortality in a cohort of elderly Japanese participants.

**METHODS:** The participants included 419 (228 males and 191 females) physically independent, community-dwelling Japanese 71-year-old individuals. The number of steps/day was measured by a waist-mounted pedometer (Yamasa, EC-200, Japan) for seven consecutive days. Participants were divided into quartiles based on their average number of steps/day (first quartile, ≤4501 steps/day; second quartile, 4502-6111 steps/day; third quartile, 6112-7973 steps/day; fourth quartile, ≥7974 steps/day). The participants were followed up over a mean period of 9.8 years (1999-2010) for mortality. The hazard ratios and 95% confidence intervals (CIs) for death across the baseline quartiles of steps/day were obtained from Cox proportional hazards model while adjusting for sex, height, weight, percentage of body fat, cigarette smoking, alcohol intake, medication use, and functional capacity.

**RESULTS:** Seventy-six participants (18.1%) died during the follow-up period. The hazard ratios for death across the quartiles of steps/day (lowest to highest) were 1.0 (referent), 0.78 (95%CI 0.41-1.47), 1.22 (95%CI 0.67-2.20), 0.43 (95%CI 0.21-0.90) (P for trend=0.035). Participants in the highest quartile had a significantly lower risk of death, compared with the lowest quartile.

**CONCLUSIONS:** A high level of pedometer-determined physical activity was significantly associated with a lower risk of all-cause mortality in physically-independent Japanese elderly individuals.

1995 Board #147 June 2, 3:30 PM - 5:00 PM

### Self-rated Physical Fitness And Estimated Maximal Oxygen Uptake In Relation To All-cause And Cause-specific Mortality

Katja Borodulin<sup>1</sup>, Jenni Kulmala<sup>1</sup>, Alina Solomon<sup>2</sup>, Tiia Ngandu<sup>1</sup>, Miia Kivipelto<sup>3</sup>, Tiina Laatikainen<sup>4</sup>. <sup>1</sup>National Institute for Health and Welfare, Helsinki, Finland. <sup>2</sup>University of Eastern Finland, Kuopio, Finland. <sup>3</sup>Karolinska Institute, Stockholm, Sweden. <sup>4</sup>Hospital District of North Karelia, Joensuu, Finland.  
(Sponsor: Gerald J. Jerome, FACSM)  
Email: katja.borodulin@thl.fi  
(No relationships reported)

**PURPOSE:** To investigate longitudinal associations of self-rated physical fitness and estimated maximal oxygen uptake with all-cause and cause-specific mortality risk, taking into account the modifying effects of age, gender, physical activity and chronic conditions. **METHODS:** Data comprise the National FINRISK Prospective Study Cohort 1972-2007 with endpoints on all-cause and cause-specific mortality data from the Finnish National Register of Causes of Death over a follow-up from 3 to 38 years. A total of 62,204 participants reported information on perceived physical fitness level and a subsample of 4,947 persons underwent a non-exercise test on maximal oxygen uptake in 2002. From the analyses, we excluded persons with prevalent severe diseases at baseline or persons who died within two years or who developed dementia within 5 years after the follow-up had started. Cox proportional hazards models were used with adjustments for sex, education, body mass index, physical activity, smoking, severe chronic conditions and study year. **RESULTS:** During the mean follow-up of 20.0 (SD±11.2) years, altogether 14,723 (23.7%) participants died. Mortality rates per 1000 person-years for participants with good, satisfactory and poor self-rated fitness were 7.5, 12.7 and 19.6, respectively. In the fully adjusted models, poor (HR 1.9, 95%CI 1.8-2.0) and satisfactory (HR 1.4, 95%CI 1.3-1.5) self-rated fitness predicted all-cause mortality when compared to the reference group of good fitness level. Poor and satisfactory fitness levels associated directly with mortality due to cardiovascular, cerebrovascular and respiratory diseases, trauma, infections, dementia and cancer when compared to good fitness level in the fully adjusted models. In men, higher estimated maximal oxygen uptake associated with lower risk of lung cancer mortality (HR 0.8, 95%CI 0.7-0.96) when compared to low fitness in the fully adjusted models. **CONCLUSION:** Self-rated fitness reflects a combination of unfavorable biological and lifestyle-related factors that increase mortality risk. Self-rated fitness is a feasible non-invasive method for the entire population and thus should be used more actively for preventive activities in health care.

1996 Board #148 June 2, 3:30 PM - 5:00 PM  
**Physical Inactivity Predicts Serum Vitamin D Deficiency In Older Adults**  
 Inhwan Lee, Sanghee Lee, Jiyoung Kong, Jeonghyeon Kim, Changduk Ha, Hyunsik Kang. *Sungkyunkwan University, Suwon, Korea, Republic of.*  
 Email: ansh00@naver.com  
 (No relationships reported)

Body fatness and decreased physical activity are associated with low serum vitamin D in children, adolescents, and adults. However, little is known regarding the etiology of vitamin D deficiency in older adults, especially in Korea.

**Purpose:** To investigate the relationships between serum vitamin D deficiency with physical activity and body fatness in older Korean adults. **Methods:** In a cross-sectional design, 39 men and 194 women aged >65 years underwent accelerometer-based monitoring of daily physical activity and body fatness assessment. Serum vitamin D levels were determined by using the LIAISON 25(OH) Vitamin D TOTAL Assay. Based on serum vitamin D levels, subjects were classified as sufficiency (>30 ng•ml<sup>-1</sup>), insufficiency (20–29 ng•ml<sup>-1</sup>), and deficiency (150min moderate and vigorous physical activity per week) were used to classify the subjects either active (met the recommendations) or inactive (did not meet the recommendations). Logistic regression analyses were used to determine the odds ratio (OR) for having serum vitamin D inadequacy. Statistical significances were tested at P=0.05. **Results:** Vitamin D levels were positively associated with daily step ( $r=0.441$  and  $P<0.001$ ), low- ( $r=0.343$  and  $P<0.001$ ), moderate- ( $r=0.351$  and  $P<0.001$ ), high-intensity physical activity ( $r=0.293$  and  $P<0.001$ ) and negatively associated with body mass index ( $r=-0.223$  and  $P=0.001$ ), percent of body fat ( $r=-0.182$  and  $P=0.005$ ) and waist circumference ( $r=-0.196$  and  $P=0.003$ ). Compared to the active group (OR=1), the inactive group had a significantly higher OR (OR=4.157; 95% confidence interval=1.688–10.235;  $P=0.001$ ) for having vitamin D deficiency even after adjusting for covariates such as age, sex, and body fatness. **Conclusion:** The current findings suggest that physical activity along with vitamin D supplementation should be promoted as a preventive means against vitamin D deficiency in elderly Koreans. Supported by The National Research Foundation Grant funded by the Korean Government (2014R1A1A2056473).

1997 Board #149 June 2, 3:30 PM - 5:00 PM  
**Association Between Muscular Function, Muscular Endurance And Cognitive Function In Community-dwelling Older Adults**  
 Takumi Abe<sup>1</sup>, Taishi Tsuji<sup>2</sup>, Tomohiro Okura<sup>1</sup>. <sup>1</sup>University of Tsukuba, Tsukuba, Japan. <sup>2</sup>Chiba University, Chiba, Japan.  
 (No relationships reported)

Previous studies suggest that lower-limb muscular function is related to cognitive function in older adults. However, it is not clear whether muscular function (MF) in knee extension with maximal exertion or muscular endurance (ME) is more closely associated with cognitive function.

**PURPOSE:** To investigate the association in older adults between cognitive function and lower-limb MF in knee extension with maximal exertion and ME. **METHODS:** Participants were 328 community-dwelling older adults (73.6 ± 5.5 yrs; 46.3% men). We examined MF in knee extension with maximal exertion using grand reaction force in the sit-to-stand (STS) movement. Participants sat on a chair with arms folded over their chests and then stood up and sat down again as fast as possible in two seconds for three trials. The force plate placed under their legs measured 1) the maximal rate of force development over 90 msec divided by weight (RFD9/w), and 2) the peak reaction force divided by weight (F/w). We used the highest RFD9/w and F/w scores from the three trials for analysis. We measured ME with the 5-time STS test as reported by Whitney et al. (2005) in which we recorded the time it took participants to stand up and sit down in the chair with their arms folded five times as fast as possible. We evaluated cognitive function with the 5-Cog test, which measures attention, memory, visuospatial function, verbal fluency and reasoning. We defined cognitive function of the participants based on the total 5-Cog score. Using multiple regression analysis to examine relationships between each variable and cognitive function, we constructed two models: model 1 included cognitive function as the dependent variable and RFD9/w, F/w and the 5-time STS time as the independent variables; model 2 had the model 1 variables but also included age and education as covariates. **RESULTS:** Model 1 showed that only the 5-time STS time was significantly associated with cognitive function in both genders. Even with the additional covariates, model 2 results (5-time STS time, men:  $P = 0.037$ ,  $\beta = -1.819$ ; women:  $P < 0.001$ ,  $\beta = -2.766$ ) were similar to model 1. **CONCLUSION:** Lower-limb ME is more closely associated with cognitive function than MF in knee extension with maximal exertion.

1998 Board #150 June 2, 3:30 PM - 5:00 PM  
**Prospective Association between Domain-Specific Physical Activity and Risk of Depressive Symptoms in Older Adults**  
 Cong Huang, Yasutake Tomata, Haruki Momma, Ichiro Tsuji, Ryoichi Nagatomi. *Tohoku University, Sendai, Japan.*  
 Email: hcongman@yahoo.com  
 (No relationships reported)

Physical activity has been recommended to general population for preventing depressive symptoms. However, only few prospective studies focused on the association between the domain-specific physical activity levels and risk of depressive symptoms. **PURPOSE:** To investigate the prospective association between domain-specific physical activity and depressive symptoms among Japanese older people. **METHODS:** In this study, participants comprised 365 (169 men) community-dwelling older individuals aged ≥70 years, who were living in the Tsurugaya area of Sendai, Japan. These participants did not have depressive symptoms at baseline. Depressive state was evaluated by a short version of Geriatric Depression Scale (GDS-15), and a GDS-15 score ≥6 was defined as depressive symptoms. Furthermore, a valid questionnaire was used to assess domain-specific physical activity. Leisure-time physical activity levels by estimating metabolic equivalents (METs) hours/day based on frequency and duration of walking, brisk walking, moderate exercise, and strenuous exercise. METs of physical activity in other domains (occupational, domestic, commuting) were calculated based on the numbers of hours spent at different levels of intensity (sitting, standing, walking, strenuous work). Associations between physical activity and depressive symptoms were examined by multiple regression analysis. Covariates included sex, age, body mass index, educational levels, living status, smoking status, drinking status, sleep duration, and cognitive function. Data were expressed as odds ratios (OR) and 95% confidence intervals (CI). **RESULTS:** Multivariate analysis showed that tertiles of leisure-time physical activity were inversely associated with depressive symptoms during 10-years follow-up period (OR [95% CI]: T2, 0.97 [0.54–1.76]; T3, 0.42 [0.21–0.85];  $P$  for trend = 0.019). Similarly, high levels of physical activity in other domains were also associated with decreased incidence of depressive symptoms (OR [95% CI]: T2, 0.73 [0.40–1.36]; T3, 0.52 [0.27–0.99];  $P$  for trend = 0.045). **CONCLUSION:** This long-term prospective study demonstrated that the both leisure-time and non-leisure-time (occupational, domestic, commuting) physical activity may be preventive factors for depressive symptoms in older adults.

1999 Board #151 June 2, 3:30 PM - 5:00 PM  
**Longitudinal Association Between Low- And High-light Intensity Physical Activity And Cognitive Function In Older Adults: Regards Study**  
 Wenfei Zhu<sup>1</sup>, Virginia J. Howard<sup>2</sup>, Virginia G. Wadley<sup>2</sup>, Brent Hutto<sup>3</sup>, John E. Vena<sup>4</sup>, Natalie Colabianchi<sup>5</sup>, Steven P. Hooker, FACSM<sup>6</sup>. <sup>1</sup>Shaanxi Normal University, Xi'an, China. <sup>2</sup>University of Alabama at Birmingham, Birmingham, AL. <sup>3</sup>University of South Carolina, Columbia, SC. <sup>4</sup>Medical University of South Carolina, Charleston, SC. <sup>5</sup>University of Michigan, Ann Arbor, Ann Arbor, MI. <sup>6</sup>Arizona State University, Phoenix, AZ.  
 (Sponsor: Steven Hooker, FACSM)  
 Email: zhuwenfei729@gmail.com  
 (No relationships reported)

**Purpose:** Regular moderate-to-vigorous intensity physical activity (MVPA) provides benefits for cognitive health among older adults. Recently, there has been a shift from focusing on MVPA to considering the potential benefits of light intensity PA (LPA), because older adults accumulate 3–4 hr/day of LPA. This study investigated the longitudinal association of objectively measured low-light intensity PA (LLPA) and high-light intensity PA (HLLPA) with cognitive function in older adults.

**Methods:** Participants were recruited from the REasons for Geographic and Racial Differences in Stroke (REGARDS) Study. ActicalTM accelerometers provided estimates of LLPA (50–556 counts/min), HLLPA (557–1,064 counts/min), MVPA (>1,065 counts/min), for 4–7 consecutive days. Incidence of cognitive impairment was defined by the Six-Item Screener. Letter fluency, animal fluency, word list learning and Montreal Cognitive Assessment (orientation and recall) were conducted to develop z-scores for domains of executive function and memory. Associations between LPA and cognitive impairment were examined using multivariate logistic regression models. General Linear regression models were used to assess the association between LPA and z-scores of executive function and memory.

**Results:** During 3.3 ± 0.5 years of follow-up, 4,941 participants (70.1 ± 8.6 yr, 54.2% women, 31.7% African American) were included, with 283 incident cases of cognitive impairment. Average time spent in LLPA and HLLPA were 167.4±61.1, and 24.0±19.2 min/day, respectively. After adjustments for age, sex, race, education and other health related factors, participants in the highest HLLPA quartile (40.9 min/day) had 35%

lower risk of cognitive impairment than the lowest quartile (HR: 0.65, 95% C.I.: 0.45-0.94). Quartiles of HLPAs were inversely associated with change over time in executive function and memory z-scores (P<0.01).

**Conclusion:** Higher levels of objectively measured HLPAs were independently associated with lower incidence of cognitive impairment, and better maintenance of memory and executive function in older adults. Future PA guidelines may need to be modified to include HLPAs in addition to MVPA to sustain cognitive health in older adults.

2000 Board #152 June 2, 3:30 PM - 5:00 PM  
**High Levels of Moderate-to-vigorous Physical Activity Are Associated With Increased Risk Of Falling In Middle-aged And Older Adults**

Victor Z. Dourado, Evandro Sperandio, Ana Esther Oliveira, Marcello Romiti, Antônio Gagliardi, Rodolfo Arantes. *Federal University of São Paulo, Santos, Brazil.*  
 Email: vzedourado@yahoo.com.br  
 (No relationships reported)

**PURPOSE:** sedentary behavior (SB) has been described as an independent risk factor for health problems and mortality, regardless of the amount of moderate-to-vigorous physical activity (MVPA). However, the critical roles of SB and MVPA on risk of falls was poorly investigated by objective measure of physical activity (PA). We aimed to compare the associations between SB and MVPA, and the occurrence of falls in older adults. **METHODS:** We enrolled 379 subjects aged 40-80 years that wore an ActiGraph GT3x+ accelerometer over the hip during 7 days to measure PA. Participants were inquired as follows: "Have you had a fall in the past 12 months". Self-reported cardiovascular risk factors were recorded. We registered SB (i.e., PA < 1.5 METs) and MVPA. We also assessed isokinetic peak torque (PT) of the quadriceps femoris, peak oxygen uptake (V'O<sub>2</sub>) on a treadmill, and lean and fat body masses (LBM; FBM) by bioelectrical impedance. We compared critical roles of SB and MVPA on the occurrence of falls by multiple logistic regression adjusted by age, sex, obesity, arterial hypertension, diabetes, dyslipidemia, smoking, LBM, peak V'O<sub>2</sub>, and quadriceps PT. **RESULTS:** Forty-eight participants reported at least one fall (14.5%). Fallers presented lower SB and higher MVPA. They were predominantly women and older and presented higher FBM and lower peak V'O<sub>2</sub> and quadriceps PT (p < 0.05). MVPA, but not SB, was selected as independent predictor, increasing the odds of having a fall in 18% (Table 1). **CONCLUSION:** In older adults without mobility limitations, high MVPA increased the risk of falling. Interventions to promote MVPA should be designed including falls prevention strategies.

| Significant predictors of falls after multiple regression analysis |             |       |        |       |            |                |
|--|-------------|-------|--------|-------|------------|----------------|
| Predictors   | Coefficient | SE    | Wald   | p     | Odds ratio | 95%CI          |
| MVPA (%)   | 0.169       | 0.078 | 4.702  | 0.030 | 1.184      | 1.016 - 1.379  |
| Arterial hypertension  | 1.838       | 0.550 | 11.170 | 0.001 | 6.281      | 2.138 - 18.452 |
| Quadriceps PT (N.M)  | -0.025      | 0.008 | 10.825 | 0.001 | 0.976      | 0.961 - 0.990  |
| Age 60 to 80 years   | 1.326       | 0.641 | 4.271  | 0.039 | 3.765      | 1.071 - 13.235 |

2001 Board #153 June 2, 3:30 PM - 5:00 PM  
**The Energetic Cost of Low Back Pain: Findings from the Baltimore Longitudinal Study of Aging**

Eleanor M. Simonsick<sup>1</sup>, Benjamin Aronson<sup>2</sup>, Jennifer A. Schrack<sup>3</sup>, Gregory E. Hicks<sup>4</sup>, Gerald J. Jerome, FACSM<sup>5</sup>, Stephanie A. Studenski<sup>1</sup>, Luigi Ferrucci<sup>1</sup>. <sup>1</sup>National Institute on Aging, Baltimore, MD. <sup>2</sup>George Washington University, Washington, DC. <sup>3</sup>Johns Hopkins Bloomberg School of Public Health, Baltimore, MD. <sup>4</sup>University of Delaware, Newark, DE. <sup>5</sup>Towson University, Towson, MD. (Sponsor: Gerald J. Jerome, FACSM)  
 Email: simonsickel@mail.nih.gov  
 (No relationships reported)

Chronic pain in the lumbar spine and hip region often referred to as chronic low back pain commonly occurs in older adults. Such pain negatively impacts mobility and contributes to slow gait. Whether lumbopelvic pain (LPP) is associated with a greater energetic cost of walking and its manifestations is unknown. **PURPOSE:** To examine the cross-sectional association between LPP and dimensions of walking ability including energetic cost. **METHODS:** Data are from 767 well-functioning men (49.8%) and women aged 60-89 years participating in the Baltimore Longitudinal Study of Aging (BLSA). LPP was defined as reported pain in the back or either hip within the preceding year distinguished as none, mild or moderate to severe.

Walking outcomes included reported walking ability scored from 0 to 9, usual gait speed as the faster of 2 trials over 6m, time to walk 400m as quickly as possible and the energetic cost of walking (ml O<sub>2</sub>/kg/meter) assessed over ground using a Cosmed K4b2 during 2.5 minutes of usual paced walking. Generalized linear regression models adjusted for age, sex, race, height and weight were used to compare mean values of the walking outcomes across the three levels of LPP. **RESULTS:** LPP was present in 59.7% with 30.4% reporting moderate to severe pain. Greater LPP was associated with worse reported walking ability (p<.001), a longer time to walk 400m (p=.002) and higher energetic cost of walking (p=.012), but not usual gait speed. Patterns of association varied - for the 400m walk those with moderate to severe pain needed more time than those with either mild or no pain (293s vs 283s; p=.019 and 279s; p<.001, respectively); whereas, for the energetic cost of walking, those with any LPP had higher cost (.165 vs .157; p=.006) than those with no LPP. **CONCLUSION:** Among well-functioning older persons (all completed 400m without stopping), LPP within the past year was common and associated with a greater energetic cost of walking regardless of its severity. This greater cost manifests as both poorer perceived and observed walking endurance which may reflect diminishing compensatory capacity and/or increasing fatigability. Future work should evaluate how lumbopelvic pain and pain severity may impact gait mechanics and contribute to greater energetic cost of walking and/or its consequences.

**D-33 Free Communication/Poster - Heat/Cold Exposure**

Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
 Room: Exhibit Hall A/B

2002 Board #154 June 2, 2:00 PM - 3:30 PM  
**Preliminary Findings: Effects Of Caffeine And Heat Exposure On Exercise Induced-creatine Kinase**

Selasi Attipoe, Patricia A. Deuster, FACSM. *Uniformed Services University, Bethesda, MD.*  
 Email: selasi.attipoe.ctr@usuhs.edu  
 (No relationships reported)

**Introduction:** The beneficial effects of caffeine on performance have been well studied. However, minimal work has focused on ingestion of caffeine during heat stress. The available literature is inconclusive with some suggesting caffeine consumption in a heated environment has no significant impact on performance and others indicating that it may make individuals more susceptible to heat-related illness. The purpose of this study was to examine the effect of caffeine on thermoregulation and creatine kinase (CK) levels in response to exercise under hot and thermoneutral conditions. **Methods:** Caucasian men and women underwent a fitness test and standardized exercise protocol: 60-minutes of walking at 3.1 mph on a 2% grade, followed by a 5-min step-test and 15 timed squats in an environmental chamber. The exercise protocol was administered under two different oral (caffeine 7.5 mg/kg or placebo) and environmental (thermoneutral/T: 22°C/40% humidity and heat/H: 40°C/40% humidity) treatment conditions. Core temperature (T<sub>c</sub>) and heart rate (HR) were continuously monitored, and CK was measured before, immediately after, and 48 and 72 hours post-exercise. **Results:** Participants (n=32; 27±1.5 yrs) were relatively fit (BMI=25±0.5; VO<sub>2</sub>max=50±1.4 ml/min/kg). Univariate factorial ANOVA showed significant main effects of oral and environment treatments on T<sub>c</sub>, but only environment treatment affected HR. T<sub>c</sub> was significantly higher for caffeine compared to placebo [F(1,113)=5.4, p<0.05, effect size ω=0.05], and in heat compared to thermoneutral conditions F(1,113)=13.2, p<0.001, ω=0.11]. HR was only significantly higher in heat compared to thermoneutral condition [F(1,110)=18.3, p<0.001, ω=0.14]. No significant interaction effects were noted for T<sub>c</sub> or HR under any treatment conditions. Repeated measures ANOVA showed no statistical difference in serum CK levels across time points by oral (p=0.85) or environment (p=0.70) treatments; and no interaction effects were detected. **Conclusion:** Preliminary analyses suggest caffeine and heat may not significantly impact serum CK levels. Thus, caffeine consumption in a heated environment may not have a significant impact on muscle damage.

THURSDAY, JUNE 2, 2016

2003 Board #155 June 2, 2:00 PM - 3:30 PM  
**Changes In Endothelium Markers During A Summer Ultra-endurance Road Cycling Event In The Heat**  
 Brian Kupchak<sup>1</sup>, Elizabeth Umeda<sup>1</sup>, Josh Kazman<sup>1</sup>, Jakob Vingren<sup>2</sup>, Elaine Lee<sup>3</sup>, Lawrence Armstrong, FACSM<sup>3</sup>, Patricia Deuster, FACSM<sup>1</sup>. <sup>1</sup>Uniformed Services University, Bethesda, MD. <sup>2</sup>University of North Texas, Denton, TX. <sup>3</sup>University of Connecticut, Storrs, CT. (Sponsor: Patricia Deuster, FACSM)  
 Email: brian.kupchak@usuhs.edu  
 (No relationships reported)

**Purpose.** To assess the impact of completing a 164-km road cycling event performed in a hot environment (Wichita Falls, TX in August), on endothelium markers in men and women. **Methods.** A total of 37 participants, 28 men and 9 women, mean age of 51.8 ± 9.5 y completed the ride. Plasma samples were collected the morning before (Pre) and immediately after (IP) completing the ride. We examined associations between changes in pre- and post-ride concentrations of endothelial cell markers - endothelin-1 (ET-1), p-selectin, and intercellular adhesion molecule 1 (I-CAM1) - as a function of race time and participant characteristics. Results. All of the endothelial cell markers (ET-1, p-selectin, and I-CAM1) increased significantly from Pre to IP. Controlling for Pre values: completion time was positively correlated with ET-1 ( $r=0.42$ ,  $p<0.01$ ) and negatively related to p-selectin ( $r=-0.42$ ,  $p<0.001$ ); percent body fat was negatively correlated with p-selectin ( $r=-0.40$ ,  $p<0.01$ ) and I-CAM1 ( $r=-0.35$ ,  $p<0.05$ ). In addition, males had greater concentrations of I-CAM1 ( $d=1.32$ ,  $p<0.01$ ) and p-selectin ( $d=0.84$ ,  $p<0.05$ ) than females. **Conclusion.** Completing a 164-km ride in the heat resulted in increased concentrations of selected endothelial cell markers in both men and women. Whereas this may suggest endothelial cell injury, it is unclear whether this activation leads to an increased risk of blood clot formation.

2004 Board #156 June 2, 2:00 PM - 3:30 PM  
**Central Cardiovascular Adjustments in Burn Survivors Performing Steady-state Exercise in The Heat**  
 Steven A. Romero, Daniel Gagnon, Amy N. Adams, Naomi Kennedy, Hai Ngo, Paula Y.S. Poh, Craig G. Crandall, FACSM. *University of Texas Southwestern Medical Center and the Institute for Exercise and Environmental Medicine, Dallas, TX.* (Sponsor: Craig Crandall, FACSM)  
 Email: stevenromero@texashealth.org  
 (No relationships reported)

Relative to normothermia, cutaneous blood flow is greater during exercise performed in hyperthermic conditions in order to facilitate heat dissipation. Likewise, heart rate and cardiac output are elevated to maintain arterial blood pressure despite significant cutaneous vasodilation. However, it is unclear if these central cardiovascular adjustments occur in burn survivors exercising in hyperthermic conditions given that whole-body cutaneous vasodilation is significantly attenuated in grafted skin. **Purpose:** To test the hypothesis that, relative to normothermic conditions, heart rate and cardiac output are greater when burn survivors exercise in hyperthermic conditions. **Methods:** Ten well-healed burn survivors (6 females; age 35 ± 12 years; weight 80 ± 24 kg; mean ± SD), with an average of 51 ± 21% (range: 22 - 85%) of their body surface area burned, participated in this study. Subsequent to a 30 min rest period in the respective climate conditions, subjects performed steady-state cycling at 50W and 75W in hyperthermic (40°C, 30% relative humidity) and normothermic conditions. Oxygen uptake, heart rate, cardiac output (inert gas rebreathing), and arterial blood pressure were measured throughout. **Results:** Prior to exercise, oxygen uptake, heart rate, cardiac output, and arterial blood pressure were similar between thermal conditions (data not shown). Oxygen uptake was similar between thermal conditions at both workloads ( $P > 0.2$ ). At 50W, heart rate (normothermia 111 ± 7 beats min<sup>-1</sup> vs. hyperthermia 125 ± 6 beats min<sup>-1</sup>) and cardiac output (normothermia 9.0 ± 0.7 l min<sup>-1</sup> vs. hyperthermia 10.7 ± 0.8 l min<sup>-1</sup>), were greater in the hyperthermic condition (both  $P \leq 0.05$ ). At 75W, heart rate was similar between thermal conditions (normothermia 132 ± 10 beats min<sup>-1</sup> vs. hyperthermia 139 ± 7 beats min<sup>-1</sup>;  $P = 0.27$ ), however cardiac output was greater in the hyperthermic condition (normothermia 9.7 ± 0.9 l min<sup>-1</sup> vs. hyperthermia 11.1 ± 0.8 l min<sup>-1</sup>;  $P = 0.07$ ). Arterial blood pressure was similar between thermal conditions throughout exercise. **Conclusions:** Despite attenuated whole-body cutaneous vasodilation in grafted skin, the magnitude of the increase in heart rate and cardiac output are generally greater when burn survivors exercise in hyperthermic conditions.  
 Supported by NIH Grant R01 GM068865.

2005 Board #157 June 2, 2:00 PM - 3:30 PM  
**Effect Of Localized Cooling On Thermo-physiological Responses To Cycling-induced Hyperthermia During Recovery In Thermally-challenging Conditions**  
 Afton Seeley<sup>1</sup>, Christopher Cheatham<sup>1</sup>, Ross Sherman<sup>2</sup>, Yuanlong Liu<sup>1</sup>. <sup>1</sup>Western Michigan University, Kalamazoo, MI. <sup>2</sup>Grand Valley State University, Allendale, MI. (Sponsor: Kevin Jacobs, FACSM)  
 Email: ads129@miami.edu  
 (No relationships reported)

**PURPOSE:** To determine the effects of a phase changing ice-vest and a palm-cooling device on rectal and mean skin temperatures, heart rate (HR), and perceived thermal comfort during a 60 minute recovery period following exercise in the heat. **METHODS:** Ten recreationally active men and women (25 ± 3 years, VO<sub>2</sub> peak: 43.6 ± 7.5 mL·kg<sup>-1</sup>·min<sup>-1</sup>) cycled for 60 minutes at 50% VO<sub>2</sub> peak on a friction-braked cycle ergometer while exposed to hot environmental conditions (36°C; 45% relative humidity). Following exercise, each subject donned an ice vest, used a palm-cooling device, or sat passively, in randomized order for 60 additional minutes while in hot environmental conditions. Rectal (T<sub>re</sub>) and four-site (chest, triceps, quadriceps, calf) skin (T<sub>sk</sub>) temperatures, heart rate (HR), and perceived thermal comfort (TC) were measured every 5 min throughout exercise and recovery. **RESULTS:** Sixty minutes of cycling in hot environmental conditions elicited an elevation in T<sub>re</sub> from baseline across all exercise bouts (PostT<sub>re</sub>: 38.29 ± .32 °C, Net T<sub>re</sub> gain: 1.11 ± .34 °C). Reduction in mean T<sub>sk</sub> during the recovery period was significantly greater with the ice vest than the non-cooling condition (MD = 1.20 ± .39 °C,  $p = 0.042$ ), with specific differences at 10-30, 45, and 55 min of recovery ( $p < 0.05$ ). Reduction in HR during recovery was found to be significantly greater with the ice vest than the non-cooling condition (MD = 8.5 ± 1.5 b·min<sup>-1</sup>,  $p = 0.001$ ) with differences recorded at 5, 15, and 25-60 min of recovery ( $p < 0.05$ ). Despite T<sub>re</sub> and HR differences, no significant T<sub>re</sub> ( $p = 0.61$ ) or perceived TC ( $p = 0.24$ ) effects were found between the three recovery conditions. Use of the palm-cooling device was not statistically different than the non-cooling control in any variable measured. **CONCLUSION:** The use of a phase-changing ice vest following exercise, while still exposed to environmental heat stress, augmented T<sub>sk</sub> and HR recovery. This may be attributed to the larger surface area exposed to the cooling stimulus compared to the palm-cooling device. However, this cooling technique was not effective in lowering T<sub>re</sub> more than a non-cooling control, which arguably may play a greater role in hyperthermic fatigue. Furthermore, the use of palm-cooling was ineffective in providing thermo-physiological benefit during post-exercise recovery in a hot environment.

2006 Board #158 June 2, 2:00 PM - 3:30 PM  
**Repeated Immersion in Cold Water Does Not Alter Physiological Responses to Exercise in the Heat**  
 Douglas M. Jones<sup>1</sup>, Kaitlyn A. Rostomily<sup>1</sup>, Carina M. Pautz<sup>1</sup>, Danica W. Ito<sup>1</sup>, Stephen P. Bailey, FACSM<sup>2</sup>, Bart Roelands<sup>3</sup>, Romain Meeusen, FACSM<sup>3</sup>, Michael J. Buono, FACSM<sup>1</sup>. <sup>1</sup>San Diego State University, San Diego, CA. <sup>2</sup>Elon University, Elon, NC. <sup>3</sup>Vrije Universiteit Brussel, Brussels, Belgium. (Sponsor: Michael J. Buono, FACSM)  
 (No relationships reported)

Repeated cold stress induces physiological changes such as decreased skin temperature and a delayed onset of shivering in an effort to reduce heat loss and conserve energy during subsequent cold exposures. What remains unknown is whether repeated cold stress alters physiological and perceptual responses to exercise in the heat. Changes that occur in response to cold acclimation to attenuate heat loss could potentially result in increased body temperatures and higher thermal perceptions when exposed to a hot environment. **PURPOSE:** To determine if physiological and perceptual responses to exercise in the heat are influenced by repeated immersions in cold water. **METHODS:** Twelve healthy volunteers (age: 25.6 ± 5.2 years, height: 174.0 ± 8.9 cm, weight: 75.6 ± 13.1 kg) performed two heat trials consisting of 120 minutes of treadmill walking at 3.3 mph, 4.0% grade in 40°C and 40% RH. The first heat trial (pre-CA) was performed prior to seven 90-minute cold water immersions in 10°C water. Each immersion was separated by 24 hours. The second heat trial (post-CA) was performed 24 hours after the final immersion. Heart rate (HR), core temperature (T<sub>re</sub>), mean skin temperature (T<sub>msk</sub>), perceived exertion (RPE), thermal sensation (TS), and skin blood flow (SBF) were collected during each heat trial. Sweat rate and body heat storage were calculated for each trial. **RESULTS:** Significantly reduced skin temperature and a delayed onset of shivering were observed during immersion 7 when compared with immersion 1, suggesting that acclimation to cold occurred.

Findings from the heat trials revealed that mean  $\pm$  SD pre-CA vs post-CA end of test values for HR ( $145 \pm 19$  vs  $147 \pm 21$  bpm,  $p = 0.58$ ),  $T_{\text{rec}}$  ( $38.6 \pm 0.3$  vs  $38.5 \pm 0.4^\circ\text{C}$ ,  $p = 0.11$ ),  $T_{\text{max}}$  ( $36.6 \pm 0.5$  vs  $36.5 \pm 0.4^\circ\text{C}$ ,  $p = 0.36$ ), SBF ( $90.3 \pm 27.2$  vs  $82.2 \pm 33.5$  PU,  $p = 0.46$ ), RPE ( $12.8 \pm 2.0$  vs  $12.8 \pm 1.5$ ,  $p = 1.00$ ), TS ( $2.9 \pm 0.8$  vs  $2.8 \pm 0.4$ ,  $p = 0.59$ ) were not negatively impacted by repeated immersion in cold water. Additionally, similar responses for SR ( $1.3 \pm 0.3$  vs  $1.3 \pm 0.5$  L/hr,  $p = 0.49$ ), and HS ( $32.4 \pm 14.9$  vs  $27.6 \pm 11.9$  W/m<sup>2</sup>,  $p = 0.12$ ) were observed.

**CONCLUSION:** Findings suggest that repeated immersions in cold water do not alter physiological or perceptual responses to exercise in the heat. Future studies should seek to determine if longer adaptations to cold elicit changes when subsequently exposed to hot environments.

2007 Board #159 June 2, 2:00 PM - 3:30 PM  
**Thermoregulatory Response of Obese and Lean Adolescent Boys Cycling at the Same Metabolic Heat Production**

Paulo L. Sehl, Carolina A. Rodrigues, Tágli Henrique, Flavia Meyer. *Federal University of Rio Grande do Sul, Porto Alegre, Brazil.* (Sponsor: George J.F. Heigenhauser, FACSM)  
 Email: psehl@hotmail.com  
 (No relationships reported)

Adiposity is considered a factor which impairs thermoregulation during exercise in the heat. In adolescents, previous studies showed either similar or greater increase in rectal temperature ( $T_{\text{re}}$ ) in obese compared to lean. The differences amongst studies may be due to lack of controlling factors such as metabolic heat production ( $H_{\text{prod}}$ ), aerobic fitness and hydration levels. **PURPOSE:** To test the hypothesis that obese, compared to lean, adolescent boys with similar aerobic fitness and hydration levels will have greater  $T_{\text{re}}$  increase when exercising in the heat at the same  $H_{\text{prod}}$ . **METHODS:** Subjects were 11 heat-acclimatized boys (age  $12.8 \pm 1.5$  yrs, Tanner II-IV), five obese and six lean (%fat  $38.8 \pm 12.4$  vs.  $15.5 \pm 3.6$ ), with similar  $\text{VO}_{2\text{peak}}$  by total muscle mass ( $70.3 \pm 10$  vs.  $67.7 \pm 10.5$  mL kg<sup>-1</sup> min<sup>-1</sup>). They performed two 25-min exercise bouts, separated by 10-min rest in a controlled hot environment ( $35^\circ\text{C}$ , 40-45% RH). Subjects cycled at a power output that was clamped at a  $H_{\text{prod}}$  of  $5.5 \text{ W kg}^{-1}$  calculated by  $\text{VO}_2$  and  $\text{VCO}_2$  that were measured continuously.  $T_{\text{re}}$  and skin ( $T_{\text{skin}}$ ) temperatures were measured continuously. Body mass was measured before, and after each bout to calculate sweat volume. Boys were kept hydrated as water volume intake at rest between the exercise bouts was similar to fluid loss from the 1<sup>st</sup> bout. Results are expressed as mean  $\pm$  SD. **RESULTS:** The increase in  $T_{\text{re}}$  was not different in obese ( $0.18 \pm 0.3^\circ\text{C}$ ) and lean ( $0.25 \pm 0.22^\circ\text{C}$ ) boys at the end of exercise. Pooling all boys, no significant relationship was observed between  $\Delta T_{\text{re}}$  and %fat.  $T_{\text{skin}}$  increased similarly between obese ( $1.4 \pm 1.5^\circ\text{C}$ ) and lean ( $0.9 \pm 0.6^\circ\text{C}$ ) boys by the end of exercise. Total absolute sweat volume was greater ( $P = 0.03$ ) in obese ( $310 \pm 101$  vs.  $167 \pm 75$  mL); but, non-significant when corrected by body surface area (obese:  $162 \pm 48$ , lean:  $126 \pm 73 \text{ mL m}^{-2}$ ). **CONCLUSION:** When exercising at the same  $H_{\text{prod}}$  in the heat and controlled hydration and fitness levels, no difference was found in  $T_{\text{re}}$  increase between groups despite differences in adiposity.

2008 Board #160 June 2, 2:00 PM - 3:30 PM  
**Effect of Precooling On Cardiovascular Drift And Maximal Oxygen Uptake: A Pilot**

Charlie P. Katica<sup>1</sup>, Jonathan Wingo, FACSM<sup>2</sup>, Robert L. Herron<sup>2</sup>, Greg A. Ryan<sup>3</sup>, Stacy H. Bishop<sup>4</sup>, Mark Richardson<sup>2</sup>. <sup>1</sup>*Pacific Lutheran University, Tacoma, WA.* <sup>2</sup>*The University of Alabama, Tuscaloosa, AL.* <sup>3</sup>*Catawba College, Salisbury, NC.* <sup>4</sup>*Montevallo University, Montevallo, AL.* (Sponsor: Dr. Jonathan Wingo, FACSM)  
 (No relationships reported)

Hot environmental conditions result in substantial cardiovascular drift (CV drift) during exercise, which is proportional to reductions in maximal oxygen uptake ( $\text{VO}_{2\text{max}}$ ). Continuous cooling during exercise has been shown to mitigate the magnitude of CV drift and concomitant reduction in  $\text{VO}_{2\text{max}}$ , but it remains unknown if precooling before exercise has similar effects. **PURPOSE:** To determine if precooling blunts the magnitude of CV drift and accompanying decrement in  $\text{VO}_{2\text{max}}$  during prolonged, constant-rate, submaximal exercise in the heat.

**METHODS:** After a control  $\text{VO}_{2\text{max}}$  test, 5 men cycled on separate days at 60%  $\text{VO}_{2\text{max}}$  for 45 min in  $35^\circ\text{C}$  after being cooled for 20 min ( $45^\circ\text{C}$ ) or after no cooling treatment ( $45^\circ\text{C}$ ). After the 45 min, they completed a graded exercise test to measure  $\text{VO}_{2\text{max}}$ .  $\text{VO}_{2\text{max}}$  was also measured after 15 min of cycling at 60%  $\text{VO}_{2\text{max}}$  on a different day ( $15\text{max}$ ), so that CV drift and  $\text{VO}_{2\text{max}}$  could be measured over the same points in time.

**RESULTS:** Precooling successfully lowered mean skin temperature just before the start of exercise (mean  $\pm$  SD,  $32.9 \pm 0.4^\circ\text{C}$  vs.  $34.5 \pm 1.3^\circ\text{C}$  for  $45^\circ\text{C}$  and  $45^\circ\text{NC}$ , respectively,  $P = 0.05$ ), but rectal ( $37.0 \pm 0.3^\circ\text{C}$  and  $36.7 \pm 0.1^\circ\text{C}$  for  $45^\circ\text{C}$  and  $45^\circ\text{NC}$ , respectively,  $P = 0.51$ ) and mean body temperatures ( $36.3 \pm 0.4^\circ\text{C}$  and  $36.3 \pm 0.4$

$^\circ\text{C}$  for  $45^\circ\text{C}$  and  $45^\circ\text{NC}$ , respectively,  $P = 0.98$ ) were unaffected. During subsequent exercise, the magnitude of CV drift was unaffected by precooling ( $P > 0.05$ ), and  $\text{VO}_{2\text{max}}$  was also unaffected ( $45^\circ\text{C} = 2.49 \pm 0.2 \text{ L} \cdot \text{min}^{-1}$  vs.  $45^\circ\text{NC} = 2.41 \pm 0.2 \text{ L} \cdot \text{min}^{-1}$ ,  $P = 0.53$ ).

**CONCLUSIONS:** Precooling of the head, neck, quadriceps, calves and torso has no effect on the magnitude of CV drift and decrease in  $\text{VO}_{2\text{max}}$  during subsequent exercise in the heat.

2009 Board #161 June 2, 2:00 PM - 3:30 PM  
**A Passive Hyperthermia Bout on Glucose Tolerance and Leptin Responses in Obese Type 2 Diabetics.**

Eric Rivas<sup>1</sup>, Dan E. Newmire<sup>2</sup>, Craig G. Crandall, FACSM<sup>3</sup>, Vic Ben-Ezra<sup>2</sup>. <sup>1</sup>*University of California, Irvine, CA.* <sup>2</sup>*Texas Woman's University, Denton, TX.* <sup>3</sup>*Institute for Exercise and Environmental Medicine, Dallas, TX.* (Sponsor: Craig Crandall, FACSM)  
 Email: erivas4@uci.edu  
 (No relationships reported)

**BACKGROUND:** Acute and chronic hyperthermic treatments in animal diabetic models have repeatedly resulted in improved insulin sensitivity and glycemic control. **PURPOSE:** This study tested the hypothesis that an acute 1 h bout of hyperthermic treatment would improve glucose, insulin, and leptin responses to an oral glucose challenge (OGTT) in obese type 2 diabetics and healthy humans.

**METHODS:** Nine obese ( $45 \pm 7.1\%$  fat mass) type 2 diabetics (DM2:  $50.1 \pm 12.9$ ,  $7.5 \pm 1.8\%$  HbA1c) absent of insulin therapy and nine similar aged ( $41.1 \pm 13.7$  y,  $P = 0.185$ ) healthy non-obese controls ( $33.4 \pm 7.8\%$  fat mass,  $P = 0.009$ ;  $5.3 \pm 0.4\%$  HbA1c,  $P = 0.007$ ) participated. Using a randomized design, subjects underwent both a whole-body passive hyperthermia treatment via head-out warm water immersion (1 hr resting in  $39.4 \pm 0.4^\circ\text{C}$  water) that increased internal body temperature by  $\sim 1.6^\circ\text{C}$  and a non-immersion control resting trial. Twenty-four hours post treatments, a 75 g OGTT was administered to evaluate changes in plasma glucose, insulin, C-peptide, and leptin concentrations.

**RESULTS:** Warm water immersion resulted in similar increases in internal body temperature ( $\Delta T_{\text{re}}$ ,  $1.6 \pm 0.4^\circ$ ), mean skin temperature ( $\Delta T_{\text{sk}}$ ,  $6.5 \pm 0.8$ ), and heart rate (AHR from rest,  $33.5 \pm 8.3$  bpm) between groups. The hyperthermic exposure did not alter area under the curve responses for plasma glucose, insulin, or C-peptide during the OGTT in either group, relative to the control trial. Fasting absolute and normalized (per kg fat mass) plasma leptin were significantly increased ( $P = 0.009$ ) in both DM2 and control groups 24 hours after hyperthermic treatment, and remained elevated at 120 min post OGTT ( $P < 0.001$ ) when compared to the control trial.

**CONCLUSIONS:** These data indicate that 1 hr hyperthermic treatment does not improve glucose or insulin responses to a glucose challenge 24 h post treatment in moderate metabolic controlled obese DM2 or healthy individuals. However, hyperthermia elevated plasma leptin levels independent of fat mass which may alter appetite in both populations. Thus, chronic hyperthermic treatments may be an avenue for reducing caloric intake, reducing fat mass, and thus improving metabolic control.

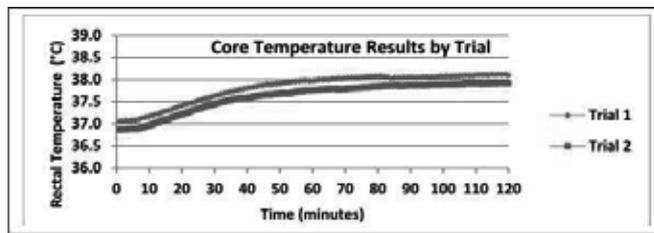
2010 Board #162 June 2, 2:00 PM - 3:30 PM  
**Reproducibility of a Heat Tolerance Test: Evaluating Return to Duty Status in Heat Injured Warfighters**

Jay Heaney. *Naval Health Research Center, San Diego, CA.* (Sponsor: Michael Buono, FACSM)  
 Email: jay.h.heaney.civ@mail.mil  
 (No relationships reported)

**PURPOSE:** Certain Military Occupational Specialty populations require thermoregulatory capacity be evaluated for warfighters who have experienced a heat stroke injury as part of their "Return to Duty" determination. Within the Navy and Marine Corp, the NHRC Heat Tolerance Test (HTT) is utilized, requiring the completion of a 120 min HTT with a core temperature ( $T_{\text{re}}$ )  $\leq 38.6^\circ\text{C}$ . Data are presented evaluating the reproducibility of the NHRC HTT performed by warfighters recovering from a heat stroke injury.

**METHODS:** Forty male, active-duty volunteers with a prior heat stroke injury (age  $24.9 \pm 4.8$  yrs; ht  $179.6 \pm 6.9$  cm; wt  $86.0 \pm 8.0$  kg) completed two HTT trials of continuous treadmill walking (3.3 mph, 4% grade) exposed to  $40^\circ\text{C}$ , 40% RH.  $T_{\text{re}}$  and HR were recorded every minute during each trial. There was a minimum of 3 days separating the repeat trials. A repeated measures ANOVA was used to test for significance ( $p < 0.05$ ) between trials.

**RESULTS:** Of the 80 simulated HTTs (0-120 min) that were evaluated, 31 subjects (62 trials) passed both HTT trials. Six subjects failed both trials and 3 subjects failed trial 1 but passed trial 2. Analysis of  $\Delta T_{\text{re}}$  values between trial 1 ( $1.1 \pm 0.4^\circ\text{C}$ ) and trial 2 ( $1.1 \pm 0.4^\circ\text{C}$ ), respectively, revealed no significant differences ( $p > 0.05$ ).



**CONCLUSIONS:** As displayed in the above graph,  $T_{\text{rec}}$  response demonstrated a similar response for each of the two trials. Of the 3 subjects who had different pass/fail responses, values were just over the failing threshold in trial 1 and just under the passing threshold in the trial 2. These results demonstrate that NHRC's HTT produced similar physiological responses among repeat trials amongst 92% warfighters with a heat stroke injury.

2011 Board #163 June 2, 2:00 PM - 3:30 PM  
**Effect of Ice Slurry Ingestion on Cardiovascular Drift and Maximal Oxygen Uptake During Heat Stress**  
 Jason Ng<sup>1</sup>, Ward C. Dobbs<sup>2</sup>, Bjoern Hornikel<sup>2</sup>, Jonathan E. Wingo, FACSM<sup>2</sup>. <sup>1</sup>California State University, San Bernardino, San Bernardino, CA. <sup>2</sup>The University of Alabama, Tuscaloosa, AL.  
 Email: jason.ng@csusb.edu  
 (No relationships reported)

The progressive increase in heart rate (HR) and decrease in stroke volume (SV)—known as cardiovascular (CV) drift—is associated with a reduction in maximal oxygen uptake ( $\dot{V}O_{2\text{max}}$ ). External body cooling by fan airflow mitigates the decrease in  $\dot{V}O_{2\text{max}}$  associated with CV drift during cycling in hot conditions. It remains unknown whether internal body cooling via ice slurry ingestion elicits a similar response.

**PURPOSE:** To investigate the effect of ice slurry ingestion on CV drift and  $\dot{V}O_{2\text{max}}$  during heat stress.

**METHODS:** Eight men (mean  $\pm$  SD; age =  $22 \pm 4$  y, height =  $182.2 \pm 6.0$  cm, mass =  $76.3 \pm 11.2$  kg, body fat =  $9.1 \pm 3.9\%$ ,  $\dot{V}O_{2\text{max}}$  =  $52.2 \pm 7.9$  mL·kg<sup>-1</sup>·min<sup>-1</sup>) completed a graded exercise test on a cycle ergometer in 22 °C to measure  $\dot{V}O_{2\text{max}}$ . Then on 3 separate counterbalanced occasions, they cycled at 60% $\dot{V}O_{2\text{max}}$  in hot conditions (35 °C, 40% RH) for either 15 min, 45 min with tepid (23 °C) fluid ingestion (45FL), or 45 min with ice (-1 °C) slurry ingestion (45ICE), followed immediately by measurement of  $\dot{V}O_{2\text{max}}$ .

**RESULTS:** The increase in HR was twice as large in 45FL (8.4%) compared to 45ICE (4.6%;  $P \leq 0.05$ ). SV declined by 6.2% in 45FL but was maintained with 45ICE ( $P \leq 0.05$ ).  $\dot{V}O_{2\text{peak}}$  decreased by 8.8% but was not different between conditions ( $P > 0.05$ ).

**CONCLUSIONS:** While ice slurry ingestion attenuated CV drift more than fluid ingestion, it did not mitigate the decline in  $\dot{V}O_{2\text{max}}$ . Further research is warranted to determine if ice slurry ingestion mitigates the decline in  $\dot{V}O_{2\text{max}}$  during exercise at higher intensities and/or in more extreme heat stress.

2012 Board #164 June 2, 2:00 PM - 3:30 PM  
**Wet-bulb Globe Temperature Comparison Of Olympic Games Host Cities In 2008, 2012, 2016, And 2020**  
 Yuki Murata<sup>1</sup>, Yuri Hosokawa<sup>2</sup>, Kumiyo Kai<sup>3</sup>. <sup>1</sup>Chukyo University, Toyota, Japan. <sup>2</sup>Korey Stringer Institute, University of Connecticut, Storrs, CT. <sup>3</sup>Nagoya Women's University, Nagoya, Japan.  
 (No relationships reported)

Tokyo, Japan, is the host city for the XXXII Olympic Summer Games in 2020. The average temperature and humidity in Tokyo is over 25°C and 80%, with more than 3,000 patients taken to emergency rooms for heat illnesses every summer. Environmental considerations should be made to ensure the health and safety of athletes and spectators during the events. The American College of Sports Medicine (ACSM) currently recommends the use of sporting event modifications based on the wet-bulb globe temperature (WBGT). **PURPOSE:** To retrospectively summarize the WBGT data of Tokyo during the summer days and to compare them to the WBGT data of other Olympic Summer Game locations from 2008, 2012, and 2016. **METHODS:** WBGT, dry-bulb temperature, and wet-bulb temperature of Tokyo, London, Beijing, and Rio de Janeiro were collected retrospectively from online database (Tokyo, Japanese Ministry of the Environment; London, Met Office National Meteorological Archive of United Kingdom; Beijing, Weather Underground; Rio de Janeiro, Weather Underground). The highest daily WBGT values ( $WBGT_{\text{HT}}$ ) from 2 days before the opening ceremony to 2 days after the closing ceremony were collected from the recent 5-year period for Tokyo (July 22th to August 11th in 2011-2015). For London, Beijing,

and Rio de Janeiro,  $WBGT_{\text{HT}}$  from 5-year period leading up to the corresponding Olympic year was used (London, July 25th to August 14th in 2008-2012; Beijing, August 6th to 26th in 2004-2008; Rio de Janeiro, August 3th to 23th in 2011-2014). Average  $WBGT_{\text{HT}}$  value for each city was compared using ANOVA. **RESULT:** Average  $WBGT_{\text{HT}}$  in Tokyo ( $29.6 \pm 1.1$ °C) was significantly higher ( $p < 0.01$ ) than previous Summer Olympic cities (London,  $20.3 \pm 0.8$ °C; Beijing,  $27.0 \pm 0.9$ °C; Rio de Janeiro,  $23.4 \pm 0.9$ °C). **CONCLUSION:** Historical data suggest that average  $WBGT_{\text{HT}}$  of Tokyo is "Cancel level for EHS risk" according to the ACSM's guideline for continuous activity and competition. Tokyo Olympic Games in 2020 may experience one of the hottest climate conditions in the Olympic history. The Japan Olympic Committee should work closely with sports scientists to implement institutional strategies to ensure the health and safety of athletes and spectators from heat injuries.

2013 Board #165 June 2, 2:00 PM - 3:30 PM  
**Core Temperature In Triathletes During The Ironman World Championship - Kailua Kona (Hawaii)**  
 Guillermo Olcina<sup>1</sup>, Julio Calleja-González<sup>2</sup>, Carmen Crespo<sup>1</sup>, Rafael Timón<sup>1</sup>, Braulio Sánchez-Ureña<sup>3</sup>, Jeffrey M. Mjaanes, FACSM<sup>4</sup>. <sup>1</sup>Sport Sciences Faculty, University of Extremadura, Cáceres, Spain. <sup>2</sup>Sport Sciences Faculty, University of Basque Country, Vitoria, Spain. <sup>3</sup>Human movement and Quality Life School, National University, Heredia, Costa Rica. <sup>4</sup>Rush University Medical Center, Chicago, IL. (Sponsor: Jeffrey M. Mjaanes, FACSM)  
 Email: golcina@unex.es  
 (No relationships reported)

During ultra-endurance events, thermoregulation plays an important role in guaranteeing physical performance and avoiding health problems (i.e: heat stroke). Hyperthermia occurs when the core temperature rises above 38.5°C. Weather conditions (heat & humidity) or training level of athletes may affect thermoregulation. **PURPOSE:** To measure core temperature ( $T_{\text{core}}$ ) in high-level triathletes during the Ironman World Championship (Hawaii) under thermal stress conditions. **METHOD:**  $T_{\text{core}}$  of fifteen triathletes (age:  $36.11 \pm 7.36$  years, weight:  $71.14 \pm 7.12$  kg, height:  $179 \pm 0.04$  cm, fat %:  $8.48 \pm 0.85$ ) who classified for the Ironman World Championship in Kailua - Kona were measured using an ingestible pill telemetry system before competition, upon completion of the event (marathon) and after 60 minutes of recovery. Event mean ambient temperature was 29.1 °C (range 20-36 °C) and relative humidity was 76% (range 71-88%). Body Mass Index (BMI) and exercise perceived exertion (Borg Scale and Visual Analog Scale-Pain) were measured before the event and 60 minutes after the event. Performance variables were extracted from their own GPS and official race time and splits. Statistical analysis was performed using Repeated Measured Test, ANOVA. **RESULTS:** Finish time (hh:mm:ss) was 10:06:56  $\pm$  0:48:30. Initial  $T_{\text{core}}$  was  $36.62 \pm 0.17$  °C, increasing at the end of the event ( $38.55 \pm 0.64$   $p < 0.01$ ) and remaining high 60 minutes after the event ( $38.65 \pm 0.41$ °C  $p < 0.002$ ). BMI significantly decreased after the event ( $22.85 \pm 1.11$  vs.  $21.73 \pm 1.36$   $p < 0.05$ ) while exercise perceived exertion - Borg Scale ( $10.2 \pm 1.64$  vs.  $18.60 \pm 1.67$   $p < 0.003$ ) and perceived muscle pain - VAS Pain ( $2.75 \pm 1.59$  vs.  $9.08 \pm 1.13$   $p < 0.001$ ) increased significantly after the event. **CONCLUSION:** High-level triathletes competing under thermal stress conditions in the Kona Ironman reached a state of hyperthermia during the event. After 60 minutes of recovery, when exercise perceived exertion was at a maximum, the hyperthermic state persisted. Strategies to aid cooling and recovery, especially after the race, should be considered by both triathletes and event organizers. Supported by Government of Extremadura-Spain (GR15020 - CTS036) and 226ERS-Endurance Research Lab

2014 Board #166 June 2, 2:00 PM - 3:30 PM  
**Exercising In The Heat Disrupts Human Heat Balance In Heart Failure Patients**  
 Bryce Balmain<sup>1</sup>, Ollie Jay<sup>2</sup>, Surendran Sabapathy<sup>1</sup>, Danielle Royston<sup>1</sup>, Glenn Stewart<sup>1</sup>, Rohan Jayasinghe<sup>3</sup>, Norman Morris<sup>1</sup>. <sup>1</sup>Griffith University, Gold Coast, Australia. <sup>2</sup>University of Sydney, Sydney, Australia. <sup>3</sup>Gold Coast University Hospital, Gold Coast, Australia.  
 Email: bryce.balmain@griffithuni.edu.au  
 (No relationships reported)

Heart failure (HF) patients appear to show altered thermoregulatory responses during exercise; however, this has not been examined during exercise in the heat. **Purpose:** Accordingly, this study compared thermoregulatory and human heat balance parameters of HF and healthy controls (CON) during exercise in a warm environment. **Methods:** Eight HF (NYHA class I-II), and six CON matched for age (HF:  $63 \pm 7$ ; CON:  $64 \pm 7$  yr;  $p = 0.72$ ) and body surface area (HF:  $2.04 \pm 0.11$ ; CON:  $1.96 \pm 0.13$  m<sup>2</sup>;  $p = 0.26$ ) performed two 60-min cycling tests at 60% of their individual peak oxygen uptake in a 30°C environment. Oxygen uptake ( $\dot{V}O_2$ ), core temperature ( $T_{\text{c}}$ ), mean skin temperature ( $T_{\text{sk}}$ ), and forearm cutaneous vascular conductance (CVC) (derived from the ratio of laser Doppler flux to mean arterial pressure) were monitored at

rest and during exercise. Whole body sweat rate (WBSR) was determined from pre-post nude body weight corrected for fluid intake. Metabolic heat production ( $H_{prod}$ ) and evaporative heat balance requirements ( $E_{req}$ ), as well as dry heat loss ( $H_{dry}$ ) and evaporative heat potential ( $E_{sk}$ ) – assuming all secreted sweat evaporated, were calculated. **Results:** Absolute  $H_{prod}$  (HF: 367±96; CON: 511±116 W) and  $H_{prod}$  per unit mass (HF: 4.1±0.9; CON: 6.5±1.3 W/kg) were lower ( $p<0.05$ ) for HF and consequently  $E_{req}$  (HF: 298±92 W, 3.4±0.9 W/kg; CON: 438±109 W, 5.6±1.3 W/kg) was also lower ( $p<0.05$ ) for HF compared to CON. Despite a difference in  $H_{prod}$ ,  $H_{dry}$  was similar ( $p>0.05$ ) between the two groups (HF: 69±18 W, 0.9±0.4 W/kg; CON: 72±20 W, 0.9±0.2 W/kg). Increases in  $T_{re}$  (HF: 0.94±0.4; CON: 0.97±0.29°C) and  $T_{sk}$  (HF: 2.48±0.88; CON: 3.11±1.02°C) were similar ( $p>0.05$ ); but, increases in CVC (HF: 132±14; CON: 553±215 %CVC<sub>rest</sub>) were lower ( $p<0.01$ ) in HF compared to CON. WBSR (HF: 0.38±0.15; CON: 0.67±0.31 L/hr) tended to be lower ( $p=0.09$ ) in HF compared to CON; however, the relative difference in  $E_{sk}$  to  $H_{prod}$  (HF: 70±23; CON: 86±25%) was similar ( $p>0.05$ ) between groups. **Conclusion:** Despite exercising with a lower  $H_{prod}$  per unit mass, HF patients had a similar rise in  $T_{re}$  with a smaller increase in CVC compared to CON. These results suggest that from a thermoregulatory perspective, HF patients are limited in their ability to manage a thermal load and distribute internal heat content among various tissues in the body, secondary to poorer circulation to the periphery.

2015 Board #167 June 2, 2:00 PM - 3:30 PM  
**Intranasal Insulin Administration Enhances Thermoregulatory Responses During Passive Heating In Humans**

Kazunobu Okazaki<sup>1</sup>, Ryosuke Takeda<sup>2</sup>, Daiki Imai<sup>1</sup>, Akemi Ota<sup>2</sup>, Nooshin Naghavi<sup>2</sup>, Yoshihiro Yamashina<sup>2</sup>, Yoshihiro Yamashina<sup>2</sup>. <sup>1</sup>Research Center for Urban Health and Sports, Osaka City University, Osaka, Japan. <sup>2</sup>Osaka City Univ Grad Sch Med, Osaka, Japan. (Sponsor: Katsumi Asano, FACSM)  
 Email: okazaki@sports.osaka-cu.ac.jp  
 (No relationships reported)

**PURPOSE:** We have reported that thermoregulatory responses during passive heating were enhanced with glucose ingestion prior to heating compared with fructose ingestion. We hypothesized that insulin increased by glucose ingestion might enhance thermoregulation responses via central mechanisms. In this study, we assessed the effects of insulin delivery to the brain by intranasal insulin administration on thermoregulatory responses during passive heating in humans.

**METHODS:** Five healthy male subjects (24.2±6.0 yrs, mean±SD) were participated. Fructose solution (75g of fructose with 300 mL of water) was ingested after baseline measurements. Then, insulin (Insulin trial, 160 IU/1.6mL in total) or normal saline (Control trial, 1.6 mL in total) was administrated intranasally during 15 min in a random order. Twenty minutes after ingestion, the subjects were passively heated by lower legs immersion (42°C of water) for 60 min. Esophageal (Tes) and skin temperatures, cardiorespiratory variables, cutaneous blood flow and sweat rate at the forearm and chest were continuously measured. Blood samples were taken before ingestion, before heating, and 10, 20, 40, 60 min after the start of heating. Sweat loss was calculated from body weight before and after the trial.

**RESULTS:** There were no significant effects of insulin on heart rate, blood pressures, oxygen consumption, blood glucose concentration, relative change in plasma volume, and mean skin temperature. Tes was lower, chest sweat rate and sweat loss were higher in Insulin trial than Control trial. We found marginally significant effects of insulin on Tes, chest sweat rate, and sweat loss ( $P = 0.10, 0.12, \text{ and } 0.07$ , respectively).

**CONCLUSIONS:** Insulin delivery to the brain by intranasal insulin administration enhances thermoregulatory responses and reduces thermal strain during passive heating in humans.

2016 Board #168 June 2, 2:00 PM - 3:30 PM  
**Thermal Sensation During Hyperthermia Is Modified With Postural Change And Aging**

RYOSUKE TAKEDA, Kazunobu Okazaki, Akemi Ota, Nooshin Naghavi, Yoshihiro Yamashina, Yoshikazu Hirasawa, Akina Suzuki, Daiki Imai, Hisayo Yokoyama, Toshiaki Miyagawa. Osaka City Univ Grad Sch Med, Osaka-shi, Japan.  
 Email: m2065903@med.osaka-cu.ac.jp  
 (No relationships reported)

**PURPOSE:** Aging is associated with deteriorated autonomic heat dissipative responses and blunted thermal sensations during hyperthermia. We recently found that postural change from supine (SUP) to sitting (SIT) increased whole body thermal sensation while decreased autonomic heat dissipative responses during hyperthermia in young subjects. In this study, we assessed whether these responses with postural change during hyperthermia was maintained in older subjects.

**METHODS:** Seventeen young (21±1.6 yrs, mean±SD) and twelve older (71±3.0 yrs) healthy men underwent measurements of whole body thermal sensation (VAS) in SUP and SIT randomly under normothermia (NT; Tes, 36.6±0.0°C and 36.4±0.2°C,

respectively, mean±SE) and mild-hyperthermia with lower legs immersion in 42°C water (HT; Tes, 37.3±0.0°C and 37.4±0.2°C, respectively). Tes and Tsk (mean skin temperature) were measured continuously.

**RESULTS:** Tes and Tsk increased during HT than NT in both groups. There were no significant differences in Tes and Tsk between young and older men during both conditions. Whole body thermal sensation was lower in older than young men under all conditions ( $P<0.05$ ). Whole body thermal sensation was increased with postural change from supine to sitting in young men ( $P<0.05$ ) but remained unchanged in older men. Response of whole body thermal sensation with postural change from supine to sitting during HT was significantly lower in older than young men ( $P<0.05$ ).

**CONCLUSIONS:** Whole body thermal sensation under normothermia and hyperthermia was blunted and its response with postural change during hyperthermia was disappeared with aging.

2017 Board #169 June 2, 2:00 PM - 3:30 PM  
**Six Days Of Mild Heat Stress Reduces Inflammation & Carbohydrate Metabolism Bias in C2C12 Myotubes**

Mandy C. Szymanski, Kyle L. Sunderland, Roger A. Vaughan, Matthew R. Kuennen. High Point University, High Point, NC.  
 Email: mkuennen@highpoint.edu  
 (No relationships reported)

**PURPOSE:** Heat acclimation stimulates metabolic adaptations in skeletal muscle that improve work performance in hot environments. While organismal heat responses are well characterized, less is known about the molecular adaptations that coordinate these responses. This work investigated the effect of repeated heat exposure in vitro using C2C12 myotubes as a model system. **METHODS:** C2C12 myotubes were incubated for 2hr/d at 40°C for 6d (heat treatment) or maintained at 37°C (control). Protein expression of heat shock proteins, inflammatory markers, and several regulators of glycolytic and lipid metabolism were measured via western blot. Group comparisons were made using students t-tests, statistical significance was set at  $p<0.05$ . **RESULTS:** Heat treatment led to an induction of the heat shock response, as indicated by increased expression of HSF-1, HSP-60, and HSP-70 (by 35%, 142%, and 104%, respectively). This coincided with repression of markers along the NFKB pathway, including a 24% reduction in p-IKkA and a 20% reduction in pNFKB p65. Interestingly, while GLUT-4 was unchanged, p-GSK-3a/b (repressor of GS) was increased by 79% and GSK-3a (activator of GS) was reduced by 38%, suggesting suppressed GS activity. p-ACCb was also elevated by 26% in heat-treated cells; however FAS expression was not significantly altered. **CONCLUSION:** Thermal preconditioning appears to bias C2C12 myotubes away from glycogen storage towards lipid synthesis; actions which coincide with reduced inflammation and activation of the heat shock response. We propose that the reduction in NFKB signaling and altered substrate storage both contribute to the benefits that prior heat exposure affords upon subsequent stress.

2018 Board #170 June 2, 2:00 PM - 3:30 PM  
**Postural Sway In Persons With Multiple Sclerosis During Passive Heat Exposure**

Paula Y. S. Poh<sup>1</sup>, Amy N. Adams<sup>1</sup>, Mu Huang<sup>2</sup>, Dustin R. Allen<sup>2</sup>, Scott L. Davis<sup>2</sup>, Craig G. Crandall, FACSM<sup>1</sup>. <sup>1</sup>Institute for Exercise and Environmental Health, Dallas, TX. <sup>2</sup>Southern Methodist University, Dallas, TX. (Sponsor: Craig Crandall, FACSM)  
 Email: paula.ys.poh@gmail.com  
 (No relationships reported)

Multiple sclerosis (MS) is a neurological disease marked by demyelination and axonal loss within the central nervous system. This pathology often results in poor postural stability, which underlies the increased risk of falls. Additionally, individuals with MS often experience transient increases in clinical signs and symptoms during heat exposure (Uthoff's Phenomenon). **PURPOSE:** To test the hypothesis that heat exposure compromises postural stability in MS patients.

**METHODS:** Seven individuals with relapsing-remitting MS (mean ± SD: age, 49 ± 10 y) and 6 healthy controls (47 ± 10 y) participated in this study. Following a 30 min baseline period in a thermoneutral environment (25°C, 30% relative humidity (RH)), three 30 sec stand tests, with eyes closed, were performed on a force plate to measure distance travelled from the center of gravity, an index of postural sway. Subjects were randomly exposed to a 40°C, 30% RH environment (HYPER) or a 25°C, 30% RH environment (NEUT). Stand tests were repeated at 15 and 60 min during each thermal condition. Hemodynamic and thermal variables were measured continuously.

**RESULTS:** In both groups, skin temperature was elevated during the HYPER trial ( $P < 0.001$ ), whereas no differences in internal temperature were observed for HYPER or NEUT trials ( $P = 0.53$ ). In MS patients, the distance travelled from the center of gravity at 15 min (23.9 ± 14.7 cm;  $P = 0.04$ ) and 60 min (27.4 ± 20.8 cm;  $P = 0.005$ ) of HYPER exposure was greater relative to pre-heating baseline (19.6 ± 3.8 cm). Also in MS patients, this index of sway was unchanged relative to baseline (17.5 ± 0.8 cm) at the 15 (16.8 ± 6.1 cm;  $P = 0.96$ ) and 60 min (16.8 ± 6.1;  $P = 0.79$ ) time points during NEUT. No differences in the index of sway were observed in the healthy controls across either thermal condition.

Abstracts were prepared by the authors and printed as submitted.

**CONCLUSIONS:** In the absence of vision, HYPER increased postural sway relative to NEUT in MS patients. These findings suggest that MS patients have decreased postural stability during heat exposure, which can potentially increase their risk of falling. Project funded by the National Multiple Sclerosis Society.

2019 Board #171 June 2, 2:00 PM - 3:30 PM  
**The Extracellular Heat Shock Protein 72 Response To A 7-day Desert-based Ultra-marathon**

Lee Taylor<sup>1</sup>, Craig A. Suckling<sup>2</sup>, Justin D. Roberts<sup>2</sup>, Bryna CR Christmas<sup>3</sup>, Hannah Marshall<sup>4</sup>. <sup>1</sup>ASPETAR, Doha, Qatar. <sup>2</sup>Anglia Ruskin University, Cambridge, United Kingdom. <sup>3</sup>Qatar University, Doha, Qatar. <sup>4</sup>University of Bedfordshire, Bedford, United Kingdom. (Sponsor: Lars McNaughton, FACSM)  
 Email: drleetaaylorphd@gmail.com  
 (No relationships reported)

Extracellular heat shock protein 72 (eHsp72) concentration has been shown to significantly increase in response to extreme stress. Ultra-endurance events are becoming increasingly popular and place individuals under a prolonged duration of exercise stress, which is exacerbated when undertaken in extreme environmental conditions, particularly extreme heat. The extreme stress imposed upon the body under such conditions places individuals at increased risk of heat illness and cellular damage. The eHsp72 response to ultra-endurance events in extreme environmental conditions has received little attention and thus research is required to understand the heat shock response to such stress. **PURPOSE:** To investigate the effect of a desert based ultra-marathon (the Marathon des Sables; MDS) on the eHsp72 response in humans. **METHODS:** Thirteen (three female) competitors (age 42, range: 23-60 years, height 1.74 ± 0.10 m, mass 77.29 ± 12.92 kg, VO<sub>2</sub>max 55.25 ± 11.96 ml.kg.min<sup>-1</sup>) provided blood samples via venepuncture for the measurement of eHsp72 concentration on two occasions prior to the race: i) 12 weeks (baseline), and ii) 7 d (pre-race) prior to departure for the MDS, and two further occasions post-race: iii) ~ 6 h post-race and iv) 7 d post-race. The MDS 2015 consisted of 7 consecutive stages, over 7 d, across the Sahara Desert, Morocco, equating to a total distance of 249.4 km. eHsp72 was determined using a commercially available ELISA kit and is displayed as a percentage change from baseline values. **RESULTS:** Participants completed the ultra-marathon in an average total time of 3043 ± 1002 min. Post-race (~ 6 h) eHsp72 concentration was 122%, 117% and 108% greater than baseline, pre-race and 7 d post-race, respectively (F<sub>3, 45</sub> = 63.348, p < 0.001). **CONCLUSION:** eHsp72 concentration is significantly elevated in response to 7 consecutive days of prolonged exercise heat stress in extreme environmental conditions and returns to near baseline values within 7 d post race completion.

2020 Board #172 June 2, 2:00 PM - 3:30 PM  
**The Effects of Cooling during Constant Power Non-steady State Cycling in Endurance Trained Athletes**

Eric P. Homestead, Benjamin J. Ryan, Jesse A. Goodrich, William C. Byrnes, FACSM. *University of Colorado Boulder, Boulder, CO.* (Sponsor: William C. Byrnes, FACSM)  
 Email: eric.homestead@colorado.edu  
 (No relationships reported)

**PURPOSE:** The aim of this study was to compare the effects of different cooling methods on thermoregulatory and energetic responses during constant power, non-steady state cycling in thermoneutral conditions. **METHODS:** Endurance trained males (n = 12) performed a graded exercise test to determine lactate threshold power (1 mM above baseline). On three separate days, subjects cycled at their lactate threshold power for 60 min or until volitional exhaustion under three conditions: wearing a water perfused vest and sleeves circulating ice-cooled water (COOL), a synthetic shirt embedded with an active particle technology claimed to facilitate evaporative heat loss (EVAP), and a standard synthetic shirt (CON). Metabolic variables, core temperature (T<sub>c</sub>), sweat rate, thermal sensation, and rating of perceived exertion (RPE) were measured during testing. **RESULTS:** A greater percent of subjects completed 60 min of cycling during COOL (82%) and EVAP (75%) compared to CON (64%). The increase in T<sub>c</sub> from baseline at isotime (same time point across conditions based on the shortest duration completed in all three experimental conditions specific to each subject) was reduced during COOL and EVAP compared to CON (1.44 ± 0.45 and 1.52 ± 0.43 vs. 1.66 ± 0.45 °C, p < 0.05). Sweat rate was reduced during COOL compared to EVAP and CON (1,312 ± 331 vs. 1,525 ± 393 and 1,550 ± 548 mL · hr<sup>-1</sup>, p < 0.01). Gross efficiency decreased over time from baseline in all conditions (p < 0.01), but COOL attenuated this decrease by 22% compared to CON (p < 0.05). No differences in the change in gross efficiency over time were found between COOL and EVAP or between EVAP and CON. Over time, thermal sensation was reduced by 23% during COOL compared to EVAP and CON (p < 0.01), whereas RPE was reduced by 3% and 2% during COOL and EVAP compared to CON (p < 0.01). **CONCLUSION:** During constant power, non-steady state cycling, cooling using the vest and sleeves or the synthetic shirt embedded with an active particle technology blunted the rise in core temperature and RPE over time compared to the standard synthetic shirt. Cooling using

the vest and sleeves also reduced the decrease in gross efficiency over time as well as reduced sweat rate and thermal sensation compared to wearing the standard synthetic shirt. Supported by a donation from 37.5 Technology.

2021 Board #173 June 2, 2:00 PM - 3:30 PM  
**Physiological and Perceptual Effects of a Cooling Garment During Simulated Industrial Work in the Heat**

Cory L. Butts, Cody R. Smith, Matthew S. Ganio, Brendon P. McDermott. *University of Arkansas, Fayetteville, AR.* (Sponsor: Stavros A. Kavouras, FACSM)  
 Email: clbutts@uark.edu  
 (No relationships reported)

Work in the heat increases physiological strain, especially when clothing limits heat dissipation. Using phase change cooling garments (CG) to mitigate core temperature rise may reduce physiological strain and prevent heat illness. **PURPOSE:** Evaluate the physiological and perceptual effects of using a phase change CG while conducting simulated industrial work in the heat. **METHODS:** Male participants (n=20, age 25 ± 4 y, ht 1.79 ± 0.08 m, body mass 75.0 ± 10.7 kg, body fat 13.6 ± 5.2%) wearing compression undergarments, coverall suit, gloves, and hard-hat to mimic industry clothing, completed two randomly assigned trials in an environmental chamber (34.2 ± 0.05°C, 54.7 ± 0.3%RH). Trials consisted of two 20 min work bouts (W1 and W2; separated by five min seated rest) and involved treadmill walking, lifting and moving boxes, tests of dexterity, and carrying dumbbells over steps. A final performance (PER) bout (maximum number of repetitions in 15 min of box moving, dexterity tests, and carrying dumbbells over steps) was followed by 10 min of recovery (REC). Phase change inserts (10°C) were added to the compression undergarment during the CG trial after baseline measures and replaced pre-PER, while the control (CON) trial included no inserts. Physiological and perceptual measures were recorded post W1, W2, and PER, and at three and 10 min of REC. Heat storage (HS) was also calculated. **RESULTS:** Rectal temperature was different at 3 min (CON 38.78 ± 0.38°C, CG 38.52 ± 0.39°C, P=0.003) and 10 min (CON 38.72 ± 0.37°C, CG 38.36 ± 0.40°C, P<0.001) of REC. Heart rate was lower in the CG trial (P<0.05) post-W2, pre-PER, and at 3 min and 10 min REC (CON 118 ± 13, CG 100 ± 12 bpm, P<0.001). Skin temperature was reduced with CG from post W1 (P<0.001) through 10 min REC (CON 36.9 ± 0.6°C, CG 32.9 ± 1.2°C, P<0.001). HS was reduced with CG (27.0 ± 7.6 W · m<sup>-2</sup>) compared to CON (42.7 ± 9.9 W · m<sup>-2</sup>, P<0.001). Rating of perceived exertion was decreased with CG from W2 (P=0.04) through 10 min REC (P=0.004). PER repetitions were not different between trials (CON 5.6 ± 1.1, CG 5.8 ± 1.1, P=0.10). **CONCLUSION:** The data indicated that the cooling intervention attenuated thermal, physiological, and perceptual strain during work in the heat. This CG could increase safety, facilitate performance, and reduce heat illness risk in occupational settings. Funded by PreventaMed, Inc.

2022 Board #174 June 2, 2:00 PM - 3:30 PM  
**Assessing Warm Weather Race Preparedness Using the Heat Stress Score**

Yuri Hosokawa, Rachel K. Katch, Robert A. Huggins, Rebecca L. Stearns, Douglas J. Casa, FACSM. *University of Connecticut, Storrs, CT.* (Sponsor: Douglas Casa, FACSM)  
 Email: yuri.hosokawa@uconn.edu  
 (No relationships reported)

Successful heat acclimatization optimizes one's exercise performance in the heat and requires direct physiological measures such as rectal temperature (T<sub>RE</sub>) and heart rate. However, these methods are not expedient for recreational runners who are preparing for a warm weather road race. **PURPOSE:** To investigate the use of the heat stress score (HSS), an index to quantify heat exposure, to determine one's preparedness to perform in a warm weather road race. **METHODS:** Twenty-seven runners (n=15 men, n=12 women) competing in the 2015 Falmouth Road Race (mean±SD; age, 43±13y; body mass, 66.8±9.5kg; body fat, 17.3±4.7%; VO<sub>2</sub>max, 47.5±8.2ml/kg/min) performed VO<sub>2</sub>max testing within 15 days of the race. Runners also logged their exercise location zip code, exercise start time, and exercise duration (ED) for 28days prior to race day. Environmental temperature using heat index (HI) during each outdoor exercise bout was obtained retrospectively using an online weather database (Weather Underground). For indoor exercise bouts, 18.9°C was used for HI. HSS was calculated to measure the average heat exposure per exercise bout where HSS=[HI (°C) × ED (min)] (number of exercise bouts)<sup>4</sup>. Heat exposure on the race day (HSS<sub>RD</sub>) was calculated using HSS<sub>RD</sub>=HI (°C) × race finish time [FT] (min). Runner's relative performance (RP) at the race was calculated as (RP)=100[velocity at VO<sub>2</sub>max (mph) - average race velocity (mph)]/[velocity at VO<sub>2</sub>max (mph)]<sup>4</sup>. A paired-samples t-test compared HSS and HSS<sub>RD</sub>. VO<sub>2</sub>max, post race T<sub>RE</sub>, and HSS were used in a stepwise multiple regression analysis to predict RP. **RESULTS:** Overall FT (mean±SD)= 00:57.35±00:10.17, T<sub>RE</sub>=39.79±0.65°C, total training ED and HSS were 1349±725min and 2000±754, respectively, while HSS<sub>RD</sub> was 4490±802. HSS<sub>RD</sub> was significantly greater than training

HSS ( $t [26]=-10.51, p<0.001$ ). All factors included in the regression analysis were insignificant in predicting RP. **CONCLUSION:** HSS demonstrated that runners failed to adequately expose themselves to similar levels of heat and exercise experienced on race day, however, HSS did not exhibit sufficient relationship with  $VO_{2max}$ , post race  $T_{RE}$ , and RP to assess runner's preparedness for a warm weather race. Future studies should investigate if training intensity (i.e. heart rate) explains the differences observed in RP.

2023 Board #175 June 2, 2:00 PM - 3:30 PM

**Hemoconcentration, Not Hypothermia, Is The Cause Of Increased Blood Viscosity During Cold Water Immersion**

Kaitlyn A. Rostomily. *San Diego State University, San Diego, CA.*  
(No relationships reported)

Kaitlyn Rostomily, Doug Jones, Carina Pautz, Danica Ito and Michael J. Buono, FACSM  
San Diego State University, San Diego, CA 92182  
Prolonged, severe cold water immersion (CWI) has the potential to cause significant hypothermia and hemoconcentration – both of which have previously been shown to independently increase blood viscosity. **PURPOSE:** The purpose of this study was to determine the effect of CWI on blood viscosity. **METHODS:** Ten healthy volunteers were immersed up to mid-sternum in 10 °C water for 90 minutes. Core body temperature, hematocrit (Hct), and blood viscosity were measured pre- and post-CWI. **RESULTS:** CWI caused mean ± SD core body temperature to significantly ( $P < 0.05$ ) decrease from  $37.6 \pm 0.3$  °C to  $36.1 \pm 0.7$  °C. CWI also caused mean ± SD hematocrit to significantly ( $P < 0.05$ ) increase from  $40.0 \pm 3.5\%$  to  $45.0 \pm 2.9\%$ . As a result of the hemoconcentration and hypothermia during CWI the mean ± SD blood viscosity significantly ( $P < 0.05$ ) increased from  $2.80 \pm 0.28$  mPas to  $3.33 \pm 0.42$  mPas, or 19%. In an effort to determine the relative importance of hypothermia and hemoconcentration on increasing blood viscosity during CWI, the pre-CWI blood sample was measured at both the pre-CWI and post-CWI core body temperature. This allowed for the determination of the effect of hypothermia on blood viscosity, independent of hemoconcentration. The mean ± SD blood viscosity measured at the pre-CWI ( $37.6$  °C) and post-CWI core body temperature ( $36.1$  °C) was  $2.80 \pm 0.28$  mPas and  $2.82 \pm 0.20$  mPas, respectively. Finally, changes in Hct and blood viscosity during CWI were significantly correlated with an  $r = 0.85$ . **CONCLUSION:** The results of the current study show that prolonged, severe CWI causes a significant 19% increase in blood viscosity. In addition, the results strongly suggest that almost all of the increased blood viscosity seen following CWI is the result of hemoconcentration, not hypothermia.

2024 Board #176 June 2, 2:00 PM - 3:30 PM

**Serum Myokine Levels During The 430 Mile Yukon Arctic Ultra**

Alyssa N. Weaver<sup>1</sup>, Melynda S. Coker<sup>1</sup>, Mathias Steinach<sup>2</sup>, Robert H. Coker<sup>1</sup>. <sup>1</sup>*University of Alaska Fairbanks, Fairbanks, AK.* <sup>2</sup>*Center for Space Medicine and Extreme Environments Berlin, Berlin, Germany.*  
(No relationships reported)

**PURPOSE:** The Yukon Arctic Ultra is considered the longest and coldest ultraendurance event in the world. Recently, cold exposure and exercise have been reported to influence circulating levels of certain myokines and proteins that may influence the “browning” of white adipose tissue. The purpose of the study was to evaluate the influence of the Yukon Arctic Ultra (430 mile participants) on serum irisin, meteorin, IL-6, and FGF21 in healthy individuals.  
**METHODS:** Eight male and female participants (mean±SEM; age =  $44 \pm 3$  yr; BMI =  $23.3 \pm 0.9$ ) were recruited for participation. Blood samples were collected at pre-event, mid event (200 mile) and post-event checkpoints.  
**RESULTS:** The average temperature during the event ranged from  $-45$ °C to  $-8$ °C. Due to the challenging conditions, only 50% of the participants finished the event and they lost  $2.2 \pm 0.3$  kg of body weight. Serum irisin was  $307 \pm 63$  ug/ml (pre-event), rose to  $496 \pm 17$  ug/ml (mid-event), and remained elevated at  $513 \pm 18$  (post-event) but the lack of significance was likely due to attrition. Serum meteorin remained stable at  $3.1 \pm 0.1$  ng/ml (pre-event),  $3.1 \pm 0.0$  (mid-event), and  $3.0 \pm 0.1$  ng/ml (post-event). Serum IL-6 fell from  $183 \pm 51$  ug/ml (pre-event), to  $118 \pm 55$  ug/ml (mid-event), to  $90 \pm 39$  ug/ml (post-event). Serum FGF21 was  $30 \pm 3$  ug/ml (pre-event),  $34 \pm 8$  ug/ml (mid-event), and  $62 \pm 21$  ug/ml (post-event).  
**CONCLUSION:** The combined influence of cold exposure and extreme levels of prolonged ultraendurance exercise may promote elevations in serum irisin and FGF21, while IL-6 may decline under these circumstances. Despite previous reports in pre-clinical studies of cold exposure induced increments in serum meteorin, these responses were not evident in a limited number of humans undergoing substantially greater metabolic stress. Utilizing participants competing in all distances of Yukon

Arctic Ultra 2016 and hot-weather marathons, future studies are planned to gather more data on serum myokines, and examine potential changes in FNDC5 and PGC-1 $\alpha$  in muscle and UCP-1 gene expression in white adipose tissue.

2025 Board #177 June 2, 2:00 PM - 3:30 PM

**Deterioration of Cognitive Function During Cold Water Immersion is not Changed Following Repeated Exposure**

Stephen Bailey, FACSM<sup>1</sup>, Douglas M. Jones<sup>2</sup>, Kaitlyn A. Rostomily<sup>2</sup>, Carina M. Pautz<sup>2</sup>, Danica W. Ito<sup>2</sup>, Michael J. Buono, FACSM<sup>2</sup>, Bart Roelands<sup>3</sup>, Romain Meeusen, FACSM<sup>3</sup>. <sup>1</sup>*Elon University, Elon, NC.* <sup>2</sup>*San Diego State University, San Diego, CA.* <sup>3</sup>*Vrije Universiteit Brussel, Brussels, Belgium.*  
Email: baileys@elon.edu  
(No relationships reported)

Acute cold exposure results in impaired cognitive function by diverting attention away from the primary task and reducing vigilance. Repeated exposure to cold stress induces physiological changes such as decreased skin temperature and a delayed onset of shivering in an effort to reduce heat loss and conserve energy during subsequent cold exposures. It is unclear if repeated exposure to cold attenuates the decrease in cognitive function typically seen during acute cold exposure.  
**PURPOSE:** To determine if cognitive function during acute cold exposure is changed following repeated immersions in cold water.  
**METHODS:** Eight healthy volunteers (age:  $25.9 \pm 6.4$  years, height:  $172.7 \pm 6.3$  cm, weight:  $74.9 \pm 11.4$  kg) completed seven 90-minute cold water immersions in 10°C water. Subjects completed the psychomotor vigilance task (PVT) during the 1st, 4th, and 7th cold water immersion at several time points (pre, 5 min, 30 min, 60 min, 90 min). Core temperature, heart rate, skin temperature (Tsk), thermal sensation, and skin blood flow were collected during each heat trial.  
**RESULTS:** Significantly reduced skin temperature and a delayed onset of shivering were observed during the 7th cold water immersion when compared with the 1st, suggesting that acclimation to cold occurred. Reaction time (RT) (pre= $263 \pm 7$  msec, 5 min= $268 \pm 12$  msec, 30 min= $278 \pm 10$  msec, 60 min= $294 \pm 7$  msec, 90 min= $291 \pm 8$  msec;  $p < 0.001$ ) and variability of RT (VRT) (pre= $40 \pm 6$  msec, 5 min= $43 \pm 5$  msec, 30 min= $46 \pm 4$  msec, 60 min= $51 \pm 3$  msec, 90 min= $49 \pm 4$  msec;  $p < 0.03$ ) worsened during the initial cold exposure. In comparison, RT (pre= $265 \pm 11$  msec, 5 min= $285 \pm 15$  msec, 30 min= $285 \pm 12$  msec, 60 min= $293 \pm 10$  msec, 90 min= $289 \pm 9$  msec;  $p = 0.75$ ) and VRT (pre= $43 \pm 5$  msec, 5 min= $44 \pm 5$  msec, 30 min= $44 \pm 3$  msec, 60 min= $50 \pm 4$  msec, 90 min= $47 \pm 4$  msec;  $p = 0.72$ ) during the 7th cold water immersion were not different than the 1st cold water immersion.  
**CONCLUSIONS:** Although impairment in RT and VRT was observed on both the first and final immersions, these findings suggest that repeated immersions in cold water over 7 days do not attenuate the decline in cognitive function typically seen during acute cold stress.

**D-34 Free Communication/Poster - Hydration**

Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
Room: Exhibit Hall A/B

2026 Board #178 June 2, 2:00 PM - 3:30 PM

**Fluid Loss and Individual Differences During Work in Fully Encapsulated Impermeable Chemical Protective Suits**

Emiel A. DenHartog, Candace D. Rubenstein, A. Shawn Deaton. *North Carolina State University, Textile Protection and Comfort Center, Raleigh, NC.* (Sponsor: W.Larry Kenney, FACSM)  
Email: eadenhar@ncsu.edu  
(No relationships reported)

**PURPOSE:** A major concern for responders to hazardous materials (HazMat) incidents is the heat strain that is caused by the NFPA 1991 impermeable suits.  
**PURPOSE:** The thermal strain was studied, focusing on fluid loss and individual differences to predict working times in practice.  
**METHODS:** 17 City of Raleigh firemen between the ages of 25 and 50 participated in a protocol approved by the local ethical committee. Prior to the testing of impermeable suits a pre-test was conducted at 4 different walking speeds (3 to 6 km/hr) to determine a sub-maximal heart rate versus oxygen consumption. Six different suits were evaluated in three climates: moderate (20°C WBGT), warm-wet (30°C WBGT), and hot-dry (37°C WBGT) and at three walking speeds: 2.5 km/hr, 4 km/hr, and 5.5 km/hr. Basic measurements of heat strain were taken: core and skin temperatures, heart rate and fluid loss via weighing.

**RESULTS:** Working time ranged from as low as 20 minutes in the hot-dry condition to 60 minutes (the maximum) in the moderate climate, especially at the lowest walking speed. The overall results from all experiments showed fluid loss ranged from 0.2 liter to 2.2 liter. Although this range was large, the average fluid loss was 0.8 l, with 56% of the data between 0.5 liter and 1 liter of fluid loss. Further analysis showed that drinking 0.7 Liter would safely hydrate over 50% of responders after one work-rest cycle. Applying this fluid volume over three work-rest cycles would only put 11% of responders at risk of hypohydration versus the 57% at risk with no fluid intake. The only individual parameter that predicted work time at a significant level ( $p < 0.05$ ) was the relative increase in heart rate during the pre-test, supporting the general relationship between fitness level and work time. No other individual data provided significant effects on work time.

**CONCLUSIONS:** Advising to drink one 0.7 l bottle of water after each work period is easy to implement and would provide sufficient fluid replacement for most firefighters in all conditions, irrespective of exact working time. Fitness level seemed the only individual parameter associated with an increase in work times.

This project was funded by the US Department of Defense, executed in collaboration with the Netherlands Organization for Applied Scientific Research (TNO).

2027 Board #179 June 2, 2:00 PM - 3:30 PM  
**The Effect Of Isotonic Drinks On Hydration Status Of Heat Acclimatised Australian Football Players**

Daniel E. Gahreman, Sarah K. Guajardo. *Charles Darwin University, Northern Territory, Australia.*  
 Email: d.gahreman@gmail.com  
 (No relationships reported)

The prevalence of hyperthermia and heat storage is high in tropical environments. Adaptations in acclimatised athletes include an increased sweat rate which can lead to heat stress without regular self-monitored hydration. Although water has been suggested as the primary drink during physical activity, isotonic sport drinks seem to be preferred during Australian Football competitions. It is believed that sport drinks may enhance or maintain hydration status by encouraging athletes to drink more during a game, however their use has been scrutinized for validity in tropical conditions against a variety of hydration states.

**PURPOSE:**

To determine the effect of sports drink consumption on the hydration status of acclimatised Australian Football players in a tropical environment.

**METHODS:**

Total Body Mass (TBM) and Urine Specific Gravity (USG) of two opponent teams were measured one hour before and immediately after the game using a standard digital scale (A&D, Australia) and a handheld refractometer (Atago, Japan) respectively. Dry, wet, globe temperature and air velocity was measured during each quarter using QUESTemp 36 (3M detection solutions, USA). During the warm up phase both teams had access to cold water, however during the game one team consumed Staminade (Stergic, Australia) whilst the other team had access to cool water only.

**RESULTS:**

The game was played at 7pm with the dry, wet and globe temperature averaged at 29.5°C, 25.8°C and 29.2°C respectively. A repeated measures ANOVA with a Greenhouse-Geisser determined a significant activity effect on TBM  $F(1, 35) = 158.19$ ,  $p = 0.000$ ,  $\eta^2 = 0.82$  and USG  $F(1, 35) = 67.81$ ,  $p = 0.000$ ,  $\eta^2 = 0.66$ . There was no significant condition effect on TBM  $F(1, 35) = 3.51$ ,  $p = 0.07$ ,  $\eta^2 = 0.09$  or USG  $F(1, 35) = 0.84$ ,  $p = 0.366$ ,  $\eta^2 = 0.23$ . There was also no significant players position effect on TBM  $F(2, 34) = 0.64$ ,  $p = 0.53$ ,  $\eta^2 = 0.04$  or USG  $F(2, 34) = 3.54$ ,  $p = 0.40$ ,  $\eta^2 = 0.17$ . There was a strong correlation between percentage change of TBM and percentage change of USG in the sport drink group only  $r = 0.56$ ,  $n = 17$ ,  $p = 0.018$ .

**CONCLUSION:**

The consumption of isotonic drinks during an Australian Football game did not maintain or enhance the hydration status of the players. Competing in a tropical environment will impose significant reductions in TBM and hydration regardless of the types of drinks consumed.

2028 Board #180 June 2, 2:00 PM - 3:30 PM  
**Impact Of Hypohydration And Exercise-heat Stress On Brain Structure In Men And Women**

Matthew T. Wittbrodt<sup>1</sup>, J.C. Mizelle<sup>2</sup>, Lewis A. Wheaton<sup>1</sup>, Michael N. Sawka, FACSM<sup>1</sup>, Mindy L. Millard-Stafford, FACSM<sup>1</sup>. <sup>1</sup>Georgia Institute of Technology, Atlanta, GA. <sup>2</sup>East Carolina University, Greenville, NC. (Sponsor: Mindy Millard-Stafford, FACSM)  
 Email: mwittbrodt3@gatech.edu  
 (No relationships reported)

Hypohydration (HYPO) may expand total brain ventricle volume (lateral, third, and fourth) but the impact on other brain structures (e.g., grey and white matter) is less defined. **PURPOSE:** To delineate the impact of HYPO and exercise-heat stress on brain structures in men and women.

**METHODS:** Nine physically active adults (four male, five female;  $23.9 \pm 9.3$  y) completed three experimental sessions: control (no exercise/heat exposure; CON), HYPO induced by 2.5 h intermittent walking in 45°C, 15% RH, and euhydration (EUH), 2.5 h intermittent walking in the heat with water ingestion to match sweat loss. Brain morphology was assessed using T1- and T2-weighted magnetic resonance images after a 1 h cool down.

**RESULTS:** Body mass loss was  $-2.8 \pm 0.6\%$  during HYPO with no sex differences ( $-2.9 \pm 0.3$ ,  $-2.7 \pm 0.9\%$ ). Men had greater intracranial, cortical white matter, and subcortical grey matter volume (thalamus, basal ganglia, hippocampus, amygdala) compared to women ( $p < 0.05$ ) cortical grey or white matter volume; but, tended to decrease ( $p = 0.06$ ) subcortical grey matter by  $-1.4\%$  (ES: 0.76) and increase ( $p < 0.05$ ) ventricular volume by 12.5% (ES: 1.6) and cerebrospinal fluid volume by 13.7% (ES: 1.7) compared to EUH. In contrast, EUH differed ( $p < 0.05$ ) from CON with lower ventricular and cerebrospinal fluid volumes ( $-5.1\%$ , ES: 0.72;  $-6.2\%$ , ES: 1.13) but higher intracranial volume (1.4%; ES: 0.84) compared to CON. Intracranial volume was also lower ( $p < 0.05$ ) by 1.1% (ES: 0.71) during HYPO vs. EUH.

**CONCLUSIONS:** This study found hypohydration of  $\sim 3\%$  body mass loss: 1) decreases intracranial volume and may reduce subcortical grey matter volume; 2) expands ventricle and cerebrospinal fluid volumes; and 3) induces similar changes in the brain structures of men and women. Moreover, after 1 h recovery from exertional heat stress with water replacement, brain structures differ from a control rest condition. Supported by Center for Advanced Brain Imaging Seed Grant, Neuroengineering Seed Grant, Georgia Institute of Technology, and Gisolfi Research Award, American College of Sports Medicine

2029 Board #181 June 2, 2:00 PM - 3:30 PM  
**Evaluation Of A Real Life Desire-to-drink Scale**

Catalina Capitan-Jimenez<sup>1</sup>, Alvaro Tenorio<sup>2</sup>, Luis F. Aragon-Vargas, FACSM<sup>2</sup>. <sup>1</sup>University of Costa Rica, Universidad Hispanoamericana, San José, Costa Rica. <sup>2</sup>University of Costa Rica, San José, Costa Rica. (Sponsor: Luis Fernando Aragon-Vargas, FACSM)  
 Email: ktaucr@gmail.com  
 (No relationships reported)

**PURPOSE:** to determine the strength of the association between the amount of fluid people say they want to drink after exercise and the actual amount of fluid intake within 30 min post-exercise.

**METHODS:** 11 healthy males ( $1.77 \pm 0.05$  m,  $71.64 \pm 9.0$  kg) completed a total of 27 sessions of stationary bike exercise at 75-85% HR<sub>max</sub> in the heat (WBGT =  $27.3 \pm 1.2$ ) to reach a dehydration of 1, 2, or 3% BM. Immediately before completing the exercise (D0), and 15 min after initiating rehydration (D15), participants chose from a real-life, 3D scale with 10 identical water-filled bottles (from 100 mL to 1000 mL), which one they would like to drink. Actual ad libitum water intake was recorded 15 min (I15) and 30 min (I30) post-exercise. Intake was completed in the same environment as the exercise.

**RESULTS:** Participants lost 1.42 kg (0.56 - 2.52 kg) and drank 1239 mL (490 - 1827 mL) of water (mean (range)). Water intake was different over time ( $p < 0.001$ ) registering 966 (408 - 1445 mL) and 274 (0 - 610 mL) for I15 and I30, respectively. BM recovery was  $86.5 \pm 40.2\%$  of BM loss. D0 was significantly associated with I30 ( $r = 0.47$ ,  $p = 0.016$ ) and with I15 ( $r = 0.61$ ,  $p = 0.001$ ). D15 was not significantly associated with I30 ( $r = -0.10$ ,  $p = 0.627$ ).

**CONCLUSIONS:** In the absence of fluid intake, the desire to drink water upon exercise termination is significantly associated with early actual drinking. However, the association weakens with time. The desire to drink water after some ingestion has taken place fails to drive further intake.

2030 Board #182 June 2, 2:00 PM - 3:30 PM  
**Hydration Potential of Commonly Consumed Drinks in an Office-Working Environment**  
 Stuart D.R. Galloway, Nidia Rodriguez-Sanchez. *University of Stirling, Stirling, United Kingdom.*  
 Email: s.d.r.galloway@stir.ac.uk  
 (No relationships reported)

Several factors are known to influence the hydration potential of drinks such as: volume ingested, ingestion rate, macronutrient composition, water content, electrolyte and caffeine content. However, relatively little is known about the impact of fluid composition on fluid balance during normal daily living / office working situations.

**PURPOSE:** To investigate the effect of 4 different commonly consumed drinks on urine output and net fluid balance over 3 hours in office-workers.  
**METHODS:** Twenty-three participants (euhydrated, males (n=7) and females (n=16), age: mean(SD) males 31.3(10.4) y; females 33.1(9.8) y, BMI: males 29.9(4.4); females 27.4 (3.7), arrived at work in a euhydrated state. After emptying their bladder and recording body mass they ingested 1 L of fluid over the following hour as either water, coffee, orange juice or semi-skimmed milk. Energy content of the drinks was 0 kcal/L (water), 4 kcal/L (coffee), 470 kcal/L (orange juice) and 500 kcal/L (milk). Urine output was collected immediately, and each hour for 2 hours, following fluid ingestion for volume and electrolyte analysis. On completion a final body mass was obtained.  
**RESULTS:** Mean(SD) total urine mass loss over 2 hours for still water was 1007(108) g and was significantly different to milk 797(181) g ( $P<0.05$ ). Urine losses with orange juice (953(246) g) and coffee (1067(164) g) were not different to water, but coffee was also different to milk ( $P<0.05$ ). Net fluid balance was positive at 2 h after milk ingestion (+203(181) ml) and was significantly different ( $P<0.05$ ) from water (-7(108) ml) and coffee (-67(164) ml) but not different from orange juice (+48(246) ml). Net Na<sup>+</sup> balance was significantly different from water (-495(207) mg) after ingestion of orange juice (-973(298) mg) and milk (-295(253) mg). Net K<sup>+</sup> balance was significantly different from water (-315(64) mg), after ingestion of orange juice (+576(171) mg) and milk (+901(118) mg).  
**CONCLUSIONS:** A variety of drinks can be ingested during normal daily living / working to help maintain fluid balance. Ingestion of milk led to a reduced urine output compared with the other drinks, most likely due to its electrolyte content and casein protein content. The retention of fluid volume following milk ingestion may be important in situations where frequent work breaks need to be avoided.

2031 Board #183 June 2, 2:00 PM - 3:30 PM  
**The Validity Of Urine Color Self-assessment As An Index Of Hydration In Males**  
 J.D. Adams, Daniel L. Nixon, Cameron T. Nichols, Stavros A. Kavouras, FACSM. *University of Arkansas, Fayetteville, AR.*  
 (Sponsor: Stavros A. Kavouras, FACSM)  
 Email: jxa014@uark.edu  
 (No relationships reported)

Urine color (UC) has been suggested as a practical tool for hydration assessment. To date no study has found if adults can accurately assess their own UC. **PURPOSE:** Therefore, the purpose of this study was to examine the accuracy of self-assessed UC as an index of hydration in males. **METHODS:** Seventy six males (24±5 y; 83.9±16.0 kg; 1.79±0.76 m) participated in the study. Participants were instructed to provide a single void into a specially constructed urinal which drained into a dark, plastic urine container. Participants were asked to compare their urine to an eight-point color scale. Hydration status was assessed via urine osmolality (UOsm) and UC via the eight-point color scale. **RESULTS:** Mean UC was 3±1 and UOsm 661±247 mmol/kg. UC displayed a positive relationship as a predictor of UOsm ( $R^2 = 0.21$ ;  $P < 0.001$ ). The diagnostic ability of self-assessed urine color for elevated urine osmolality was assessed via receiver operating curve. A cut-off point of ≥800 mmol/kg of urine osmolality was defined as high urine osmolality. UC had a poor overall diagnostic ability (area under the curve 65%), with excellent sensitivity (91%), and poor specificity (35%). Further threshold analysis indicated that the optimal self-assessed UC threshold for hypohydration was ≥3. **CONCLUSION:** Even though self-assessed UC had "poor" overall diagnostic ability for assessing hydration, the diagnosis of hypohydration with a UC of ≥3 was excellent, but assessing euhydration was inaccurate.

2032 Board #184 June 2, 2:00 PM - 3:30 PM  
**Effect of Dehydration on Plasma Oxidative Stress and Antioxidant Capacity**  
 Vincent P. Georgescu<sup>1</sup>, Tacito P. Souza-Junior<sup>2</sup>, Christian E. Behrens<sup>1</sup>, Marcelo P. Barros<sup>3</sup>, Alan C. Utter, FACSM<sup>1</sup>, Steven R. McAnulty<sup>1</sup>. <sup>1</sup>*Appalachian State University, Boone, NC.*  
<sup>2</sup>*Federal University of Parana, Curitiba, Brazil.* <sup>3</sup>*Cruzeiro do Sul University, Sao Paulo, Brazil.* (Sponsor: Alan C. Utter, FACSM)  
 Email: georgescuvp@appstate.edu  
 (No relationships reported)

Oxidative stress is known to be involved in many adverse mechanisms. Few studies have examined the effects of dehydration on oxidative stress. **PURPOSE:** Examine the effect of dehydration on plasma oxidative stress and antioxidant capacity in collegiate athletes.

**METHODS:** Eighty-two athletes (56 male, 26 female) were recruited to undergo an acute dehydration (3% body weight), rehydration protocol. Subjects reported to the lab for baseline anthropometrics and blood sampling. The dehydration protocol required subjects to participate in their respective training until 3% of pre-weight body mass was lost. They reported back to the lab where a blood sample was immediately collected. Subjects then drank Gatorade until body weight was reestablished to baseline values. Plasma was collected at 80 min post full re-hydration (PFR) and snap frozen in liquid nitrogen and stored at -80 degrees Celsius until analysis. Oxidative stress was determined by measuring F2-isoprostane lipid oxidation via EIA kit. Ferric reducing ability of plasma (FRAP) was used to measure plasma antioxidant potential. Plasma osmolality was determined by freezing point depression by an osmometer. Statistical analysis consisted of 1-way ANOVA. All values are reported as mean ± SD. **RESULTS:** Plasma osmolality (280.9 mOsm ± 14.2) significantly elevated (286.2 mOsm ± 15.8) post exercise ( $p = 0.031$ ), but returned to below normal values (282.1 mOsm ± 15.3) PFR. Plasma FRAP (μM/L ascorbate equivalents) values also increased post dehydration (pre: 0.237 ± 0.068, post: 0.286 ± 0.279), and decreased to near baseline levels PFR (0.247 ± 0.150) but only exhibited a statistical trend ( $P=0.08$ ). Mean concentrations of F2-isoprostanes (pg/mL) declined from (437.6 ± 125.5) at baseline to (77.5 ± 496) post dehydration, and then rose to (699.73 ± 154.2) PFR ( $p<0.001$ ).  
**CONCLUSIONS:** This study indicates that dehydration causes dramatic increases in plasma osmolality and antioxidant potential. Increased concentrations of antioxidants might be responsible for the reduction in F2-isoprostanes immediately post exercise. This decrease is followed by a large increase at 80 min post full rehydration despite normalization of plasma osmolality. The reasons for the decrease post dehydration and increase after rehydration in F2-isoprostanes warrants further examination.

2033 Board #185 June 2, 2:00 PM - 3:30 PM  
**Body Mass, Fat Mass, And Extracellular Water Decrease Following A 27-km And 50-km Trail Race**  
 Veronica M. Rasicci, Erich Y. Groezinger, Christian R. Wilhelm, Dean L. Smith, Julie M. Cousins. *Miami University, Oxford, OH.*  
 (Sponsor: Helaine Alessio, FACSM)  
 Email: rasiccvm@miamioh.edu  
 (No relationships reported)

Prolonged bouts of aerobic exercise have been shown to decrease body mass, however, there is conflicting data as to whether the decrease of body mass comes from a decrease in fat mass (FM), total body water (TBW), or a combination of FM and TBW. **PURPOSE:** To investigate the effect of a single bout of prolonged aerobic exercise on body composition and water composition following an 27k or 50k trail race. **METHODS:** 14 27k and 50k runners (age = 40.1 (11.8) years, race time = 6.5 (1.9) hours) completed the RJL bioelectrical impedance analysis (BIA) before and after the race. The RJL BIA measured FM, TBW, intracellular water (ICW), and extracellular water (ECW). Body mass was measured using a Secca digital scale. These measurements were used to determine the body composition and the water composition of the subjects. Statistical analysis was performed using paired t-test and Pearson product-moment correlations. Significance was set to  $p < 0.05$ . **RESULTS:** Body mass decreased by 1.3 kg ( $p=0.032$ ), FM decreased by 0.4 kg ( $p=0.031$ ), and ECW decreased by 0.7 kg ( $p=0.041$ ). TBW decreased by 1.3 kg ( $p=0.088$ ) and ICW decreased by 0.6 kg ( $p=0.132$ ). Change in BM was significantly correlated with change in ECW ( $r=0.592$ ,  $p=0.026$ ). Change in body mass was not correlated with race completion time. The American College of Sports medicine (ACSM) recommends BM loss during exercise not exceed 2% of an athlete's starting BM. There was 1.5% decrease in body mass, which was with in the ACSM guidelines. **CONCLUSIONS:** These data suggest that in highly trained adults, body mass, fat mass and extracellular water are significantly decreased following a prolonged bout of aerobic exercise. The change in body mass was correlated with the change in extracellular water.

2034 Board #186 June 2, 2:00 PM - 3:30 PM

**Beverage Content Influences Voluntary Fluid Intake During Exercise: A Systematic Review**

Lesley W. Vandermark<sup>1</sup>, J Luke Pryor<sup>2</sup>, Riana R. Pryor<sup>2</sup>, Lindsay J. DiStefano<sup>1</sup>, Douglas J. Casa, FACSM<sup>1</sup>. <sup>1</sup>University of Connecticut, Storrs, CT. <sup>2</sup>California State University, Fresno, Fresno, CA. (Sponsor: Douglas J Casa, FACSM)  
Email: lesley.vandermark@uconn.edu

*(No relationships reported)*

Voluntary fluid intake is known to be impacted by the palatability of fluid. Beverage content, including flavor, nutrient content, and acidity are potential impacting factors of palatability, however it is unknown how these may impact fluid intake. **PURPOSE:** To describe the influence of beverage content on voluntary fluid consumption during exercise. **METHODS:** Nine studies were included with adult (>18 y.o.) human subjects (n=190). Experimental beverages with flavor or nutrient content were compared to water and unrestricted consumption during exercise. Cohen's *d* effect sizes (ES) were calculated to compare consumption of beverages with various contents differing from plain water, and mean difference (MD) and 95% confidence intervals (CI) were calculated for meta-analysis. **RESULTS:** A large effect (ES=9.81; *p*<0.001) represented a 37% greater total fluid consumption of a carbohydrate-electrolyte beverage over water (n=6; MD[CI]=0.54 L [0.43-0.65]). A large effect (ES=11.01; *p*<0.001) represented a 34% higher fluid consumption rate of a carbohydrate-electrolyte beverage over water was revealed (n=6; MD[CI]=0.26 L/h [0.21-0.30]). A large effect (ES=12.07; *p*<0.001) represented a 51% lower body mass loss with the consumption of a carbohydrate-electrolyte beverage over water (n=5; MD[CI]=0.41 kg [0.20-0.29]). Various flavors of carbohydrate-electrolyte beverages were preferable to water during exercise (*p*<0.005), and acidified beverages were less preferable than water during exercise (*p*<0.05). **CONCLUSION:** Flavored or nutrient containing beverages, such as sports drinks, are shown to be consumed at both a higher volume and faster rate than plain water during exercise. When fluid consumption needs are high, utilization of a flavored or nutrient containing beverage improves fluid consumption and mitigates dehydration during exercise.

2035 Board #187 June 2, 2:00 PM - 3:30 PM

**Blood Profiles Indicate Muscle Damage In Underground Gold-Miners With Exercise-Associated Muscle Cramps (EAMC)**

Rudolph De Wet, Louis Holtzhausen, FACSM, Marlene Schoeman, Gina Joubert. *University of the Free State, Bloemfontein, South Africa.* (Sponsor: Louis Holtzhausen, FACSM)

Email: rudidw24@hotmail.com

*(No relationships reported)***ABSTRACT**

**PURPOSE:** To compare biochemical and haematological characteristics of underground mine-workers with EAMC with a control group of non-cramping mine workers after a work shift. **METHODS:** Retrospective descriptive haematological and biochemical profiles of underground mine workers who presented with EAMC over 18 months in a South African gold mine (CRA group) was compared with a prospective control group of similar workers without EAMC from which data were collected before (CON<sub>PRE</sub>) and after (CON<sub>POST</sub>) 8 hour shifts. Despite the large number of CRA participants, some data were non-parametric. Results were summarized using medians and percentiles where appropriate. For comparison of categorical variables, the Chi<sup>2</sup> and Fisher-exact tests were used. 95% confidence intervals indicated significant differences between the medians of paired scale data sets. **RESULTS:** Significant differences between the CRA group and the CON<sub>post</sub> group showed signs of dehydration (increased haematocrit and haemoglobin; *p*<0.001), inflammation (elevated total white cell count; *p*<0.001), elevated urea and creatinine (*p*<0.001), and lower fluid intake (*p*<0.001). Serum sodium and chloride levels were not significantly different between the CRA and CON<sub>post</sub> groups. Muscle damage was indicated by elevated but similar (*p*=0.2) creatine kinase (CK) and in both the CRA and CON<sub>post</sub> groups. The most important finding was significantly higher serum myoglobin in the CRA group compared to the CON<sub>post</sub> group (median of 51ng/ml compared to 186.5 ng/ml; *p*<0.001). **CONCLUSION:** EAMC is associated with elevated inflammatory markers, dehydration and hemoconcentration, elevated creatinine and protein levels. If corrected for dehydration, reduced serum chloride and sodium levels may be shown. Significantly higher s-myoglobin levels in miners with EAMC compared to a control group indicate an association between muscle damage and EAMC. Further investigation into the pathogenesis of EAMC will be guided by these results.

**D-35 Free Communication/Poster - Hypoxia/Altitude/Dive/Space Physiology**

Thursday, June 2, 2016, 1:00 PM - 6:00 PM

Room: Exhibit Hall A/B

2036 Board #188 June 2, 3:30 PM - 5:00 PM

**The Relationship Between Cerebral Blood Flow Characteristics and Mathematical Processing in Normoxia and Normobaric Hypoxia.**

Jon Stavres, Hayden D. Gerhart, Yongsuk Seo, Shane Draper, Ellen L. Glickman, FACSM. *Kent State University, Kent, OH.* (Sponsor: Ellen L. Glickman, FACSM)

*(No relationships reported)*

Previous research suggests that middle cerebral artery flow velocity remains unchanged at altitudes up to 6,400m, and that cerebral oxygenation and cognitive function decline. **Purpose:** The purpose of this study was to investigate the relationships between cerebral blood flow characteristics, peripheral oxygen saturation, and mathematical performance in normobaric hypoxia (NH) and normoxia (N). **Methods:** Nine participants (5 male) completed a VO<sub>2</sub> max test in NH and in N (sessions 1 and 2) followed by two experimental sessions also in NH and N (sessions 3 and 4). The experimental sessions began with baseline assessments of peripheral blood oxygen saturation (SaO<sub>2</sub>), mathematical processing (TP), frontal lobe oxygenated hemoglobin saturation (CeO<sub>2</sub>Hb), and middle cerebral artery flow velocity (MCAfv) at min 0. These variables were measured again after 30 min of acclimation, during the final 5 min of a 20 min cycling protocol (60% VO<sub>2</sub>max), and at min 1, 15, 30, and 45 of recovery. CeO<sub>2</sub>Hb, SaO<sub>2</sub>, and MCAfv were first analyzed for colinearity using a Pearson Correlation analysis. Results indicated that MCAfv was significantly correlated to CeO<sub>2</sub>Hb (*r*<sup>2</sup>=.349, *p*=.01), but not to SaO<sub>2</sub> (*r*<sup>2</sup>=.02, *p*=.885). Backwards regression analyses were then run with TP as the dependent variable and MCAfv and SaO<sub>2</sub> as the independent variables for NH, N, and the combined conditions (COMB). **Results:** In the N condition, neither the model including both predictors (SaO<sub>2</sub> and MCAfv) nor the model only including SaO<sub>2</sub> were significant predictors of TP (*R*<sup>2</sup>=.036, *F*=.961, *p*=.389 and *R*<sup>2</sup>=.036, *F*=1.957, *p*=.168, respectively). In the NH condition, the model including both SaO<sub>2</sub> and MCAfv was a significant predictor of TP (*R*<sup>2</sup>=.216, *F*=7.040, *P*=.002), with MCAfv contributing the most to the model (*B*= -.404, *P*=.001). Similar results were found in the COMB condition (MCAfv only model, *R*<sup>2</sup>=.046, *F*=5.163, *p*=.025). **Conclusions:** Results from this study suggest that middle cerebral artery flow velocity is a significant predictor of mathematical performance, and that this relationship may be more pronounced in hypoxia. This information may be valuable to individuals whose occupation requires them to use mathematical processing skills while in hypoxia.

2037 Board #189 June 2, 3:30 PM - 5:00 PM

**Effect of Hypoxia on Cognition and Neurovascular Coupling During Exercise**

Wesley K. Lefferts, Matthew C. Babcock, Matthew TISS, Corey N. White, Tom D. Brutsaert, Kevin S. Heffernan. *Syracuse University, Syracuse, NY.* (Sponsor: Bo Fernhall, FACSM)

Email: wleffert@syr.edu

*(No relationships reported)*

Optimal cognitive function requires a balance between cerebral blood flow to active brain regions (oxygen supply) and oxygen extraction by cerebral tissue (neuronal metabolic demand). Exercise and cognitive engagement creates competing demands for oxygen which can be exaggerated during hypoxia. **PURPOSE:** Investigate the effect of acute hypoxia on cerebral and cognitive function during exercise. **METHODS:** Thirty healthy participants (21±4yrs, BMI 24.0±2.6 kg·m<sup>-2</sup>; 15 men) were randomized to both a ~2.5 hour normoxic (20.0% O<sub>2</sub>) and hypoxic (12.5% O<sub>2</sub>) condition on two separate days. During the final 25 min of each condition, participants underwent 10 min of exercise-alone and 15 min of exercise+cognitive testing (cycling at 55% HRmax). Accuracy and reaction time (RT) were averaged across memory, N-Back and Flanker tasks. Prefrontal cortex tissue saturation index (TSI) and middle cerebral artery (MCA) blood flow velocity were measured using near-infrared spectroscopy and transcranial Doppler respectively at rest, during exercise alone, and during exercise+cognitive tasks. **RESULTS:** MCA velocity was overall greater in hypoxia vs normoxia, and increased similarly from rest to exercise in normoxia (66±3 to 79±3 cm/s, *p*<0.05) and hypoxia (71±3 to 82±3 cm/s, *p*<0.05). Addition of cognitive tasks during exercise had no effect on MCA velocity in normoxia (74±3 cm/s) or hypoxia (80±3 cm/s). ΔTSI increased from rest to exercise in normoxia (-0.02±0.05 to 1.15±0.35%, *p*<0.05) with no further changes with the addition of cognitive tasks (0.86±0.50%). ΔTSI decreased from rest to exercise in hypoxia (-0.05±0.05 to -1.77±0.26%, *p*<0.05) with attenuated reductions occurring with addition of cognitive tasks (-1.28±0.30%, *p*<0.05). Accuracy on cognitive tasks was similar in normoxia (84.2±7.0%) compared to hypoxia (83.9±1.0%) while RT was slower in hypoxia vs

normoxia ( $537 \pm 14$  vs  $513 \pm 13$  ms;  $p < 0.05$ ). **CONCLUSIONS:** Prefrontal oxygenation was reduced during exercise and cognitive engagement in hypoxia despite greater MCA blood flow in hypoxia and similar changes in MCA blood flow during exercise and cognitive engagement vs normoxia. Cognitive slowing during hypoxic exercise may be related to reductions in prefrontal oxygenation rather than macrovascular cerebral blood flow.

Supported by a Foundation Research Grant from ACSM

2038 Board #190 June 2, 3:30 PM - 5:00 PM  
**Tissue-specificity Of Mitochondrial Adaptations After 4 Weeks Of Normobaric Hypoxia In Rats**

Alessandra Ferri<sup>1</sup>, Alice Panariti<sup>2</sup>, Giuseppe Miserocchi<sup>2</sup>, Antonio Zaza<sup>3</sup>, Ilaria Rivolta<sup>2</sup>, David John Bishop, FACSM<sup>1</sup>.  
<sup>1</sup>Victoria University, Melbourne, Australia. <sup>2</sup>University of Milano-Bicocca, Monza, Italy. <sup>3</sup>University of Milano-Bicocca, Monza, Italy.  
 Email: alessandra.ferri@vu.edu.au  
 (No relationships reported)

Exposure to hypoxia has been suggested to activate multiple adaptive pathways so that muscles are better able to maintain cellular energy homeostasis. However, there is limited research regarding the tissue specificity of this response. Furthermore, very few studies have assessed the effects of hypoxia on both mitochondrial respiration and the content of proteins associated with mitochondrial biogenesis.

**PURPOSE:** To evaluate the response of the right (overloaded) and left ventricles, and the soleus (SOL, predominantly type I fibres) and extensor digitorum longus (EDL, predominantly type II) muscles, to 4 weeks of normobaric hypoxia ( $FiO_2$ : 0.10).

**METHODS:** Twenty male Wistar rats were randomly assigned to either normobaric hypoxia (HYP) or normoxia (NORM). Following euthanization, mitochondrial respiration was determined in permeabilized muscle fibres from left (LV) and right (RV) ventricles, the SOL, and the EDL. Citrate synthase (CS) activity was also analysed, along with the content of protein associated with mito biogenesis (HIF-1 $\alpha$ , PGC-1 $\alpha$ , CS, and representative subunits of complexes I to V of the mitochondrial respiratory chain).

**RESULTS:** Compared to NORM, there was a greater (+48% and +25%,  $p < 0.05$ ) maximal mass- and mitochondria-specific respiration (i.e. mass-specific respiration normalized to CS activity) in the SOL and LV of HYP. The RV of HYP had a greater maximal (+27%,  $p < 0.05$ ) mass-specific respiration than NORM, but when normalised to CS the mitochondrial-specific respiration was not different to NORM. In the EDL, there were no significant differences between the two groups for either mass- or mitochondria-specific respiration. There were contrasting results for CS activity in the SOL and EDL, with a higher activity in EDL ( $0.41 \pm 0.08$  vs  $0.63 \pm 0.05$   $\mu\text{mol}/\text{min}/\mu\text{g}$ , in NORM vs HYP respectively) and a lower activity in SOL ( $0.87 \pm 0.20$  vs  $0.65 \pm 0.17$   $\mu\text{mol}/\text{min}/\mu\text{g}$ , in NORM vs HYP respectively) after hypoxic exposure. There was a lower relative protein abundance of PGC-1 $\alpha$  (-25%,  $p < 0.05$ ) in RV of HYP compared to NORM, with few differences for protein content in the other muscles.

**DISCUSSION:** Our results show a muscle specific response to 4 weeks of normobaric hypoxia. Depending on the fibre type, and the presence of muscle remodelling, muscles respond differently to the same degree of environmental hypoxia.

2039 Board #191 June 2, 3:30 PM - 5:00 PM  
**Impact of Endurance Exercise in Hypoxia on Metabolic and Muscle Damage Response and Performance Recovery**

Daichi Sumi, Chihiro Kojima, Kazushige Goto. *Ritsumeikan University, Kusatsu, Japan.* (Sponsor: Kraemer RR, FACSM)  
 Email: sh0034vr@ed.ritsumei.ac.jp  
 (No relationships reported)

Training in hypoxia has been widely utilized to improve aerobic (Dufour et al 2006; Ben et al 2014) and anaerobic capacities (Faiss et al 2013; Galvin et al 2013). On the other hand, the influence of the training in hypoxia on muscle damage and recovery of performance remains unclear. These information would be great help for designing optimal recovery period between training sessions.

**PURPOSE:** The purpose of the present study was to determine metabolic and muscle damage marker responses and recovery of exercise capacity following high-intensity endurance exercise in moderate hypoxia in endurance athletes.

**METHODS:** Ten trained endurance athletes ( $19.7 \pm 0.3$  years,  $169.8 \pm 2.2$  cm,  $57.1 \pm 1.1$  kg,  $VO_{2\text{max}} 62.8 \pm 1.6$  ml $\cdot$ kg $^{-1}\cdot$ min $^{-1}$ ) completed two different trials on different days, consisting of exercise in moderate hypoxia (H,  $FiO_2$ : 14.5%) and in normoxia (N,  $FiO_2$ : 20.9%). They performed interval type of endurance exercise (10 $\times$ 3min running at 95% of  $VO_{2\text{max}}$  with 60s of active rest at 60% of  $VO_{2\text{max}}$ ) followed by 30min continuous running at 85% of  $VO_{2\text{max}}$  under hypoxia or normoxia. Venous blood samples, and values of maximal voluntary contraction for knee-extension (MVC) and respiratory muscle power were collected before the exercise and during 120min of post-exercise period. Time to exhaustion at 90% of  $VO_{2\text{max}}$  was also determined to evaluate recovery of exercise capacity.

**RESULTS:** Respiratory exchange ratio (RER) during interval and continuous exercise remained significantly higher in H trial than in N trial ( $P < 0.05$ ). The H trial revealed significantly greater exercise-induced response of blood lactate compared with N trial ( $P < 0.05$ ), while exercise-induced serum growth hormone and myoglobin (muscle damage marker) and free fatty acids elevations were significantly greater in N trial than in H trial ( $P < 0.05$ ). MVC and respiratory muscle power did not show significant difference between the two trials at any points. Time to exhaustion during running at 90% of  $VO_{2\text{max}}$  2h after the exercise session tended to be shorter in N trial than in H trial.

**CONCLUSIONS:** Endurance exercise under moderate hypoxia did not facilitate exercise-induced muscle damage response or did not delay recovery of exercise capacity compared with equivalent exercise under normoxia in endurance athletes.

2040 Board #192 June 2, 3:30 PM - 5:00 PM  
**Physiological Responses between African-American and Caucasian Males Before, During and After Normobaric Hypoxic Exercise**

Matthew R. Feeback<sup>1</sup>, Yong Suk Seo<sup>2</sup>, Ellen L. Glickman, FACSM<sup>2</sup>. <sup>1</sup>Indiana State University, Terre Haute, IN. <sup>2</sup>Kent State University, Kent, OH. (Sponsor: Dr. Ellen Glickman, FACSM)  
 Email: matthew.feeback@indstate.edu  
 (No relationships reported)

**Purpose:** To further elucidate physiological and cognitive performance differences between African-American (AA) and Caucasian individuals (CAU) before, during or after hypoxic and normoxic exercise. **Methods:** Twelve college aged (18-25) apparently healthy African-American (six volunteers) and Caucasian (six subjects) males took part in two trials consisting of normobaric normoxia and normobaric hypoxia (12% oxygen). Each subject cycled at 50% of their altitude adjusted  $VO_{2\text{max}}$  (-26% of normoxia  $VO_{2\text{max}}$ ) for one hour after a two-hour baseline. Subjects were monitored for cerebral and arterial O<sub>2</sub> saturation, as well as the Trail Making Test A and B (TMT) psychomotor performance. **Results:** Arterial saturation proved to be significantly higher in AA ( $86.0 \pm 4.7$ ) compared to CAU ( $79.5 \pm 4.8$ ) during the first 60 minutes of exposure to hypoxia at rest ( $p = 0.039$ ), but not during exercise. However, cerebral oxygenation to the left frontal lobe was decreased near the conclusion and in 30 minutes after normoxic exercise. TMT B data revealed that CAU ( $79 \pm 12.7$ ) had faster scores than the AA subjects ( $98 \pm 25.1$ ) at all time points and was significantly different at the 115 minute time point of the hypoxic trial ( $p = 0.024$ ). **Conclusion:** The data suggests that before, during and after normobaric normoxia and hypoxia trial there is a differential response between AA and CAU in regards to arterial and cerebral oxygenation, as well as psychomotor tests.

2041 Board #193 June 2, 3:30 PM - 5:00 PM  
**Effect of Acute Exercise on Mood and Cardiovascular Variables between Normoxia and Normobaric Hypoxia**

Shane N. Draper, Jon Stavres, Hayden Gerhart, Yongsuk Seo, Ellen Glickman, FACSM. *Kent State University, Kent, OH.* (Sponsor: Dr. Ellen Glickman, FACSM)  
 (No relationships reported)

Exposure to hypoxic environments can have profound deteriorating effect on physiologic and cognitive abilities, this can be observed with decreased mood, impaired judgement and reduced reaction time. Recently, studies have reported that acute moderate exercise has a positive effect on cognition and mood in persons in normoxic conditions. Collectively, acute physiological changes resulting from moderate exercise may improve mood and cognition at altitude. **Purpose:** The purpose of this study was to determine differences in anxiety, fatigue and vigor when acute moderate exercise was performed in a normobaric hypoxic (NH) and normoxic (N) environment. To help quantify these changes, arterial oxygen saturation ( $SaO_2$ ), heart rate (HR) and blood pressure (BP) were also collected. **Methods:** Nine (four women and five men) young, healthy participants completed a submaximal cycling protocol of four minute stages at 40, 80, and 120 watts. Following the submaximal protocol, a  $VO_{2\text{max}}$  test was completed to determine each participant's cycling power that would elicit 60% of their max in subsequent visits. The  $VO_{2\text{max}}$  tests were completed in both (N) and hypoxia (NH). In both the N and NH conditions, baseline  $SaO_2$ , HR, BP, anxiety, fatigue, and vigor values were collected and the participants spent 30 minutes acclimating before beginning exercise. The participant then cycled for 20 minutes and data was collected during the final 5 minutes of cycling. Data was collected again at 1, 15, 30, and 45 minutes after exercise. The order of conditions (N and NH) was counterbalanced. **Results:** There was a main effect of condition,  $F(6) = 40.30$ ,  $p = 0.000$ , time,  $F(1) = 284.08$ ,  $p = 0.000$ , as well as an interaction between condition and time,  $F(6) = 20.81$ ,  $p = 0.000$ , in  $SaO_2$ . There was a main effect of time,  $F(6) = 51.02$ ,  $p = 0.000$ , and an interaction,  $F(6) = 3.56$ ,  $p = 0.005$ , in HR. Over time,  $SaO_2$  decreased and HR increased in the NH condition. There were no significant effects ( $P > 0.05$ ) found for anxiety, fatigue, vigor, heart rate, and blood pressure. **Conclusions:** An acute bout of exercise has no effect on anxiety and fatigue in a hypoxic condition.

However, an acute bout of exercise has a positive effect on vigor in NH. Future studies could examine the effect of graded exercise intensities and different exercise modalities on mood state in hypoxia.

2042 Board #194 June 2, 3:30 PM - 5:00 PM

### Acute Activation of the Peripheral Chemoreceptors Briefly Induces Cutaneous Vasoconstriction

Blair D. Johnson, James R. Sackett, Gregory L. Coleman, Christopher L. Chapman, Suman Sarker, Zachary J. Schlader. *University at Buffalo, Buffalo, NY.* (Sponsor: David Hostler, FACSM)  
Email: blairjoh@buffalo.edu  
(No relationships reported)

Recent evidence indicates that five minutes of breathing hypoxic gas elicits cutaneous vasodilation. However, it is unclear if skin blood flow is influenced by a brief hypoxic exposure.

**Purpose** We tested the hypothesis that cutaneous vasodilation is increased following a brief hypoxic exposure.

**Methods** Seven healthy participants (2 women,  $25 \pm 2$  years, BMI  $26 \pm 3$  kg/m<sup>2</sup>) breathed 4-6 breaths of 100% nitrogen. We continuously measured skin blood flow on the ventral side of the forearm (laser Doppler), arterial oxygen saturation (finger pulse oximeter), mean arterial pressure (Finometer), and heart rate (ECG) at baseline and following the hypoxic exposure for one minute, during which data were analyzed in 15 s time bins. Skin blood flow was also normalized to mean arterial pressure (MAP) and expressed as a percentage of the local heating induced maximal cutaneous vascular conductance (%CVCmax).

**Results** Arterial oxygen saturation was lower at 45 s ( $89 \pm 7\%$ ;  $P < 0.05$ ) and 60 s ( $90 \pm 5\%$ ;  $P < 0.05$ ) vs. baseline ( $97 \pm 1\%$ ). Skin blood flow was lower 15 s after the hypoxic exposure when compared to baseline ( $4.2 \pm 0.9$  vs.  $5.1 \pm 0.9$  PU,  $P = 0.001$ ). MAP was greater at 15 s vs. baseline ( $94 \pm 7$  vs.  $88 \pm 7$  mmHg;  $P < 0.05$ ) and returned to baseline values at 30 s. %CVCmax was reduced within the first 15 s following the hypoxic exposure compared to baseline ( $4.3 \pm 1.0$  vs.  $5.6 \pm 1.2\%$ ;  $P < 0.05$ ). Skin blood flow and %CVCmax returned to baseline values 30 s following the hypoxic exposure. Heart rate was significantly greater than baseline ( $64 \pm 9$  bpm) at 15 s ( $76 \pm 13$  bpm;  $P < 0.01$ ), 30 s ( $76 \pm 14$  bpm;  $P < 0.01$ ), 45 s ( $69 \pm 11$  bpm;  $P < 0.01$ ), and 60 s ( $67 \pm 11$  bpm;  $P < 0.05$ ).

**Conclusions** Contrary to our hypothesis, a brief hypoxic exposure induces cutaneous vasoconstriction and attenuates skin blood flow. This suggests that activation of the peripheral chemoreceptors acutely lowers skin blood flow.

2043 Board #195 June 2, 3:30 PM - 5:00 PM

### Effect Of Age On Descent And Ascent Speed And Bottom Time In The Diving Ama

Lara Rodríguez-Zamora, Cecilia Schenk, Angelica Lodin-Sundström, Erika Schagatay. *Mid Sweden University, Östersund, Sweden.*  
Email: lara.rodriguez.zamora@gmail.com  
(No relationships reported)

Ama divers of Japan depend on breath-hold diving for a living. An important factor determining the efficiency of breath-hold diving is the time spent underwater, as well as the bottom time, which is the productive part of the dive. The time lost during descent and ascent depends on diving depth, and of the speed of swimming of the individual diver.

**PURPOSE:** To study if age affects Ama's diver speed of swimming and resulting bottom time.

**METHODS:** We logged the dives of 12 female Ama divers in 3 age categories: 18-32 years: young, 47-55 years mid-aged, and 75-81 years older, respectively during their seasonal summer fishing at Hegurajima Japan, involving daily 4h shifts. Time-depth loggers were attached to their waists. Time and speed of descent, ascent and bottom time of the total dive time were determined. Age comparisons were made using unpaired one-way ANOVA with Bonferroni post hoc.

**RESULTS:** Diving performance data is presented in table 1. The velocity for descent was highest in the mid-aged category while the ascent was slowest in the young category compared to both other groups. The Mid-aged category were diving the deepest.

| Variable            | Young (n=4)<br>Mean age 25(6)<br>years | Mid-aged (n=4)<br>Mean age 51(4)<br>years | Older (n=4)<br>Mean age 79(4)<br>years |
|---------------------|--|---|--|
| Depth (msw)         | 2(1)                                   | 7.2(1.6)*                                 | 4.0(1)                                 |
| Descent (s)         | 15.1(6.7)                              | 18.4(1.5)                                 | 15.4(4.1)                              |
| Ascent (s)          | 11.6(4.6)                              | 14.1(3.0)                                 | 11.1(3.2)                              |
| Bottom (s)          | 17.7(15.8)                             | 30.0(8)                                   | 14.9(2.4)                              |
| % bottom time       | 34.5(12.1)                             | 47.6(7.7)                                 | 36.4(5.0)                              |
| Descent speed (m/s) | 0.1(0.01)                              | 0.4(0.08)*                                | 0.3(0.07)                              |
| Ascent speed (m/s)  | 0.2(0.06) <sup>§</sup>                 | 0.5(0.06)                                 | 0.3(0.09)                              |

Table 1. Mean(SD) duration, speed and depth for studied age groups. Significant difference at  $P \leq 0.05$  is indicated: \* = Mid-aged vs. young and older, § = Young vs. mid-aged and older.

**CONCLUSION:** The faster descent and the greater time of the dive at the bottom of the mid-aged Ama, can be a result of more efficient duck-dive technique than in young inexperienced divers, and possibly more powerful swimming than in older divers lacking the muscle power. Descent requires efficient equalization, which could be less in young and old age groups due to technical or physiological differences. Supported by the Centrum för idrottsforskning.

2044 Board #196 June 2, 3:30 PM - 5:00 PM

### Impact of Hypobaric Hypoxia on Repeated Sprint Performance

Adam Luippold, Nisha Charkoudian, FACSM, Elizabeth Caruso, Kristen Heavens, Charles Fulco, Robert Kenefick, FACSM. *United States Army Research Institute of Environmental Medicine, Natick, MA.* (Sponsor: Dr. Robert Kenefick, FACSM)  
(No relationships reported)

**PURPOSE:** To investigate the impact of hypobaric hypoxia on sprint performance and metabolic recovery after repeated sprint bouts. **METHODS:** Six men ( $20 \pm 3$  years;  $77 \pm 13$  kg;  $181 \pm 12$  cm) performed three familiarization sprint sessions (decrease learning effects) at sea level (SL). Sprint sessions consisted of repeated high intensity exercise bouts (30 sec all-out sprint: 1 min rest) on a self-propelled treadmill. Following familiarization, volunteers performed one sprint session per week at 250m, 2000m, and 3000m (random order) carrying a load (30% body mass) in a hypobaric chamber. Sprints were repeated until peak velocity decreased by 20% of that established during familiarization. Pre- and post sprint arterial oxygen saturation (SaO<sub>2</sub>), heart rate (HR), rate of perceived exertion (RPE), and blood lactate (Hla) were measured. **RESULTS:** There was no difference ( $P > 0.05$ ) in the # of sprints completed at SL, 250m, 2000m, and 3000m (5±3, 5±2, 4±2, 4±1, respectively). Post sprint session SaO<sub>2</sub> values were lower ( $P < 0.05$ ) as altitude increased ( $96 \pm 2\%$ , 250m;  $90 \pm 5\%$ , 2000m;  $82 \pm 4\%$ , 3000m). Post session HR, RPE, and blood Hla were elevated ( $P < 0.05$ ) vs. pre-session values, but were not different ( $P > 0.05$ ) among altitudes. **CONCLUSIONS:** While repeated sprint performance was not affected due to hypobaric hypoxia, post session SaO<sub>2</sub> was reduced with each decrease in barometric pressure. It appears that the lower SaO<sub>2</sub> values associated with the simulated altitudes tested did not alter the aerobic recovery of anaerobic pathways used during sprinting as the SaO<sub>2</sub> values were not low enough to be a limiting factor.

The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

2045 Board #197 June 2, 3:30 PM - 5:00 PM

### Cognitive Function During Post-Exercise in Normobaric Hypoxia

Yongsuk Seo, Hayden Gerhart, Jon Stavres, Shane Draper, Ellen L. Glickman, FACSM. *Kent State University, Kent, OH.*  
(No relationships reported)

Acute bouts of aerobic exercise are known to induce physiological changes and effect cognitive function in both normoxia and hypoxia. However, the duration of exercise that may affect cognitive function in the hypoxic condition is currently unknown. **PURPOSE:** The present study examined the duration of improved cognitive function following a steady-state acute bout of exercise in normobaric hypoxia compared to normoxia. **METHODS:** 11 apparently healthy subjects (7 men and 4 women) (Age:  $22 \pm 3$  years, Height:  $171.2 \pm 7.6$  cm, Weight:  $74 \pm 9.8$  kg) completed Automated Neuropsychological Assessment Metrics-4th Edition (ANAM4) versions of the Running Memory Continuous Performance Task (RMCP) during and following 20 min cycling on an ergometer in both NORM (20.93% O<sub>2</sub>) and HYPO (12.5% O<sub>2</sub>). In a separate session, subjects complete the same sequence of testing in a counterbalanced manner. **RESULTS:** Throughput score in RMCP were not significantly different ( $p > 0.05$  for all) between conditions (NORM vs. HYPO) across time points, prior

to (97.4±36.2 vs. 104.8±33.7), during exercise (102.0±34.5 vs. 107.4±37.9) and recovery (Recovery 1-min: 98.5±39.8 vs. 104.4±37.0, Recovery 15-min: 101.3±35.7 vs. 105.8±37.4, Recovery 30-min: 98.4±37.6 vs. 101.9±33.9, Recovery 45-min: 101.7±39.2 vs. 104.3±39.1). Middle cerebral artery (MCA) blood flow velocity did not differ ( $p>0.05$ ) between conditions (NORM vs. HYPO) across time points, prior to (19.6±5.7 vs. 24.3±11.5), during exercise (17.8±7.2 vs. 22.3±9.4) and recovery (Recovery 1-min: 20.2±6.5 vs. 21.8±6.8, Recovery 15-min: 20.2±7.7 vs. 23.8±8.0, Recovery 30-min: 21.3±7.1 vs. 23.1±6.8, Recovery 45-min: 18.8±6.4 vs. 21.2±7.6). However, peripheral oxygen saturation (PaO<sub>2</sub>) was significantly lower across all time points in HYPO compared to NORM ( $p<0.001$ , respectively). **CONCLUSION:** Despite the reduction in PaO<sub>2</sub> during hypoxia, MCA velocity and RMCPT were not significantly different between the two conditions. Based on these data, the MCA velocity and RMCPT were not affected by hypoxia and the acute bouts of exercise (60% VO<sub>2</sub>max). Additional studies are warranted to ascertain the length of exposure and/or severity that hypoxia may impact on cognitive function.

**2046 Board #198 June 2, 3:30 PM - 5:00 PM**  
**Gender Differences in Running Memory and Mood State During Submaximal Exercise in Normobaric Hypoxia**

Hayden Gerhart, Yongsuk Seo, Curtis Fennell, Jon Stavres, Shane Draper, Ellen Glickman, FACSM. *Kent State University, Kent, OH.* (Sponsor: Ellen Glickman, FACSM)  
 Email: hgerhart@kent.edu  
*(No relationships reported)*

Numerous studies have demonstrated differences in cognitive functioning and mood state between males and females when exposed to hypoxia. **PURPOSE:** The purpose of the current study was to investigate gender differences seen in working memory and mood state as the result of low to moderate exercise in normobaric hypoxia. **METHODS:** 16 apparently healthy men (24±4 years) and 11 apparently healthy women (22±3 years) volunteered for this study. During the familiarization trial, a submaximal exercise protocol to determine the VO<sub>2</sub>/Watt(W) relationship was performed on a cycle ergometer, followed by a VO<sub>2</sub> max protocol with 20 min rest between tests. Following a 60-min acclimation, the experimental trial consisted of two 15-min bouts of submaximal exercise (40% and 60% of adjusted VO<sub>2</sub> max) in hypoxia separated by 15 min rest. VO<sub>2</sub>, HR, Oxygen Saturation (SpO<sub>2</sub>), BP, regional cerebral oxygenation (rSO<sub>2</sub>), Running Memory Continuous Performance Task (RMCPT) and Mood State were assessed during the final 5 min of each stage of exercise in hypoxia. Repeated measures ANOVA was utilized for analyzing all dependent variables. **RESULTS:** Significant differences were demonstrated between men and women for VO<sub>2</sub> max (men: 47.0±7.7 ml/kg/min; women: 40.9±4.6 ml/kg/min), adjusted VO<sub>2</sub> max (men: 34.2±5.6 ml/kg/min; women: 29.8±3.3 ml/kg/min), 60% W (men: 101±23 W; women: 68±10 W), and 40% W (men: 52±16 W; women: 35±10 W). Throughput score of RMCPT was significantly higher than hypoxic baseline (100.7±17.1) during both exercise intensities (40%; 108.1±16.5, 60%; 110.2±18.2,  $p<0.05$ , respectively) although no difference was observed between intensities ( $p=0.512$ ). TMD was significantly improved at 40% (-89.4±56.4,  $p=0.003$ ), but not at 60% (-71.1±63.4,  $p=0.074$ ). A significant difference was observed between the two exercise intensities ( $p=0.017$ ). No gender differences were found in throughput score of RMCPT ( $p=0.352$ ) or TMD ( $p=0.077$ ). Men displayed significantly higher MAP than women during 60% exercise (men: 93.0±6.2 mmHg; women: 85.8±8 mmHg;  $p=0.013$ ). No difference in SpO<sub>2</sub> or rSO<sub>2</sub> was observed between the two exercise conditions (SpO<sub>2</sub>:  $p=0.563$ ; rSO<sub>2</sub>:  $p=0.590$ ). **CONCLUSIONS:** An acute bout of low to moderate (40% - 60% VO<sub>2</sub>max) exercise in hypoxia can improve cognitive functioning and mood state in male and female individuals.

**2047 Board #199 June 2, 3:30 PM - 5:00 PM**  
**Effect of Post-exercise Normobaric Hyperoxia Recovery on Resistance Exercise-induced Fatigue**

Yu-You Wu<sup>1</sup>, Sun-Chin Yang<sup>2</sup>, Chgieh-Ling Wang<sup>2</sup>, Szu-Hsien Yu<sup>3</sup>. <sup>1</sup>University of Taipei, Taipei, Taiwan. <sup>2</sup>Shih-Hsin University, Taipei, Taiwan. <sup>3</sup>I-Lan University, I-Lan, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
 Email: a8975e@gmail.com  
*(No relationships reported)*

**PURPOSE:** To investigate the influence of normobaric hyperoxia condition on recovery after single bout resistance exercise. **METHODS:** In this crossover study, 10 female college athletes (20.1±0.6 y/o, 166.3±10.3 cm, 56.5±4.3 kg) are randomized divided into normobaric hyperoxia group, NH(60% O<sub>2</sub>) and Normobaric normoxia group, NN(21% O<sub>2</sub>). All participants performed an acute resistance exercise and recovered under 21% or 60% oxygen for 90 min immediately after a high carbohydrate meal (2 g carbohydrate per kg body weight). Blood glucose, insulin and TBARS concentration were measured before, immediately, 30, 60, and 90 min after exercise. Biceps brachii and Quadriceps femoris muscle strength were measured before, and 90 min and 24 h after exercise.

**RESULTS:** Glucose and Insulin concentration in NH group is significant higher than that in NN group 90 min after exercise. TBARS concentration in NH group is significant higher than in NN group 30 to 90 min after exercise. Muscle strength of biceps brachii is significant lower in NH group 24h after exercise compared to NN group. Pain threshold was significant increased 90min after resistance exercise. **CONCLUSIONS:** Recovery under Hyperoxia after resistance exercise is not beneficial to muscle strength recovery. The possible mechanism might be due to the lower glucose uptake and increased oxidative stress.

**2048 Board #200 June 2, 3:30 PM - 5:00 PM**  
**Impact of Staging and Physical Activity on Aerobic Exercise Responses at 4300 m**

Robert W. Kenefick, FACSM, Beth A. Beidleman, Janet E. Staab, Sean P. Andrew, Stephen R. Muza, FACSM, Katelyn I. Guerriere, Bruce S. Cadarette, Ingrid V. Sils, Charles S. Fulco. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.*  
 Email: Robert.W.Kenefick.civ@mail.mil  
*(No relationships reported)*

Residing (or "staging") for two days at altitudes of 3000 m and 3500 m has been shown to reduce incidence of acute mountain sickness (I-AMS) in unacclimatized sea level (SL) residents during their subsequent ascent to 4300m. Additionally, I-AMS at 4300m was reduced in those who participated in daily rigorous physical activity while staging at 2500 m and 3000 m. It is unclear if a similar staging/activity strategy would likewise improve cardiorespiratory responses and exercise performance at 4300 m. **PURPOSE:** To determine if cardiorespiratory and time trial (TT) responses of SL residents performed at 4300 m would improve after two days of residing at 2500 m, 3000 m, 3500 m, or 4300 m with or without increased daily activity. **METHODS:** Sixty six volunteers (45 men, 21 women; mean ± SD; 23 ± 5 yr; 173 ± 9 cm; 73 ± 12 kg; peakVO<sub>2</sub> of 49 ± 7 ml•kg<sup>-1</sup>•min<sup>-1</sup>) were assigned to 1 of 4 staging groups and within each group, were designated to be sedentary (S) or active (A) during 2 days of residence at 2500 m (n=11S, 8A), 3000 m (n=6S, 12A), 3500 m (n=6S, 8A), or 4300 m (direct ascent; n=7S, 8A). Activity consisted of ~90 min of rigorous trail hiking twice per day at the assigned staging altitudes. At SL and 4300 m, volunteers performed 20 min of steady-state (SS) treadmill walking (45 ± 3% SL VO<sub>2</sub>peak) followed by a 5-mile, 1% grade, self-paced maximal effort TT. **RESULTS:** As SS exercise intensity was identical (~45% SL VO<sub>2</sub>peak), there were no differences in VO<sub>2</sub> among staging and activity groups at SL and at 4300 m (~1.6 L•min<sup>-1</sup>). Overall, compared to SL, while at 4300 m arterial oxygen saturation decreased (97% to 74%,  $P<0.01$ ), while heart rate (124 to 140 b•min<sup>-1</sup>) and ventilation (39 to 60 L•min<sup>-1</sup>) increased ( $P<0.01$ ). However, there were no differences at SL or at 4300 m among staging or activity groups. In general, TT duration increased from SL to 4300 m by 22 min (51 to 73 min,  $P<0.01$ ), but there were no differences at SL or 4300 m among staging altitudes or activity groups. **CONCLUSIONS:** Residing for two days at 2500 m to 4300 m, with or without daily rigorous activity, did not improve cardiorespiratory responses or TT performance at 4300 m. These results are consistent with the notion that more than two days of staging are required to positively affect physiologic responses and aerobic exercise performance at 4300 m. Authors' views not official U.S. Army or DoD policy.

**2049 Board #201 June 2, 3:30 PM - 5:00 PM**  
**Physiological Evaluation Of Tight- And Loose-Fitting Powered Air-Purifying Respirators**

Edward J. Sinkule<sup>1</sup>, Jeffrey B. Powell<sup>1</sup>, Marco F. Pugliese<sup>2</sup>, Tyler D. Quinn<sup>1</sup>. <sup>1</sup>Centers for Disease Control & Prevention/NIOSH, Pittsburgh, PA. <sup>2</sup>University of Pittsburgh, Pittsburgh, PA.  
 Email: esinkule@cdc.gov  
*(No relationships reported)*

Healthcare workers are increasingly using powered air-purifying respirators (PAPRs) while performing aerosol-generating procedures on patients with certain infectious diseases (e.g., influenza, Ebola). **PURPOSE:** This study evaluated the time-weighted average-inhaled oxygen (AvgF<sub>I</sub>O<sub>2</sub>, %) and carbon dioxide (AvgF<sub>I</sub>CO<sub>2</sub>, %) concentrations, peak inhaled pressures (PIP, mmH<sub>2</sub>O), and peak inhaled temperatures (PIT, °Celsius) from human subjects wearing four different PAPRs during standing rest and treadmill exercise. **METHODS:** Men and women (n=12, each) were calibrated (same absolute work) on a treadmill at VO<sub>2</sub> = 1, 2, and Max (3.0 for men, 2.7 for women) L/min (STPD). Three loose-fitting hoods (LF-PAPR) of various sizes (model A, B, & C) and one tight-fitting full facepiece (model D) with HEPA filters were randomly selected and worn by each participant for four minutes at standing rest and each energy expenditure. Results were averaged during the last minute of each activity period and expressed as grouped means for both men and women.

## RESULTS:

PITs ranged 24-26°C in all PAPRs. The AvgF<sub>I</sub>O<sub>2</sub> for each model at rest, 1L/min, 2L/min, and Max, respectively = A, 20.39, 20.38, 20.45, 20.31; B, 19.28, 18.82, 19.30, 19.33; C, 19.40, 19.33, 19.52, 19.35; D, 20.83, 20.82, 20.68, 20.56. The AvgF<sub>I</sub>CO<sub>2</sub> for each model at rest, 1L/min, 2L/min, and Max, respectively = A, 0.50, 0.47, 0.46, 0.63; B, 1.43, 1.75, 1.53, 1.74; C, 1.33, 1.35, 1.32, 1.69; D, 0.06, 0.08, 0.12, 0.22. The PIPs for each model at rest, 1L/min, 2L/min, and Max, respectively = A, 2, 0, -6, -14; B, 1, -1, -5, -12; C, 0, -1, -5, -12; D, 11, 7, -4, -28. Negative PIPs were observed at the mouth in every LF-PAPR worn by every participant at VO<sub>2</sub> = 2L/min and higher; 44% of the PIP observations among the three LF-PAPRs were negative at VO<sub>2</sub> = 1L/min.

## CONCLUSIONS:

Inhaled breathing gases with PAPRs for a range of activities appear tolerable for healthy workers. Evidence of overbreathing the LF-PAPRs (inspiratory flow > blower flow, resulting in a negative PIP) at the mouth during exercise (VO<sub>2</sub> > 1) suggests further research is needed to better understand the cause of this unexpected result.

2050 Board #202 June 2, 3:30 PM - 5:00 PM  
**Treadmill Time-trial Performance of Unacclimatized Lowlanders Following Rapid Ascent to 3500 m or 4050 m**

Roy M. Salgado, Charles S. Fulco, Stephen R. Muza, Janet E. Staab, Sean P. Andrew, Juli E. Jones, Rob N. Demes, Marie R. Grunbeck, Beth A. Beidleman. *US Army Research Institute of Environmental Medicine, Natick, MA.*  
 Email: roy.m.salgado.ctr@mail.mil  
 (No relationships reported)

Our group recently published a mathematical model depicting the relationship of the change in cycle ergometer time-trial (TT) performance duration as a function of increasing elevation for unacclimatized lowlanders within their first 8 hrs of exposure to elevations up to 4300 m (Beidleman et al., *Med Sci Sports Exerc* 2015). Whether the model is generalizable for TT performance assessments using a different mode of exercise (i.e., treadmill) and within the first 48 hrs of exposure is unknown. Purpose: Determine if the changes in treadmill TT performance durations of unacclimatized individuals measured both at sea level (SL, 50 m) and either 3500 m or 4050 m can be estimated accurately using the published cycle ergometer TT performance model. Methods: Forty-three healthy volunteers (35 men and 8 women; mean ± SD; 22 ± 4 yrs, 74.5 ± 12.5 kg; 49.8 ± 7.3 ml·kg<sup>-1</sup>·min<sup>-1</sup>) completed a treadmill TT lasting 8.0-11.2 km both at SL and within the first 48 hr of arrival at either 3500 m (n = 16) or 4050 m (n = 27). The % increase in treadmill TT duration from SL to each elevation was the outcome variable which was, in turn, compared to the results estimated at the identical elevations using the cycle TT model. Results: The % increase in duration for the treadmill TT versus that estimated using the cycle TT model did not differ either at 3500 m (26.7 ± 14.8% versus 28.4 ± 6.9%, p = 0.69) or 4050 m (44.1 ± 17.5% versus 46.8 ± 1.6%, p = 0.42). Conclusion: The findings indicate that our published cycle ergometer model accurately estimates % changes for treadmill TT performance of unacclimatized SL residents during their first 48 hrs of exposure to altitudes of 3500 m and 4050 m. Further, the lack of significant difference between the treadmill and cycle TT performance outcomes at these two elevations suggest that the published predictive model can be applied to treadmill exercise.

Disclaimer: Author's views are not official U.S. Army or DoD policy.

2051 Board #203 June 2, 3:30 PM - 5:00 PM  
**Is there a Compensatory Mechanism to Maintain Muscle Hydration and Prevent Dehydration at High Altitude?**

Melissa J. Benton, FACSM, Amy L. Silva-Smith. *University of Colorado, Colorado Springs, CO.*  
 Email: mbenton@uccs.edu  
 (No relationships reported)

Muscle serves as a reservoir to maintain hydration, which in turn maintains blood volume and pressure. Older adults are at risk for dehydration due to loss of fluid reserves that accompanies loss of lean mass with age. Older women, with less lean mass throughout the lifespan, are at greatest risk. High altitude is an independent risk factor for dehydration so elderly women living at high altitude may be at greater risk than those living at sea level.

**PURPOSE:** To evaluate hydration status in older women residing at high (≥ 1800 m) and low altitude (≤ 75 m).

**METHODS:** Older women living at high altitude (n = 11) were pair matched based on age and BMI with women living at low altitude (n = 11). Hydration and body composition were measured with whole body multi-frequency bioelectrical impedance analysis and postural blood pressure was measured supine, sitting, and standing.

**RESULTS:** There were no differences between high altitude (HA) and low altitude (LA) in age, weight, BMI, FFMI, body composition, total body water,

and extracellular water. However, the relative amount of intramuscular water was significantly greater in HA compared to LA (26.0 ± 0.4% vs. 24.7 ± 0.4%, p < 0.05). Furthermore, systolic blood pressure was significantly higher in HA compared to LA in the sitting (145.4 ± 7.7 mmHg vs. 124.6 ± 5.1 mmHg, p < 0.05) and standing (140.7 ± 8.1 mmHg vs. 119.1 ± 5.5 mmHg, p < 0.05) positions, and a trend was observed for significantly greater diastolic blood pressure in HA versus LA for sitting (78.9 ± 4.0 mmHg vs. 70.0 ± 1.9 mmHg, p = 0.06) and standing (80.3 ± 4.0 mmHg vs. 71.3 ± 3.1 mmHg, p = 0.09). When absolute changes in blood pressure were evaluated, there was a trend for significant differences. Between supine and sitting, systolic blood pressure increased in HA by +6.4 ± 2.9 mmHg and decreased in LA by -2.7 ± 3.7 mmHg (p = 0.06) while diastolic blood pressure increased in HA by +4.5 ± 1.8 mmHg and decreased in LA by -2.4 ± 3.4 mmHg (p = 0.08).

**CONCLUSION:** Although preliminary, our findings suggest a compensatory mechanism of muscle at high altitude by which intramuscular hydration increases as a physiologic buffer to decrease risk of dehydration. As a downstream effect, this mechanism may also promote stability in postural blood pressure. More research in this area is needed.

2052 Board #204 June 2, 3:30 PM - 5:00 PM  
**Effects of Acute Hypoxia and Hyperoxia on Oxygen Uptake, Brain and Muscle Oxygenation during Incremental Exercise**

Jin Uchimaru, Hidekazu Takemura, Hirohiko Takahashi, Shozo Suzuki. *Sendai University, Shibata, Japan.*  
 Email: jn-uchimaru@sendai-u.ac.jp  
 (No relationships reported)

Changes in inspired oxygen concentration will affect the peak oxygen uptake compared with normoxia. These underlying mechanisms are not fully understood, but central and peripheral mechanisms have been proposed.

**PURPOSE:** Our study focuses on the effect of acute hypoxia and hyperoxia on oxygen uptake, brain and muscle oxygenation during exercise.

**METHODS:** Eight healthy male subjects performed on incremental maximal exercise test (15W/min step) under normoxia (Norm: 20.9 FIO<sub>2</sub>), acute hypoxia (Hypox: 14.5% FIO<sub>2</sub>) and acute hyperoxia (Hyper: 28.0% FIO<sub>2</sub>) conditions. The order of each condition was randomized and trials were spaced by 5 days. We measured oxygen uptake (VO<sub>2</sub> peak) on incremental exercise. Near-infrared spectroscopy (NIRS) was used to monitor concentration (μM) changes of oxy- and deoxyhemoglobin (Δ[O<sub>2</sub>Hb], Δ[H<sub>2</sub>O<sub>2</sub>]) in left frontal cortex region of the forehead and ipsilateral vastus lateralis muscle. Changes in total Hb and StO<sub>2</sub> were calculated (Δ[THb] = Δ[O<sub>2</sub>Hb] + Δ[H<sub>2</sub>O<sub>2</sub>], Δ[StO<sub>2</sub>]) and used as index of change in regional blood volume. Repeated-measures ANOVA were performed across treatments.

**RESULTS:** VO<sub>2</sub> peak decreased in Hypox (38.6 ± 4.0 ml/kg/min, p > 0.05) and slightly increased in Hyper (45.2 ± 7.5 ml/kg/min) compared with Norm (43.3 ± 5.9 ml/kg/min). Muscle oxygenation dropped progressively during Hypox (decrease Δ[O<sub>2</sub>Hb]: -1.79 ± 0.61 μM and ΔStO<sub>2</sub>: -19.55 ± 3.86%, increase Δ[H<sub>2</sub>O<sub>2</sub>]: 3.37 ± 0.96 μM at 100% Powerpeak), and also changes in muscle oxygenation during Hyper (decrease Δ[O<sub>2</sub>Hb]: -1.26 ± 0.76 μM and ΔStO<sub>2</sub>: -16.30 ± 5.13%, increase Δ[H<sub>2</sub>O<sub>2</sub>]: 2.96 ± 1.06 μM at 100% Powerpeak) were similar to Norm (decrease Δ[O<sub>2</sub>Hb]: -1.35 ± 0.76 μM and ΔStO<sub>2</sub>: -16.17 ± 5.30%, increase Δ[H<sub>2</sub>O<sub>2</sub>]: 3.01 ± 1.35 μM at 100% Powerpeak). Interestingly, Brain oxygenation (Δ[O<sub>2</sub>Hb]) was slightly increased and deoxygenation (Δ[H<sub>2</sub>O<sub>2</sub>]) was increased during exercise under each three conditions, respectively. Furthermore, changes brain and muscle oxygenation was also greater in Hypox compared with Norm and Hyper (p > 0.05).

**CONCLUSIONS:** Acute hypoxia decrease oxygen uptake with decreased muscle oxygenation and slightly increased brain oxygenation. But it is unlikely that changes in brain and muscle oxygenation was relate with oxygen uptake in hyperoxia, despite a similar change absolute PO<sub>2</sub> from hypoxia and/or hyperoxia to normoxia.

2053 Board #205 June 2, 3:30 PM - 5:00 PM  
**Chronic Intermittent Hypoxia Alters Hepatic Markers Of Mitochondrial Dynamics And Autophagy Signaling**

Estela Santos-Alves<sup>1</sup>, Joan R. Torrella<sup>2</sup>, António Ascensão<sup>1</sup>, José Magalhães<sup>1</sup>. <sup>1</sup>Research Centre in Physical Activity, Health and Leisure (CIAFEL), Porto, Portugal. <sup>2</sup>Faculty of Biology, University of Barcelona, Barcelona, Spain.  
 (No relationships reported)

Chronic intermittent hypoxia alters hepatic markers of mitochondrial dynamics and autophagy signaling

Santos-Alves E1, Torrella JR2, Ascensão A1, Magalhães J1  
 CIAFEL - Research Centre in Physical Activity, Health and Leisure, Faculty of Sport, University of Porto, Portugal  
 2Department of Physiology and Immunology, Faculty of Biology, University of Barcelona, Spain

**Introduction:** Chronic intermittent hypobaric hypoxia (CIHH) simulating high-altitude environments is a non-pharmacological strategy employed to antagonize the adverse effects caused by a variety of complications, including metabolic and cardiovascular diseases. However, the impact of CIHH on hepatic tissue and mitochondrial function has been scarcely studied.

**Purpose:** In this work, we aim to analyse the effects of CIHH exposition on hepatic markers of mitochondrial biogenesis, dynamics, autophagy signaling and oxidative stress.

**Methods:** Sixteen young-adult Wistar male rats were randomly divided into two groups: normoxia (N) and chronic intermittent hypobaric hypoxia (CIHH, simulated atmospheric pressure of 49.3kPa 5h/d during 5wks). Liver markers of mitochondrial biogenesis (TFAM), fusion (OPA1, MFN1, MFN2) and autophagy (Beclin1, p62, Bcl-2), as well as the mitochondrial-related metabolic modulators p66shc(ser36) and SIRT3 were assessed by Western Blotting.

**Results:** When compared to the Normoxic animals, rats exposed to intermittent hypobaric hypoxia showed a decrease in OPA1 (75%,  $p < 0.05$ ) and increased levels of beclin1 (240%,  $p < 0.05$ ), Bcl-2 (138%,  $p < 0.05$ ), Beclin1/Bcl-2 ratio (170%,  $p < 0.05$ ) and p66shc(ser36) (150%,  $p < 0.05$ ). No alterations were found in TFAM, MFN1 and MFN2, p62 and SIRT3 content.

**Conclusions:** CIHH exposure promotes alterations in liver mitochondrial markers of oxidative stress, autophagy signaling and mitochondrial dynamics, suggesting that CIHH stimulates liver mitochondrial remodeling and hepatocyte renewal.

Supported by: FCT (PTDC-DES-113580-2009)

to 6300m). **PURPOSE:** To determine if there is a difference in lactate accumulation between sea level, 24 hours, and 96 hours of exposure to an altitude of 3,147 meters with submaximal exercise. **METHODS:** 11 healthy college students (age:  $20.7 \pm .6$  years, weight:  $68.3 \pm 12$  kgs) participated. Each subject performed a maximal oxygen consumption test at sea level ( $44.3 \pm 9.3$  ml/kg/min). Three to four days later a submaximal test was performed at sea level at 60 and 70% of the subject's maximum heart rate (5 minutes at each stage). Submaximal tests were performed at sea level (SL), within 24 hours of exposure to altitude (3,417m), and after 96 hours at the same altitude. Physiological measures included: lactate accumulation (La), oxygen saturation (O2), rating of perceived exertion (RPE; 0-10 Scale), and workload (kp) at the last minute of each 5 minute stage. **RESULTS:** At submaximal exercise intensities (60 and 70%), La was significantly lower at acute exposure (24h; 1.5mmol/l) as compared to SL (2.0 mmol/l) ( $p < .04$ ), however no differences were noted when comparing SL to 96h of altitude exposure ( $p < .13$ ). O2 was different across the three conditions (SL; 96.3%, 24h (80.0%) and 96h (84.3%) of altitude exposure;  $p < .00$ ) and the two different intensities (60%; 87.7% and 70%; 86.1%) across the three conditions ( $p < .00$ ). RPE was greater at 70 (3.5) Vs 60% (1.8) ( $p < .00$ ), but there were no differences across the three conditions. Workload was greater at SL (1.9kp) Vs 24h altitude exposure (1.1kp) ( $p < .01$ ) and the two different intensities (60%; 1.2kp and 70%; 1.7kp) ( $p < .00$ ) across the three conditions. **CONCLUSION:** Lactate accumulation was observed to decrease with initial altitude exposure, however, within 96h of exposure lactate accumulation returned toward sea level values. This would suggest that elevations of 3417m also can induce the phenomenon of the "Lactate Paradox."

2054 Board #206 June 2, 3:30 PM - 5:00 PM  
**Treadmill Exercise Endurance is Reduced Immediately after Repeated 6-hour Air Dives**

John P. Florian, Elizabeth R. Bergeron, Barbara E. Shykoff.  
*Navy Experimental Diving Unit, Panama City, FL.*  
 Email: john.florian@navy.mil  
 (No relationships reported)

Surface exercise performance after repeated dives at 1.35 atmospheres absolute (ata) is reduced substantially more when divers breathe 100% O<sub>2</sub> than when they breathe air, but the studies examined performance 24 hours after completion of the last dive, when plasma volume (PV) was likely to have recovered.

**PURPOSE:** To characterize exercise performance within two hours after completing a series of repeated air dives and to determine whether performance is fully recovered three days after diving.

**METHODS:** Twelve healthy men ( $30 \pm 5$  yrs;  $VO_{2max}$ :  $51 \pm 7$  ml/kg/min; mean  $\pm$  SD) completed a dive week (5 consecutive 6-hr dives with 18-hr surface intervals) while breathing air at 1.35 ata. Endurance time on a treadmill at 85% of  $VO_{2max}$  was measured a few days before diving (BL), within two hours of surfacing after the fifth dive (PD), and three days after the fifth dive (PD3). For the 85%  $VO_{2max}$  protocol, heart rate (HR) and blood lactate were measured during a walking warm-up (5 min), level run (3 min), and every three minutes during a run at 10% grade until exhaustion. Cardiac output (Q: N<sub>2</sub>O rebreathing, Innocor) was measured in a subset of 5 subjects. SV was calculated as Q/HR, and the change in PV from BL was calculated from hemoglobin and hematocrit (Dill-Costill equation) before exercise. Treadmill data for BL, PD, and PD3 were compared at the run time matching the last data point for the shortest of the three runs. Data are presented as mean  $\pm$  SEM.

**RESULTS:** PD run times significantly decreased from BL and recovered by PD3 (PD:  $-34 \pm 5\%$ ,  $p < 0.001$ ; PD3:  $-11 \pm 6\%$ ,  $p > 0.07$ ). PV followed a similar pattern (PD:  $-8.5 \pm 1.2\%$ ; PD3:  $+4.0 \pm 1.1\%$ ;  $p < 0.001$ ). The reduced PD run times were paralleled with higher HR and lower Q and SV, all of which returned to BL levels by PD3 (HR - BL:  $171 \pm 3$ ; PD:  $183 \pm 2$ ; PD3:  $175 \pm 3$  beats/min,  $p < 0.001$ ; Q - BL:  $23.6 \pm 1.3$ ; PD:  $18.9 \pm 1.1$ ; PD3:  $24.0 \pm 1.6$  l/min,  $p < 0.002$ ; SV - BL:  $138 \pm 7$ ; PD:  $101 \pm 5$ ; PD3:  $133 \pm 10$  ml/beat,  $p < 0.002$ ). There was no difference in lactate levels among the three runs (BL:  $6.1 \pm 0.6$ ; PD:  $7.0 \pm 0.6$ ; PD3:  $7.1 \pm 0.6$  mmol/l;  $p > 0.3$ ).

**CONCLUSION:** Repeated air dives at 1.35 ata significantly reduce surface exercise endurance at high workloads, but performance is restored by the third day after diving. The increased fatigue is likely due, in part, to the reduced circulating blood volume and higher working HRs.

Supported by NAVSEA DSBBDP and ONR.

2055 Board #207 June 2, 3:30 PM - 5:00 PM  
**Alterations In Blood Lactate At Fixed Submaximal Exercise Heart Rates When Comparing Sea Level To Altitude**

Lexie Basiliere, Chad Lyons, Annelise Donahue, Paul Visich.  
*University of New England, Biddeford, ME.*  
 (No relationships reported)

Past research has observed a metabolic anomaly known as the "Lactate Paradox" at altitude. With exposure to altitude, it has been shown that rest and exercising lactate levels are reduced compared to values obtained at sea level. This reduction in lactate has been shown with both chronic and acute exposure to altitudes (4100

2056 Board #208 June 2, 3:30 PM - 5:00 PM  
**Relation of Activity Patterns and Biochemical Factors to Acute Mountain Sickness in the South Pole**

Girish Pathangey<sup>1</sup>, Courtney M. Wheatley<sup>1</sup>, Maile L. Ceridon Richert<sup>2</sup>, Paul J. Anderson<sup>2</sup>, Mike F. Harrison<sup>3</sup>, Bruce D. Johnson<sup>2</sup>. <sup>1</sup>Mayo Clinic, Scottsdale, AZ. <sup>2</sup>Mayo Clinic, Rochester, MN. <sup>3</sup>Henry Ford Hospital, Detroit, MI.  
 (No relationships reported)

Acute Mountain Sickness (AMS) can develop during rapid altitude exposure. It is a subjective diagnosis that commonly consists of symptoms related to headaches, fatigue, sleeplessness and dizziness, while more severe AMS can deteriorate to conditions that can be life threatening. The role of physical activity in the development of AMS remains controversial. Individuals working at the South Pole are required to make a rapid transition to altitude and be moderately active.

**PURPOSE:** To compare activity patterns and biochemical factors in individuals with and without AMS or its symptoms.

**METHODS:** Venous blood samples were taken from 43 healthy individuals at sea level and 2 days after high altitude exposure. Physical activity was monitored using BodyMedia activity monitors. AMS symptoms were examined using modified Louise Questionnaires. Comparisons were made using paired T-test with repeated measures and Pearson's correlation.

**RESULTS:** 29% of subjects displayed AMS between SP days 1-2 (D1-2). Total increase in energy expenditure on day 2 for AMS individuals was  $16.8 \pm 4.1\%$  and  $10.1 \pm 4.9\%$  for individuals without AMS. In addition, for patients with a total symptom score greater than 5, the time spent performing moderate and vigorous activity during D1-2 was greater by a factor of  $1.77 \pm 0.24$  to that of the baseline, and compared to patients with a symptom score less than 5 had a lower increase of  $1.34 \pm 0.23$ . Blood samples presented an increase in VEGF (82.7%), increase in EPO (27.4%), decrease in Cystatin C (-5.1%), and decrease in NE (-1.68%) for AMS individuals. A correlation of total symptom score and time of moderate and vigorous activity expenditure of individuals resulted in an R squared value of 0.66. Comparisons were statistically significant with a p value of  $p < 0.05$ .

**CONCLUSION:** Increases in activity and evaluation of blood chemistry compared to the baseline after 48 hours of ascent are associated to the risk of AMS.

2057 Board #209 June 2, 3:30 PM - 5:00 PM  
**Small Airway Function after Repeated Dives with Elevated PO<sub>2</sub>**

Barbara E. Shykoff, John P. Florian. *Navy Experimental Diving Unit, Panama City, FL.*  
 (No relationships reported)

Repetitive diving with mildly hyperbaric oxygen pressures (oxygen partial pressure (PO<sub>2</sub>) approximately 130 kPa) may cause small airway dysfunction, but the relative importance of immersion, PO<sub>2</sub>, and diver activity has not been elucidated.

**PURPOSE:** To differentiate effects of immersion and elevated PO<sub>2</sub> at rest and during exercise, parameters of small airway function were measured in conjunction with five series of dives: rest or cycle ergometer exercise in a 15-foot deep pool with O<sub>2</sub> (PO<sub>2</sub> = 130 kPa) or air (PO<sub>2</sub> = 30 kPa), and rest in a dry hyperbaric chamber with PO<sub>2</sub> = 130 kPa.

**METHODS:** Each dive series consisted of five consecutive days with six hours of exposure and 18 hours between dives (same daily starting time). Forced expired

THURSDAY, JUNE 2, 2016

volume in 1 second (FEV<sub>1</sub>), and maximum forced expired flow between 25% and 75% of volume expired (FEF<sub>25-75</sub>) were measured (CPL, nSpiire Medical) the prior week and before and after each dive, plus on the morning after and three days after the fifth dive. The averages of three ATS-valid measures at each time were compared to the baseline average (pre-dive and pre-first dive). The numbers of divers for each condition were wet resting O<sub>2</sub>:10; wet resting air: 10; dry resting O<sub>2</sub>:12; wet exercise O<sub>2</sub>:10; wet exercise air: 14.

**RESULTS:** After surfacing no parameters decreased from baseline. FEV<sub>1</sub> and FEF<sub>25-75</sub> increased after exercise air dives (Maximum changes: FEV<sub>1</sub>: 2.3%, FEF<sub>25-75</sub>: 10.2%, p < 0.001). However, FEV<sub>1</sub> and FEF<sub>25-75</sub> were low on mornings following resting and exercise O<sub>2</sub> dives (Maximum changes: resting: FEV<sub>1</sub> -5.2%, FEF<sub>25-75</sub> -10.6%, both p < 0.01; exercise: FEV<sub>1</sub>: -5.2%, p < 0.02; FEF<sub>25-75</sub>: -15.4%, p < 0.001). Changes resolved after the next dive, but persisted on the third day after the fifth wet O<sub>2</sub> dives: resting O<sub>2</sub>: FEV<sub>1</sub> -4.2%, p < 0.03; exercise O<sub>2</sub>: FEV<sub>1</sub>: -3.9%, p < 0.02; FEF<sub>25-75</sub>: -10%, p < 0.005.

**CONCLUSION:** Decreases in indices of small airway function appear to follow from a combination of volume shifts (immersion) and elevated PO<sub>2</sub>. Effects are delayed after the end of exposure, suggesting inflammation. Without a later immersion, small airway function remains depressed for three days following wet O<sub>2</sub> at rest or exercise, while volume shifts with elevated pulmonary blood flow (exercise) and minimally- elevated PO<sub>2</sub> (air) appear to improve function.

Supported by NAVSEA DSBPD and ONR.

2058 Board #210 June 2, 3:30 PM - 5:00 PM

#### Four-day Head-down Tilt Bed Rest as a Model for Studying Rapid Alterations in Hemoglobin Mass

Benjamin J. Ryan<sup>1</sup>, Jesse A. Goodrich<sup>1</sup>, Walter F. Schmidt<sup>2</sup>, Ellen R. Stothard<sup>1</sup>, Kenneth P. Wright, Jr.<sup>1</sup>, William C. Byrnes, FACSM<sup>1</sup>. <sup>1</sup>University of Colorado Boulder, Boulder, CO.

<sup>2</sup>University of Bayreuth, Bayreuth, Germany. (Sponsor: William C. Byrnes, FACSM)

Email: benjamin.ryan@colorado.edu

(No relationships reported)

Rapid decreases in hemoglobin mass (Hbmass) have been reported in healthy humans with spaceflight and following descent from high altitude. It has been proposed that a selective increase in the destruction of young red blood cells (RBCs) mediates these decreases but conclusive evidence demonstrating neocytolysis is lacking. Based on the proposed triggers and time course of adaptation during spaceflight, we hypothesized that 4 days of -6° head-down tilt bed rest (HDTBR) would cause a rapid decrease in Hbmass that would be associated with evidence of increased RBC destruction.

**PURPOSE:** To examine changes in Hbmass before (PRE), 5 hours after (POST), and 5 days after (POST5) 4 days of HDTBR. **METHODS:** Seven healthy, recreationally active men (age: 21 ± 3 years, peak oxygen uptake: 50 ± 6 mL kg<sup>-1</sup> min<sup>-1</sup>) completed 4 days of HDTBR. Hbmass was assessed using the optimized carbon monoxide rebreathing method. Markers of RBC production and destruction assessed included [erythropoietin] ([EPO]), [soluble transferrin receptor] ([sTfR]), reticulocyte count, [ferritin], [haptoglobin], and [bilirubin]. **RESULTS:** [EPO] decreased by 30 ± 33% from PRE to POST (p = 0.028). Contrary to our hypothesis, Hbmass was increased by 4.0 ± 4.3% from PRE to POST (p = 0.014) before decreasing to a level 3.6 ± 2.4% below PRE at POST5 (p = 0.027). From PRE to POST, [haptoglobin] increased 66 ± 73% (p = 0.013), [bilirubin] decreased 26 ± 34% (p = 0.054), [ferritin] increased 17 ± 17% (p = 0.012), and reticulocyte count remained stable. From PRE to POST5, sTfR decreased 17 ± 5% (p = 0.018) but there were no significant alterations in [ferritin], [haptoglobin], [bilirubin] or reticulocyte count. **CONCLUSION:** Our findings suggest that 4-day HDTBR results in a transient increase in Hbmass that may be influenced by decreased RBC destruction. However, since the POST measurement occurred following re-ambulation, a potential role for other factors (i.e., spleen contraction) on the increase in Hbmass cannot be excluded. The decrease in Hbmass at POST5 appears to be mediated by decreased RBC production rather than increased RBC destruction. These findings highlight the need to re-examine the time course and mechanisms of Hbmass alterations with short-term spaceflight and simulated microgravity.

2059 Board #211 June 2, 3:30 PM - 5:00 PM

#### Metabolic Assessment of Suited Mobility using Functional Tasks

Jason R. Norcross<sup>1</sup>, Shane M. McFarland<sup>2</sup>, Robert Ploutz-Snyder<sup>3</sup>. <sup>1</sup>Wyle Science Technology and Engineering Group, Houston, TX. <sup>2</sup>MEI Technologies, Houston, TX. <sup>3</sup>Universities Space Research Association, Houston, TX.

Email: jason.norcross-1@nasa.gov

(No relationships reported)

Existing methods for evaluating space suit mobility have focused on isolated joint range of motion or torque, but these techniques have little to do with functional performance. **PURPOSE:** To evaluate suited mobility at the system level through measuring metabolic cost (MC) of functional tasks.

**METHODS:** Six male subjects completed 2-3 trials of 5 functional tasks (walk, side step, stair climb, and upper body and full body object relocations) in each of 3 different space suits including 2 planetary suits, the Mark III (64 kg) and Rear Entry I-suit (REI, 43 kg) and a modified intravehicular activity suit (Demonstrator, 27 kg) with enhanced mobility for contingency spacewalks. All tasks were performed in 1g. Rate of carbon dioxide (CO<sub>2</sub>) production was determined by measuring suit inlet flow and outlet CO<sub>2</sub> concentration. Respiratory exchange rate was assumed to be 0.85 for the conversion to kcal. Mixed-effects regression methods were used to compare metabolic cost across the three different space suits, incorporating random intercept terms to accommodate within-subjects experimental design, and random variance terms to accommodate the observed heterogeneity of variance among the three suits.

**RESULTS:** MC of all functional tasks was significantly higher in the Demonstrator suit, averaging 33-62% more depending on task. MC was similar between Mark III and REI suits, except for the side step and stair climb tasks where MC was significantly lower in the REI.

**CONCLUSIONS:** Although the Demonstrator was the lightest space suit evaluated, it required the highest MC to complete all tasks, suggesting poor mobility. MC differences between the Mark III and REI were evident on tasks that required vertical travel likely due to mass differences between suits.

| Suited Metabolic Cost (kcal • rep-1) of Functional Tasks in Different Space Suits |             |             |             |                              |                             |
|---|-------------|-------------|-------------|------------------------------|-----------------------------|
| Space Suit / Task   | Walk        | Side Step   | Stair Climb | Upper Body Object Relocation | Full Body Object Relocation |
| Demonstrator  | 1.75 ± 0.11 | 1.64 ± 0.29 | 1.57 ± 0.32 | 2.68 ± 0.67                  | 4.20 ± 0.78                 |
| Mark III  | 1.32 ± 0.12 | 1.19 ± 0.14 | 1.17 ± 0.13 | 1.66 ± 0.33                  | 3.01 ± 0.68                 |
| REI   | 1.31 ± 0.16 | 1.03 ± 0.13 | 1.04 ± 0.10 | 1.66 ± 0.30                  | 2.84 ± 0.39                 |

2060 Board #212 June 2, 3:30 PM - 5:00 PM

#### Calf Strength Loss during Mechanical Unloading: Does It Matter?

Kirk L. English<sup>1</sup>, Ajitkumar Mulavara<sup>2</sup>, Jacob Bloomberg<sup>3</sup>, Lori L. Ploutz-Snyder, FACSM<sup>2</sup>. <sup>1</sup>JES Tech, Houston, TX.

<sup>2</sup>Universities Space Research Association, Houston, TX. <sup>3</sup>NASA-Johnson Space Center, Houston, TX. (Sponsor: Lori Ploutz-Snyder, FACSM)

Email: kirk.english-1@nasa.gov

(No relationships reported)

During the mechanical unloading of spaceflight and its ground-based analogs, muscle mass and muscle strength of the calf are difficult to preserve despite exercise countermeasures that effectively protect these parameters in the thigh. It is unclear what effects these local losses have on balance control and functional performance, which will be integral to successful completion of demanding tasks during future exploration missions. **PURPOSE:** To determine the impact of bed rest-induced reductions in calf strength on changes in balance control, dynamic postural stability, and brief functional performance. **METHODS:** Thirty-five males (33.6 ± 7.4 y, 77.2 ± 10.3 kg) were randomized to high intensity exercise or control conditions and completed 70 d of 6-degree head down tilt bed rest. Eccentric isokinetic ankle plantarflexor strength (30° · s<sup>-1</sup>), balance (sway test, quantitatively scored 0 to 100), dynamic postural stability (tandem walk), and brief functional performance (seat egress, obstacle avoidance, and ramp climb [egress], and rock translation) were assessed pre- and post-bed rest. Simple regression was performed with plantarflexor strength change (post - pre) as the predictor variable and change in balance, dynamic postural stability, and functional performance (post - pre) as the outcome; all subjects' data were analyzed together. **RESULTS:** Bed rest elicited a 12.5% reduction in calf strength (Pre: 196 Nm vs. Post: 168 Nm, P < 0.0001); balance control, dynamic postural stability, and functional performance were also negatively affected. Calf strength change explained 11% of the increase in egress time (Pre: 16.4 s vs. Post: 24.7 s; r = 0.33, P = 0.05), 14% of the increase in rock translation time (Pre: 14.2 s vs. Post: 18.5 s; r = 0.37, P = 0.03), 10% of the change in tandem walk performance (Pre: 80.1% correct steps vs. Post: 50.4% correct; r = 0.32, P = 0.06), and 6% of the decrease in balance performance (Pre: 85.6 vs. Post: 71.8; r = 0.25, P = 0.14). **CONCLUSION:** Bed rest-induced losses in calf strength account for 6% to 14% of concomitant changes in balance, dynamic postural stability, and brief functional task performance. Additional work to evaluate the influence of calf strength loss on the performance of longer and more plantarflexor-intensive tasks (e.g., ladder climb and uphill ambulation) is needed.

2061 Board #213 June 2, 3:30 PM - 5:00 PM

**Bluetooth Heart Rate Monitors for Spaceflight**

Roxanne E. Buxton<sup>1</sup>, Michael R. West<sup>2</sup>, Kent L. Kalogera<sup>3</sup>, Andrea M. Hanson<sup>4</sup>. <sup>1</sup>University of Houston, Houston, TX. <sup>2</sup>Aerodyne Industries, LLC, Houston, TX. <sup>3</sup>Wyle Science, Technology and Engineering Group, Houston, TX. <sup>4</sup>NASA Johnson Space Center, Houston, TX.  
Email: roxanne.e.buxton@nasa.gov

(No relationships reported)

Heart rate monitoring is required for crewmembers during exercise aboard the International Space Station (ISS) and will be for future exploration missions. The cardiovascular system must be sufficiently stressed throughout a mission to maintain the ability to perform nominal and contingency/emergency tasks. High quality heart rate data are required to accurately determine the intensity of exercise performed by the crewmembers and show maintenance of VO<sub>2</sub>max. The quality of the data collected on ISS is subject to multiple limitations and is insufficient to meet current requirements.

**PURPOSE:** To evaluate the performance of commercially available Bluetooth heart rate monitors (BT\_HRM) and their ability to provide high quality heart rate data to monitor crew health aboard the ISS and during future exploration missions.

**METHODS:** Nineteen subjects completed 30 data collection sessions of various intensities on the treadmill and/or cycle. Subjects wore several BT\_HRM technologies for each testing session. One electrode-based chest strap (CS) was worn, while one or more optical sensors (OS) were worn. Subjects were instrumented with a 12-lead ECG to compare the heart rate data from the Bluetooth sensors. Each BT\_HRM data set was time matched to the ECG data and a  $\pm 5$ bpm threshold was applied to the difference between the 2 data sets. Percent error was calculated based on the number of data points outside the threshold and the total number of data points.

**RESULTS:** The electrode-based chest straps performed better than the optical sensors. The best performing CS was CS1 (1.6% error), followed by CS4 (3.3% error), CS3 (6.4% error), and CS2 (9.2% error). The OS resulted in 10.4% error for OS1 and 14.9% error for OS2.

**CONCLUSIONS:** The highest quality data came from CS1, but unfortunately it has been discontinued by the manufacturer. The optical sensors have not been ruled out for use, but more investigation is needed to determine how to obtain the best quality data. CS2 will be used in an ISS Bluetooth validation study, because it simultaneously transmits magnetic pulse that is integrated with existing exercise hardware on ISS. The simultaneous data streams allow for beat-to-beat comparison between the current ISS standard and CS2. Upon Bluetooth validation aboard ISS, the research team will down select a new BT\_HRM for operational use.

**D-36 Free Communication/Poster - Muscle Molecular Biology Applications**

Thursday, June 2, 2016, 1:00 PM - 6:00 PM

Room: Exhibit Hall A/B

2062 Board #214 June 2, 2:00 PM - 3:30 PM

**Effects Of Sprint Interval Training On Apoptosis And MHC Gene Expression In Rat Skeletal Muscles**

neda khaledi<sup>1</sup>, milad azad<sup>1</sup>, mehdi heydari<sup>2</sup>. <sup>1</sup>kharazmi university, tehran, Iran, Islamic Republic of. <sup>2</sup>shahid beheshti university of medical science, research institute for endocrine science, tehran, Iran, Islamic Republic of.

Email: n.khaledi@khu.ac.ir

(No relationships reported)

**Neda Khaledi<sup>1</sup>, Milad Azad<sup>1</sup>, Mehdi Heydari<sup>2</sup>**

<sup>1</sup>kharazmi university, tehran, Iran, Islamic Republic of. <sup>2</sup>shahid beheshti university of medical science, research institute for endocrine science, tehran, Iran, Islamic Republic of. (n.khaledi@khu.ac.ir)

Physical exercise induces signaling pathways and regulatory molecules. It is believed that exercise can induce apoptosis which play important roles in retain of tissue and cellular homeostasis. FOXO1 has an important role to regulate apoptosis and induce fiber type transition in skeletal muscle. The effect of sprint interval training on apoptosis and fiber type transitions is unclear. **PURPOSE:** we examined response of FOXO1 as an important factor of apoptosis and fiber type transition in rat skeletal muscle after acute and chronic sprint interval exercise. **METHODS:** 24 male Sprague-Dawley rats (200-230 g) divided into 3 groups (n=8); chronic sprint interval (CSI), acute sprint interval (ASI), control (C). CSI was sprinting 1 min and 2-5 min rest between sets (6-10 sets/days, 5-6 days/weeks) on treadmill for 9 weeks. ASI was running with 10 m/min to 85 m/min which gradually increased in 3 consecutive days that included 7 sets of 1 min with rest interval of 3 min in between. Soleus and super vastus lateralis (SVL) muscles mRNA were analyzed by real-time RT-PCR.

**RESULTS:** In soleus muscle, FoxO1 mRNA expression levels had a 1% decrease in

ASI and 41% in CSI group compare to control group. In SVL muscle, FoxO1 mRNA expression had a 2% increase in ASI and a 37% decrease in CSI. No significant change in FOXO1 mRNA expression were observed between groups. Also, MHC I and Ila mRNA expression (0.3-, 0.4-fold) in soleus and MHC IIb (0.31-fold) in SVL decreased in CSI group, but in ASI, MHC I mRNA increased (3.69-fold) in SVL significantly ( $P \leq 0.05$ ). **CONCLUSION:** FOXO1 mRNA expression is more abundantly in fast muscle and probably has a limited effects on apoptosis in response to sprint interval training.

2063 Board #215 June 2, 2:00 PM - 3:30 PM

**Acute Physical Exercise Increases Glucose Uptake in Skeletal Muscle of Old Rats Through Rho-Kinase Metabolism**

Vitor R. Muñoz<sup>1</sup>, Inês S. Lima<sup>2</sup>, Leandro P. Moura<sup>1</sup>, Rafael C. Gaspar<sup>1</sup>, Rania A. Mekary<sup>3</sup>, Vagner R. Silva<sup>1</sup>, Eduardo R. Ropelle<sup>1</sup>, Young-Bum Kim<sup>2</sup>, José Rodrigo Pauli<sup>1</sup>. <sup>1</sup>Faculty of Applied Sciences - FCA/UNICAMP, Limeira, Brazil. <sup>2</sup>Harvard Medical School, Boston, MA. <sup>3</sup>Harvard T. Chan School of Public Health, Boston, MA.

Email: vitor.munoz93@gmail.com

(No relationships reported)

**PURPOSE:** Senescence promotes several metabolic disorders, including insulin resistance (IR). It is known that physical exercise is an important non-pharmacological agent in the prevention and treatment of IR and consequently reducing the incidence of T2DM. Rho-kinase (Rock) has been postulated as an important protein that acts directly on the phosphorylation of IRS-1, collaborating up to 50% of glucose uptake in skeletal muscle tissue. Therefore, the aim of this study was evaluate whether the increase of glucose uptake by muscle tissue from old rats after physical exercise, also occurs due to Rock metabolism. **METHODS:** Wistar rats were distributed into 3 groups: Sedentary Young (SY): 5 months old and sedentary rats and two groups composed by aged rats (17 months old): Old Sedentary (Old) and Old Exercised (Old Exe). The Old Exe group was submitted to a single exercise session of swimming without overload, whose protocol was composed by two sessions of three hours of exercise with 45 min of rest between sessions. Four hours after exercise the animals were divided into 3 different lots of animals (each lot was composed by all groups with 7 animals per group). A lot was submitted to the insulin tolerance test, another submitted to the glucose tolerance test and a third lot was euthanized and used to collect samples from muscle tissue for further analysis of the insulin signaling pathway and Rock metabolism through immunoprecipitation and western blotting. **RESULTS:** As expected, aged rats developed insulin resistance. This finding was, in part, due to the increase of RhoE, molecule that inhibits Rock activity and decrease of RhoA, molecule that increases Rock activity, which culminated in a lower activity of Rock and consequently lower phosphorylation of IRS-1/Akt pathway and thus lower glucose uptake, which collaborated with insulin resistance. However, after exercise, old rats reversed the framework found on Rock metabolism, such as increased levels of RhoA and Rock and reduced levels of RhoE without alterations on adipose tissue volume. **CONCLUSION:** Physical exercise can contribute to glucose homeostasis through Rock metabolism on aged rats. Thus, these results reveal a new mechanism by which physical exercise collaborates on glucose uptake in skeletal muscle of aged animals without the use of insulin.

FAPESP (2013/21491-2)

2064 Board #216 June 2, 2:00 PM - 3:30 PM

**Protection Of Avenanthramides On TNF $\alpha$ -induced Muscle Cell Atrophy Via NF $\kappa$ B Inhibition**

Dongwook Yeo, Chounghun Kang, Li Li Ji, FACSM. Laboratory of Physiological Hygiene and Exercise Science, University of Minnesota Twin Cities, Minneapolis, MN.

Email: yeoxx039@umn.edu

(No relationships reported)

Chronic inflammation is a primary cause of muscle atrophy partly due to nuclear factor (NF) $\kappa$ B-mediated upregulation of pro-inflammatory cytokines such as TNF $\alpha$ , IL-6, and IL-1 $\beta$ . Avenanthramides (AVAs) have been shown to suppress inflammatory responses in several cells and in human, but their effects on muscle atrophy has never been studied.

**PURPOSE:** The purpose of this study was to investigate whether AVA treatments prevent TNF $\alpha$ -induced proteolysis and atrophy in skeletal muscle cells. **METHODS:** C2C12 cells were cultured in standard media at 37°C. AvaA, AvaB, and AvaC in 0.05%DMSO were administered when the cells reached 70% confluence. After 24 h, TNF $\alpha$  (10 ng/ml) was added and the cells were incubated for various times. **RESULTS:** TNF $\alpha$ -treated cells decreased I $\kappa$ B $\alpha$  content compare to Control indicating NF $\kappa$ B activation. P65 DNA binding was increased by 6.6-fold with TNF $\alpha$  ( $P < 0.01$ ); however, AVAs+TNF $\alpha$  cells showed 33% (AvaA,  $P < 0.01$ ), 18% (AvaB,  $P < 0.01$ ), and 19% (AvaC,  $P < 0.01$ ) less activation than TNF $\alpha$  alone.

IL-6 levels increased with TNF $\alpha$  ( $P < .001$ ) but were reduced by 24, 32 and 28% ( $P < .01$ ) with AVA-A, -B, and -C, respectively. IL-1 $\beta$  level was increased by 47% with TNF $\alpha$  ( $P < .01$ ), whereas this effect was abolished in AVAs+TNF $\alpha$  cells. TNF $\alpha$  increased reactive oxygen species (ROS) production by 1.3-fold ( $P < .01$ ) but ROS did not change in AVAs+TNF $\alpha$ . E3 ubiquitin ligase Atrogin-1 mRNA level increased 23% in TNF $\alpha$  vs. control ( $P < .05$ ). However, AVAs+TNF $\alpha$  decreased Atrogin-1 mRNA by 31, 41, and 47% ( $P < .01$ ), respectively vs. control, and by 47, 35 and 54% ( $P < .01$ ), respectively, vs. TNF $\alpha$  ( $P < .01$ ). A 44% ( $P < .01$ ) increase in MuRF-1 mRNA level was found in TNF $\alpha$  vs. Control whereas AVAs+TNF $\alpha$  showed no change. The cell viability was decreased in TNF $\alpha$  ( $P < .01$ ) but not in AVAs+TNF $\alpha$ .

**CONCLUSION:** AVAs reduced pro-inflammatory cytokine transactivation and ROS production, and improved survival rate due to inhibition of TNF $\alpha$ -induced NF $\kappa$ B activation in C2C12 cell.

2065 Board #217 June 2, 2:00 PM - 3:30 PM

### Effects of Repeated Exhaustive Exercise on mGluR5 Expression in the Rat Striate Nucleus

Meihua Su<sup>1</sup>, Duoduo Yang<sup>2</sup>, Zhaojing Chen<sup>3</sup>, Charity Cavazos<sup>3</sup>, Debra A. Bembem, FACSM<sup>3</sup>, Michael G. Bembem, FACSM<sup>3</sup>.  
<sup>1</sup>Minnan Normal University, Zhangzhou, China. <sup>2</sup>Guizhou University of Engineering Science, Guizhou, China. <sup>3</sup>University of Oklahoma, Norman, OK. (Sponsor: Michael G Bembem, FACSM)

(No relationships reported)

Glutamate is an important excitatory neurotransmitter in the central nervous system that has been related to central fatigue during exercise. Metabotropic glutamate receptors (mGluRs), which lead to metabolic changes within the cell by regulating intracellular second messengers when coupled with G protein, have drawn much attention in fields like neurology because of its effects on central fatigue without neurological side effects. **PURPOSE:** To investigate the changes of mGluR5 induced by repeated exhaustive exercise in the striate nucleus (subcortical part of the forebrain) of rats. **METHODS:** Eighteen healthy male Wistar rats aged 8 weeks and weighing 260  $\pm$  10 g, were randomly divided into 3 groups: control (CG, n=6), immediately post exhaustive exercise (0EG, n=6) and 24-hour recovery post exercise (24EG, n=6) groups. They were trained on an animal treadmill at 0% incline and three different speeds: 8.2m/min for 15 min, 15m/min for 15 min, and 20m/min until exhaustion, and this exercise protocol was repeated daily for 7 days. Rat brain slices were analyzed using immunohistochemistry techniques and 5 vision fields were randomly selected (200 $\times$ ) from the striatum portions of each slice were used for positive cell counts and Integrated option density (IOD) analysis by True Color Pathological Image-Pro Plus 6.0 image analysis system to observe the expression of mGluR5. **RESULTS:** Compared to the control group, the indicator of mGluR5 protein IOD (4220.0  $\pm$  348.3) and mGluR5 positive cells (8072.3  $\pm$  641.3) in rat striatum significantly increased for both 0EG (9100.0  $\pm$  580.3, 1701.3  $\pm$  131.8, respectively) and 24EG (7293.3  $\pm$  460.5, 1269.3  $\pm$  114.5, respectively) groups after exercise ( $p < .05$ ), and the increase in 0EG was significantly greater than for 24EG ( $p < .05$ ). **CONCLUSION:** Increases in mGluR5 protein content in the rat striatum following exercise may be due to the fact that rats are unable to adapt to the stress stimulus at the beginning of acute exercise and that repeated exhaustive exercise could result in upregulation of mGluR5 receptors. It is suggested that mGluR5 may play an important role during exercise induced central fatigue.

Supported by Science Foundation of Fujian Province, China, Grant No.2013J05055

2066 Board #218 June 2, 2:00 PM - 3:30 PM

### Effects Of Acute High-intensity Exercise In Normobaric Hypoxia And Hyperoxia On Thoroughbred Skeletal Muscle

Hirofumi MIYATA<sup>1</sup>, Kazuma OKABE<sup>1</sup>, Hiroshi NAGAHISA<sup>1</sup>, Kazutaka MUKAI<sup>2</sup>, Hajime OHMURA<sup>2</sup>, Toshiyuki TAKAHASHI<sup>2</sup>. <sup>1</sup>Yamaguchi Univ., Yamaguchi, Japan. <sup>2</sup>Japan Racing Association, Utsunomiya, Japan.  
Email: hiro@yamaguchi-u.ac.jp

(No relationships reported)

**PURPOSE:** The purpose of this study was to examine the effects of transient hypoxic and hyperoxia during high-intensity exercise on satellite cell activation and angiogenesis in Thoroughbred skeletal muscle.

**METHODS:** In the first experiment, six Thoroughbreds horses (6.3  $\pm$  0.8 years old) ran on a treadmill in normoxia (N1; FIO<sub>2</sub> = 21%) and hypoxia (Hpo; FIO<sub>2</sub> = 16%) at the same speed for the same duration. In the second experiment, the same horses ran in normoxia (N2; FIO<sub>2</sub> = 21%) and hyperoxia (Hpr; FIO<sub>2</sub> = 26%) at the same speed for the same duration. During these experiments, oxygen consumption and plasma lactate concentration were measured. In addition, biopsy samples were obtained from gluteus medius muscle before exercise and immediately, 4 and 24 hours, and 3 and 7 days after exercise, and immunohistochemical analysis and relative quantitative analysis of mRNA expression using real-time RT-PCR were performed.

**RESULTS:** In the first experiment, the oxygen consumption was 29% lower and the plasma lactate concentration was 47% higher during exercise in Hpo than in N1. The mRNA expressions related to satellite cell activation (IGF-1, HGF, Pax7, Myogenin) were higher, but the mRNA of factors related to angiogenesis (VEGF-A, PGC-1 $\alpha$ , Angiopoietin 1) were slightly lower in Hpo than in N1 at 3day after exercise. In contrast to the first experiment, the oxygen consumption was 20% higher and the plasma lactate concentration was 27% lower in Hpr than in N2 in the second experiment. The mRNA expressions of satellite cell activation-related factors remained unchanged, but the mRNA of factors related to angiogenesis (VEGF-A, PGC-1 $\alpha$ ) were slightly higher in Hpr than in N2 at 4 hours after exercise.

**CONCLUSIONS:** These results suggest that transient exposure to Hpo during high-intensity exercise in horses increases the contribution of the glycolytic energy supply and promotes satellite cell activation in muscle, in contrast, the exposure to Hpr during exercise increases reliance on aerobic energy supply and stimulates angiogenesis in muscle.

2067 Board #219 June 2, 2:00 PM - 3:30 PM

### Physical Inactivity-induced Histone Modification In The Rat Soleus Muscle

Toshinori Yoshihara<sup>1</sup>, Ryo Kakigi<sup>2</sup>, Takamasa Tsuzuki<sup>1</sup>, Chang Shuo-wen<sup>1</sup>, Toshiharu Natsume<sup>1</sup>, Yuri Takamine<sup>1</sup>, Noriko Ichinoseki-Sekine<sup>3</sup>, Shuichi Machida<sup>1</sup>, Takao Sugiura<sup>4</sup>, Hisashi Naito<sup>1</sup>. <sup>1</sup>Graduate School of Health and Sports Science, Juntendo University, Inzai, Japan. <sup>2</sup>Faculty of Medicine, Juntendo University, Bunkyo-ku, Japan. <sup>3</sup>Faculty of Liberal Arts, The Open University of Japan, Chiba, Japan. <sup>4</sup>Faculty of Education, Yamaguchi University, Yamaguchi, Japan.

Email: t-yoshih@juntendo.ac.jp

(No relationships reported)

Recently, we reported that limb-immobilization-induced muscle atrophy enhances trimethylation of lysine residues 9 and 27 of histone H3, a signal for transcriptional silencing, and this is controlled by epigenetic regulation via histone deacetylase 4. However, the effects of physical inactivity on histone modification remain unclear.

**PURPOSE:** This study examined the effect of physical inactivity on histone modification in the rat soleus muscle.

**METHODS:** Twenty-two 3-week-old male Wistar rats were randomly assigned into control (CT, n = 6), physical inactivity (IN, n = 8), and regular exercise training (TR, n = 8) groups. Rats in the IN group were housed in a small cage with half of the usual floor space to limit their range of movement. Rats in the TR group were exposed to treadmill exercise 5 days per week for 8 weeks. After the experiment, the soleus muscles were removed and global levels of histone modification were determined by Western blot analysis.

**RESULTS:** The relative muscle weight of the soleus muscle was decreased significantly in the IN group compared with the CT and TR groups. There were no significant differences in the acetylation of histone H3 among groups. However, trimethylation of lysine residue 9 was significantly higher in the IN group than in the CT group, while that in the TR group was significantly lower than in the IN group.

**CONCLUSIONS:** Physical inactivity increases trimethylation of lysine residue 9 of histone H3 in the rat soleus muscle, whereas regular physical exercise has the opposite effect.

2068 Board #220 June 2, 2:00 PM - 3:30 PM

### Human Skeletal Muscle Mitochondrial Related mRNA Response to Exercise in the Cold

Robert Shute, Matthew Heesch, Taylor La Salle, Matthew Bubak, Terence Laursen, Nicholas Dinan, Dustin Slivka, FACSM. University of Nebraska at Omaha, Omaha, NE.  
(Sponsor: Dustin Slivka, FACSM)

(No relationships reported)

Endurance exercise in the cold with recovery in the cold has been shown to affect the expression of select genes to a greater extent than room temperature endurance exercise and recovery. However, it is not known whether the recovery period in the cold is a critical component to this response.

**PURPOSE:** To determine mitochondrial related gene expression response to exercise in a cold compared to room temperature environment.

**METHODS:** Recreationally trained males (n = 11, age: 24  $\pm$  1 y, height: 178  $\pm$  1 cm, weight: 80.3  $\pm$  3.7 kg, %BF: 14.6  $\pm$  1.0%, VO<sub>2peak</sub>: 4.34  $\pm$  0.24 L  $\cdot$  min<sup>-1</sup>) completed two trials consisting of cycling in a cold (C) or room temperature (RT) environment (7  $^{\circ}$ C and 20  $^{\circ}$ C, respectively) for 1 h at 60% of W<sub>max</sub> followed by 3 h of supine recovery at room temperature. Muscle biopsies were taken from the vastus lateralis pre-exercise and three h post-exercise for gene expression analysis. Heart rate (HR) and expired gasses were also measured throughout the trials.

**RESULTS:** Exercise VO<sub>2</sub> was lower in C than RT (2.70  $\pm$  0.11, 2.84  $\pm$  0.11 L  $\cdot$  min<sup>-1</sup>, respectively, p = 0.003). HR was similar during exercise and recovery between C and RT (Exercise: 153  $\pm$  2 and 156  $\pm$  3 bpm, respectively, p = 0.284; Recovery: 74  $\pm$  3 and

76 ± 3 bpm, respectively,  $p = 0.370$ ). Environmental temperature ( $p = 0.397$ ) and VO2 ( $p = 0.729$ ) were not different during recovery. PGC-1 $\alpha$  and VEGF increased with exercise ( $p < 0.001$ ,  $p < 0.001$ , respectively) but were not different between trials ( $p = 0.643$  and  $p = 0.428$ , respectively). ER $\alpha$  increased with exercise in RT ( $p = 0.011$ ) and decreased with exercise in C ( $p = 0.018$ ). Additionally, ER $\alpha$  was lower in C than RT at 3 h post exercise ( $p = 0.003$ ). MEF2A and NRF2 did not change with exercise ( $p = 0.470$ ,  $p = 0.431$ , respectively) but were lower in C than RT at 3 h post exercise ( $p = 0.037$ ,  $p = 0.034$ , respectively). NRF1 and TFAM did not change with exercise ( $p = 0.156$ ,  $p = 0.324$ , respectively) nor were they different between C and RT at 3 h post exercise ( $p = 0.231$ ,  $p = 0.994$ , respectively).

**CONCLUSIONS:** Despite no difference in PGC-1 $\alpha$  mRNA there was a blunted mRNA response of genes downstream of PGC-1 $\alpha$  with exercise in a cold environment compared to exercise in a room temperature environment.

Funded by Graduate Research and Creative Activity from UNO and NE-INBRE Developmental Research Program Project, National Institute for General Medicine Science (8P20GM103427).

2069 Board #221 June 2, 2:00 PM - 3:30 PM

### Differential Expression Of Pgc1 $\alpha$ 4 During Skeletal Muscle Regeneration And Myogenic Differentiation

Nicholas P. Greene, Jacob L. Brown, Megan E. Rosa, David E. Lee, Lemuel A. Brown, Richard A. Perry, Jr, Tyrone A. Washington. *University of Arkansas, Fayetteville, AR.* (Sponsor: Stephen F. Crouse, FACSM)  
Email: npgreene@uark.edu  
(No relationships reported)

Skeletal muscle regeneration is a vital process to maintain physical function and adapt to exercise, characterized by alterations in multiple processes including inflammation, satellite cell proliferation and cell cycle alterations, and protein synthesis. The PGC-1 $\alpha$  isoform, PGC-1 $\alpha$ 4 promotes muscle growth via IGF-1 and myostatin. However, whether PGC-1 $\alpha$ 4 plays a role in muscle regeneration following injury and by extension during myogenic differentiation, as occurs in satellite cell proliferation, is unknown. **PURPOSE:** To determine alterations in Pgc1 $\alpha$ 4 mRNA content during muscle regeneration and myogenic differentiation. **METHODS:** C57BL/6J mice were submitted to muscle damage by intramuscular injection of the myotoxin bupivacaine (BUPI) or PBS (control) to the tibialis anterior (TA) muscle. Mice from BUPI and PBS groups were humanely euthanized and TAs collected at 3, 5, and 28d post-injection. To examine Pgc1 $\alpha$ 4 mRNA content during myogenic differentiation C2C12 myoblasts were differentiated beginning at confluence and collected at 1d prior to confluence, and 0, 1, 2, 3, 4, 5d of differentiation. TAs and C2C12 cells were analyzed for Pgc1 $\alpha$ 4 mRNA by real time RT-PCR. For animal studies data were analyzed by t-test within each timepoint to compare PBS and BUPI groups. For cell culture, data were analyzed across time by one-way ANOVA,  $\alpha$  was set at 0.05 for all experiments. **RESULTS:** Following muscle injury: 3d post injury Pgc1 $\alpha$ 4 mRNA content was 70% lower in BUPI compared to PBS control, >2-fold elevated at 5d in BUPI compared to PBS control, while 65% greater Pgc1 $\alpha$ 4 mRNA content at 28d in BUPI compared to PBS was not significant ( $P=0.09$ ). During differentiation Pgc1 $\alpha$ 4 mRNA peaked at 3d at ~11-fold greater than 0d and was significantly elevated over all other timepoints except 4d. Muscle differentiation factor myogenin peaked in content at 2d differentiation (535 fold, elevated at all points after 0d) while Igf1 peaked at 4d (2.15 fold). **CONCLUSION:** During muscle regeneration Pgc1 $\alpha$ 4 mRNA is repressed during phases associated with elevated inflammation (3d) and is elevated at timepoints associated with muscle growth (5d). These data are concomitant with expression changes during myogenic differentiation and suggest a potentially significant role of PGC-1 $\alpha$ 4 in muscle regeneration and differentiation.

2070 Board #222 June 2, 2:00 PM - 3:30 PM

### Myocellular Endoplasmic Reticulum Stress Is Increased By Autophagy Inhibition And Decreased By Exercise

Adrienne R. Herrenbruck, Bradley S. Fleenor, Lance M. Bollinger. *University of Kentucky, Lexington, KY.*  
Email: adrienne.herrenbruck@uky.edu  
(No relationships reported)

Skeletal muscle endoplasmic reticulum (ER) stress is a major cause of obesity-induced insulin resistance. Autophagy, the degradation mechanism that clears damaged cellular organelles including ER, is decreased in skeletal muscle cells of severely obese women. However, it is unknown if impaired autophagy contributes to ER stress in obesity. Purpose: To determine the effects of autophagy inhibition and muscle activity on ER stress in skeletal muscle cells. Methods: C57BL/6J mice ( $n = 7$ ) were fed a high fat diet (HFD) for 16 wk, soleus and tibialis anterior (TA) muscles collected, and LC3 activation measured by western blot. C2C12 myotubes were treated with an autophagy inhibitor (ConcA) for 24 h and assessed for changes in ER morphology and gene expression (RT-PCR) of the ER stress mediators ATF4, spliced XBP1 (sXBP1), GRP94, and GRP78. Autophagy flux (3H-tyrosine release) and expression of major

ER stress genes (RT-PCR) were measured following 30 minutes of myocellular cyclic stretch, an in vitro model of resistance exercise. Results: LC3 activation was unchanged in soleus, but significantly reduced (0.64 fold) in TA from HFD mice, which is consistent with decreased autophagy in this muscle. Autophagy inhibition induced morphological changes in ER structure and significantly increased gene expression of sXBP1 (5.21 fold), GRP94 (1.62 fold), and GRP78 (1.62 fold), but not ATF4 in C2C12 myotubes. Acute cyclic stretch significantly increased autophagy flux (1.34 fold) and gene expression of unspliced XBP1 (1.34 fold,  $p=0.051$ ), indicating a shift away from sXBP1, which is consistent with decreased ER stress. Gene expression of sXBP1, GRP94, GRP78, and ATF4 was unchanged following cyclic stretch. Conclusions: Diet-induced obesity decreases autophagy flux in a muscle-specific manner. Impaired autophagy may contribute to obesity-induced ER stress. Exercise may relieve ER stress, in part, by increasing autophagy.

2071 Board #223 June 2, 2:00 PM - 3:30 PM

### Effect Of Acute Alcohol Ingestion On Resistance Exercise-Induced Muscle MTORC1 Signaling In Women.

Hasina M. Aziz, Anthony A. Duplanty, David W. Hill, Brian K. McFarlin, FACSM, Hui Y. Luk, Levitt E. Danielle, Ronald G. Budnar, Jr., Duane B. Huggett, Jakob L. Vingren, FACSM, Daniel L. Fancher. *University of North Texas, Denton, TX.* (Sponsor: Dr. Jakob Vingren, FACSM)  
Email: MashaAziz@my.unt.edu  
(No relationships reported)

**PURPOSE:** To investigate the effect of consuming alcohol after heavy resistance exercise (RE) on mTORC1 signaling in women. **METHODS:** Nine resistance-trained women (mean ± SD: 22.4 ± 1.7 yr, 60.1 ± 6.0 kg, 161 ± 4 cm, 26.8 ± 2.9 % body fat) completed two identical acute heavy smith machine squat (6 sets of 10 repetitions at 80% of 1-repetition maximum) trials followed by ingestion of either an alcoholic beverage (ALC; 1.09 g ethanol/kg lean mass<sup>-1</sup>, diluted to 15% v/v) or an isovolumetric placebo beverage (PLA). A within-subjects, randomized, counterbalanced, crossover, design was employed. Prior to exercise (PRE) and three (+3h) and five (+5h) hours post-exercise, muscle tissue samples were obtained from the vastus lateralis by microbiopsy. Muscle samples were analyzed for phosphorylated mTOR, S6K1, and 4E-BP1 using Western blotting. **RESULTS:** A significant main effect ( $p < 0.05$ ) for time was found for mTOR phosphorylation; mTOR phosphorylation was higher at +3h (ALC: 0.102 ± 0.014 AU; PLA: 0.085 ± 0.009 AU) than at PRE (ALC: 0.111 ± 0.021 AU; PLA: 0.112 ± 0.010 AU) and at +5h (ALC: 0.097 ± 0.016; PLA: 0.088 ± 0.007 AU). A trend ( $p = 0.052$ ) for time was found for S6K1 phosphorylation suggesting greater phosphorylation at +3h compared to Pre and +5h. No significant differences between conditions or over time were found for 4E-BP1 phosphorylation. **CONCLUSIONS:** The major finding of this study was that post-exercise alcohol ingestion did not affect phosphorylation of the mTORC1 signaling pathway following RE in women.

2072 Board #224 June 2, 2:00 PM - 3:30 PM

### Isolation and Characterization of Pericytes from Murine Skeletal Muscle

Katherine E. LaBarbera, Sarah Witkowski. *University of Massachusetts Amherst, Amherst, MA.* (Sponsor: Jane A. Kent, FACSM)  
(No relationships reported)

Pericytes are multipotent stem cells located in the perivascular space throughout the microvasculature. Their ability to differentiate into mesodermal cell types and modulate the local tissue environment through paracrine signaling makes pericytes a novel therapeutic target, but their prospective isolation and identification preclude their widespread use in therapeutic research. **PURPOSE:** To use novel flow cytometry methods to isolate and characterize pericytes from murine skeletal muscle. **METHODS:** Gastrocnemius and soleus complexes were dissected from CD1 mice, aged 3 months. Muscles were digested using collagenase into a single cell suspension. Cells were filtered through 70  $\mu$ m and 40  $\mu$ m mesh then resuspended in staining medium. Cells were stained at 4°C for 20 minutes with the following antibodies: CD45-BB515 (1:400), CD34-BV421 (1:100), CD56-PE (1:100) and CD146-Alexa647 (1:100). Fluorescence activated cell sorting (FACS) was used to sort CD45-CD56-CD34-CD146+ pericytes using appropriate unstained, single stained, and fluorescence minus one controls. P0 cells were plated on 0.2% gelatin coated plates in EB2 complete medium. At 70% confluence, P0 cells were split 1:1 on polystyrene tissue culture plates, and split 1:2 thereafter. Flow cytometry was used to determine the expression of pericyte markers (NG2 and PDGFR $\beta$ ), mesenchymal cell markers (CD73, CD90, and CD105), endothelial (CD31) and hematopoietic cells (CD45) markers on P5 cells. Characterization data were analyzed for the percentage of positive cells and median fluorescent intensity relative to unstained control (nMFI). **RESULTS:** Pericytes were positive for the pericyte marker CD146 (15.5%, nMFI 102.4), weakly positive for PDGFR $\beta$  (10.8%, nMFI 7.5), and weakly positive for NG2 (7.0%, nMFI

6.9). Cultured pericytes were positive for mesenchymal stem cell markers CD73 (52.9%, nMFI 56.9), and CD105 (35.3%, nMFI 9.5), but negative for CD90 (4.9%, nMFI 6.3). Pericytes were negative for the endothelial marker CD31 (2.1%, nMFI 4.4) and hematopoietic marker CD45 (5.4%, nMFI 7.9). **CONCLUSIONS:** FACS sorting for CD45-CD56-CD34-CD146+ cells yields murine pericytes that can be reliably isolated, definitively characterized, and may be suitable for in vivo and in vitro experiments to test the efficacy of pericyte cell therapy for various diseases.

2073 Board #225 June 2, 2:00 PM - 3:30 PM

### Role Of Metalloproteases In Shedding Of Dipeptidyl-peptidase Iv From Skeletal Muscle Cells

Leslie E. Neidert, C. Brooks Mobley, Michael D. Roberts, Heidi A. Kluess, FACS. *Auburn University, Auburn, AL.* (Sponsor: Heidi A Kluess, FACS)  
Email: len0009@auburn.edu  
(No relationships reported)

Dipeptidyl- Peptidase IV (DPP-IV) is a membrane bound myokine that is involved in converting the powerful vasoconstrictor, neuropeptide Y, into the non-vasoconstricting form. Previous work in this lab suggested that DPP-IV is released from myocyte cell cultures, when a whey protein solution is applied, but not when leucine is applied. A possible mechanism is a process called shedding that occurs via the metalloproteases MMP2 and MMP9. These MMP's are known to mediate the shedding of DPP-IV from adipocytes and smooth muscle cells and exist in commercially available whey protein, but not in leucine products.

**Purpose:** To determine if the shedding of DPP-IV from skeletal muscle cells is mediated by metalloproteases. We hypothesized that when MMP2 and MMP9 were inhibited (i), the amount DPP-IV released in the presence of whey protein would be decreased.

**Methods:** C2C12 cells underwent 4-5 days of differentiation. They were treated for 6 hours with one of the following: leucine (Leu) or whey protein (WP), LEU+MMP2i, Leu+MMP9i, Leu+complete protease inhibitor (CP), WP+MMP2i, WP+MMP9i, or WP+CP. Control plates were also run with one of the following: MMP2i, MMP9i, CP, or dimethyl sulfoxide (DMSO-vehicle for inhibitors). The media was collected for DPP-IV activity measurements, which were measured using a fluorometric assay.

**Results:** The DPP-IV activity of the control cells treated with only the inhibitors and vehicle, as well as Leu+MMP2i and Leu+MMP9i were not significantly different from Leu. Only Leu+CP had a significant decrease in DPP-IV activity from Leu (22.5% decrease;  $p=0.01$ ). DPP-IV activity of the DMSO group was significantly increased from WP (35.4% increase;  $p<0.001$ ); however when the inhibitors were added, this increase was no longer significant. When whey protein was given with the inhibitors, DPP-IV activity significantly decreased for all 3 groups from WP (WP+MMP2i: 32.3% decrease; WP+MMP9i: 40.6% decrease, and WP+CP: 51.0% decrease; all  $p<0.0001$ )

**Conclusion:** The shedding of DPP-IV from skeletal muscle cells is mediated by metalloproteases 2 and 9, which are present in whey protein. This is a possible mechanism by which milk products may affect neuropeptide Y-mediated blood flow.

2074 Board #226 June 2, 2:00 PM - 3:30 PM

### Transcriptional, But Not Post-translational Control Of Pgc-1 $\alpha$ Is Altered Following Exercise In A Hot Environment

Matthew Bubak, Matthew Heesch, Robert Shute, Dustin Slivka, FACS. *University of Nebraska at Omaha, Omaha, NE.* (Sponsor: Dr. Dustin Slivka, FACS)  
(No relationships reported)

Previous work has reported a reduced mRNA response related to mitochondrial biogenesis after exercise and subsequent recovery in the heat compared to room temperature conditions. However, the continued heat exposure after exercise may have contributed to the observed heat induced mRNA repression. **Purpose:** To determine mitochondrial biogenesis-related gene expression and sub-cellular location of PGC-1 $\alpha$  protein in human skeletal muscle following exercise in a hot environment as compared to a room temperature environment. **Methods:** Recreationally trained males ( $n=11$ , age:  $24 \pm 3$  y, height:  $178 \pm 5$  cm, weight:  $80.3 \pm 12.8$  kg, %BF:  $14.6 \pm 3.6\%$ , VO<sub>2</sub> peak:  $4.34 \pm 0.84$  L · min<sup>-1</sup>) completed two trials in a temperature and humidity controlled environmental chamber. The trials consisted of cycling in either a hot (H) or room temperature (RT) environment ( $33^\circ\text{C}$  and  $20^\circ\text{C}$ , respectively) for one hour at 60% of W<sub>max</sub> followed by 3 h of supine recovery at room temperature. Muscle biopsies were taken from the vastus lateralis pre-, post-, and 3 h post-exercise for analysis of mRNA expression and PGC-1 $\alpha$  protein subcellular location. **Results:** PGC-1 $\alpha$ , ERR $\alpha$ , and VEGF mRNA increased following exercise in RT ( $p=0.002$ ,  $p=0.011$ , and  $p<0.001$ , respectively). PGC-1 $\alpha$  and VEGF mRNA also increased following exercise in H, but to a lesser degree than in RT ( $p=0.037$  and  $p=0.008$ , respectively). ERR $\alpha$  did not increase after exercise in H and was lower following H than RT ( $p=0.007$ ). NRF-1 was unchanged following exercise in RT, but was down-regulated following exercise in H ( $p=0.002$ ). GABPA, and SIRT-1 mRNA were all lower following H than RT ( $p=0.046$  and  $p=0.021$ , respectively). PPAR $\gamma$  and

TFAM mRNA were unaffected by exercise in either H or RT. Nuclear PGC-1 $\alpha$  protein increased following exercise in both H and RT ( $p=0.029$ ), but was not different between trials. **Conclusion:** These data indicate that exercise in a hot environment blunts expression of mitochondrial biogenesis-related mRNA as compared to exercise in a room temperature environment, despite similar increases in nuclear PGC-1 $\alpha$  translocation.

Supported by the Graduate Research and Creative Activity (GRACA) grant from the University of Nebraska Omaha and NE-INBRE Developmental Research Program Project (DRPP), National Institute for General Medicine Science (8P20GM103427).

2075 Board #227 June 2, 2:00 PM - 3:30 PM

### Resistance Exercise-induced mTORC1-signal Activation Is Not Impaired in Skeletal-muscle of STZ-induced Type 1 Diabetic Rats

Kohei Kido<sup>1</sup>, Satoru Ato<sup>1</sup>, Takumi Yokokawa<sup>2</sup>, Tatsuki Miyake<sup>1</sup>, Koji Sato<sup>3</sup>, Satoshi Fujita<sup>1</sup>. <sup>1</sup>Ritsumeikan university, Shiga, Japan. <sup>2</sup>Kyoto university, Kyoto, Japan. <sup>3</sup>Kobe university, Hyogo, Japan.

Email: sh0006vk@ed.ritsumeik.ac.jp

(No relationships reported)

Type 1 diabetes (T1DM) is characterized with a decreased protein synthesis and increased protein degradation, leading to skeletal muscle atrophy. It is well known that PI3K-Akt-mTOR is major signal pathway for the skeletal muscle protein synthesis, but its activity is attenuated in T1DM due to reduced plasma levels of insulin. On the contrary, acute resistance exercise (RE) augments protein synthesis through mTORC1 signal in both healthy and type 2 diabetic individuals. However, there is no previous study, which investigated the effect of acute RE on mTORC1 signal regulation in T1DM.

#### PURPOSE:

To investigate the effect of an acute bout of RE on mTORC1 signaling pathways in the skeletal muscle of streptozotocin (STZ)-induced type 1 diabetic rats.

#### METHODS:

The male SD rats aged 10-week were divided into two groups, STZ or control (CON). The T1DM was induced by a single injection of streptozotocin (55mg/kg) in STZ group, and plasma glucose greater than 19.4mmol/L was confirmed 3days after the injection. On the 4th day, the right gastrocnemius muscle of STZ and CON rats was isometrically exercised (RE) via percutaneous electrical stimulation. Rats were sacrificed 0, 1 or 3 h after RE. The phosphorylation status of Akt (Thr308 and Ser473), p70S6K (Thr389) and rpS6 (Ser240/244) were assessed with gastrocnemius muscle using western blotting.

#### RESULTS:

The p-Akt (Thr308 and Ser473) were significantly increased immediately after RE in both STZ and CON. Although p-Akt (Thr308) was still significantly elevated at 1 h after RE, p-Akt (Ser473) was returned to baseline level in both groups. However, there was no significant difference of p-Akt (Thr308 and Ser473) after RE between two groups, despite p-Akt (Ser473) at baseline level was significantly lower in STZ than CON. Additionally, STZ and CON showed significant phosphorylation of p70S6K and rpS6 immediately after RE, and it remained significant until 3h after RE. However, there was no significant difference in p-p70S6K and p-rpS6 after RE between two groups, even though the baseline level of p-rpS6 was significantly lower in STZ than CON.

#### CONCLUSIONS:

Acute resistance exercise induced mTORC1 signal activation is not impaired in STZ induced diabetic rats, despite basal phosphorylation of Akt and rpS6 were reduced by streptozotocin-induced hyperglycemia and hypoinsulinemia.

2076 Board #228 June 2, 2:00 PM - 3:30 PM

### Anti-inflammatory Effect Of Avenanthramides Via Nf- $\kappa$ B Pathways In C2c12 Skeletal Muscle Cells.

Choung-Hun Kang<sup>1</sup>, Woo Shik Shin<sup>1</sup>, Dongwook Yeo<sup>1</sup>, Wonchung Lim<sup>2</sup>, Li Li Ji, FACS. <sup>1</sup>University of Minnesota at twin cities, Minneapolis, MN. <sup>2</sup>Cheongju University, Cheongju, Korea, Republic of. (Sponsor: Li Li Ji, FACS)

(No relationships reported)

Suppression or abnormalities of skeletal muscle function caused by disuse, aging and certain diseases are associated with increased oxidative stress and inflammatory response. Avenanthramides (Avns), the polyphenol compounds only found in oats, exhibit anti-inflammatory effects by inhibiting NF $\kappa$ B activation in select cell lines. However, the molecular mechanism by which Avns reduces inflammation in skeletal muscle cell is still unclear.

**PURPOSE:** The purpose of this study was to investigate (1) whether Avns suppress inflammatory responses in skeletal muscle cells; and (2) the molecular mechanism by which Avns can inhibit NF $\kappa$ B activation.

**METHODS:** C2C12 mouse skeletal muscle cell lines were treated with 200 $\mu$ M tert-Butyl hydroperoxide (tBHP) for 6h with or without three different forms of

Avns (AvnA, AvnB and AvnC). Interactions between Avns and IκB kinase (IKKβ) were tested by protein-ligand docking and protein kinase assay. NFκB-mediated inflammatory pathways were evaluated.

**RESULTS:** The docking score correlated with IKKβ *in vitro* activity suggesting Avns are synergistic bioinhibitors for IKKβ pathway. Avns reduced the kinase activity in response to tBHP treatment. TNF-α and IL-1β mRNA levels were increased by 6.2- and 13-fold ( $P < 0.01$ ), respectively, with tBHP compared to control, but these levels were reduced by approximately 2-fold with Avns ( $P < 0.01$ ). IκB protein degradation and NFκB luciferase assay, used as a marker of NFκB activation, showed that Avns suppressed tBHP-induced NFκB activation (all  $P < 0.01$ ). Cyclooxygenase-2 (COX-2) protein expression was increased with tBHP, along with a 3.1-fold increase in COX-2 luciferase activity ( $P < 0.01$ ), but these markers were reduced by ~2-fold with Avns ( $P < 0.01$ ). Prostaglandin E2 (PGE2) level was increased 3.7-fold with tBHP treatment ( $P < 0.01$ ), but was decreased by 59, 54 and 62% ( $P < 0.01$ ), respectively, with AvnA, B, and C.

**CONCLUSIONS:** Avns are potent inhibitors of NFκB-mediated inflammatory response due to the downregulation of IKKβ activity in C2C12 cells.

2077 Board #229 June 2, 2:00 PM - 3:30 PM

### CAMK in Skeletal Muscle Stimulated by Caffeine to Promote Endurance Adaptation

Dagoberto Pina Jr, Keith Baar. *University of California, Davis, Davis, CA.* (Sponsor: Keith Baar, FACSM)  
Email: dpinajr@ucdavis.edu  
(No relationships reported)

#### CAMK in Skeletal Muscle Stimulated by Caffeine to Promote Endurance Adaptation

CAMKII is a kinase protein that forms an oligomer of 6 proteins that is highly seen in the muscle and brain. It can be activated by increasing the levels of  $Ca^{2+}$  within the skeletal muscle to promote the synthesis of PGC1-α mRNA to induce mitochondrial biogenesis.

**Purpose:** To determine if caffeine can cause a shift in  $Ca^{2+}$  levels in skeletal muscle to stimulate CAMKII to promote mitochondrial biogenesis. **Methods:** Mice were administered different amounts of caffeine, later tissue samples were collected to analyze and quantify levels of mitochondrial protein. Western Blots and qPCR analysis were used to determine changes in protein levels from control groups to the stimulated groups. Antibodies were used to determine the concentration of the proteins in question. These included p-CAMKII because CAMK activity is determined by measuring autophosphorylation, COX5 and 5.4, HAD, LCAD, MCAD, VLCAD, Cytochrome-C, CD36, CPT-1, GLUT4, Citrate Synthase, and PGC1-α. **Results:** Our current findings suggest that as the caffeine dosage increases the levels of mitochondria biogenesis inducing proteins increases and so do mitochondrial proteins, suggesting that there are more mitochondria being made. At the moment we are unable to compare the findings to our control groups because we have yet to receive the key with respect to our control group's protein levels from our sample provider. But with the preliminary data we have we suspect that higher dosages of caffeine induce mitochondrial biogenesis. **Conclusion:** At the moment we do not have sufficient data to make a conclusion but if the trend we are observing continues this may prove revolutionary to the way that endurance athletes train and what we will consider fast times in the future.

2078 Board #230 June 2, 2:00 PM - 3:30 PM

### Diet-induced Obesity and Matrix Metalloproteinase Gene Expression at the Onset of Skeletal Muscle Regeneration

Michelle A. Tedrowe, Lemuel A. Brown, Richard A. Perry, Jr., Megan E. Rosa, Jacob L. Brown, David E. Lee, Nicholas P. Greene, Tyrone A. Washington. *University of Arkansas, Fayetteville, AR.*  
Email: matedrow@email.uark.edu  
(No relationships reported)

Obesity negatively affects skeletal muscle's regenerative capacity. Skeletal muscle regeneration includes inflammation, ECM remodeling, and myofiber growth. Disruption to any of these processes negatively affects skeletal muscle regeneration. The extracellular matrix (ECM) acts as a scaffold for skeletal muscle and serves as a reservoir for proteins and growth factors that promote regeneration. Matrix metalloproteinases (MMPs) are zinc-dependent endopeptidases that degrade collagen fibrils within the ECM. MMP-2 and 9 are the most abundant in skeletal muscle.

**PURPOSE:** To determine if obesity alters MMP gene expression at the onset of skeletal muscle regeneration. **METHODS:** Twenty male C57BL/6J mice were randomly assigned to either a lean diet group (10% fat) or high fat diet (HFD) (60% fat) group. Within those two groups, mice were randomly assigned to either a PBS (uninjured) or a bupivacaine (injured) group. Bupivacaine is a myotoxin which induces injury to skeletal muscle. Bupivacaine or PBS was injected into the tibialis anterior (TA). Three days post-injection the TAs were extracted and quantitative PCR was

done to determine MMP-2 and 9 gene expression. **RESULTS:** There was a decrease in TA muscle mass to body weight ratio in the lean group ( $1.8 \pm 0.06$  mg/g vs.  $1.6 \pm 0.05$  mg/g,  $p < 0.05$ ) and the HFD group ( $1.5 \pm 0.1$  mg/g, vs.  $1.4 \pm 0.1$  mg/g  $p < 0.05$ ) 3 days post-injection. There was a 70% reduction in the collagen-III:I ratio in the lean injured group compared to the lean uninjured group ( $p < 0.05$ ) 3 days post-injection. However, there was a 4.5-fold increase in the collagen III:I ratio in the HFD injured group compared to the HFD uninjured group ( $p < 0.05$ ) 3 days post-injection. Obesity alone did not affect MMP-2 or 9 gene expression. There was no difference in MMP-2 gene expression ( $p > 0.05$ ) 3 days post-injection. There was a main effect of injury to increase MMP-9 ( $p < 0.05$ ) gene expression 3 day post-injection regardless of diet.

**CONCLUSION:** Collagen III:I ratio differed between lean and obese at the onset of regeneration. It does not appear that MMPs 2 and 9 are responsible for this change. Future studies can include examining other MMPs and regulators of MMPs as well as later time points during the regeneration process.

This work was supported by a grant from the American Biosciences Institute.

2079 Board #231 June 2, 2:00 PM - 3:30 PM

### Dose-Dependent Effects of Whey Peptide Intake on mTOR Signaling in Human Skeletal Muscle

Ryo Kakigi<sup>1</sup>, Toshinori Yoshihara<sup>1</sup>, Toshiharu Natsume<sup>1</sup>, Noriko Ichinoseki-Sekine<sup>2</sup>, Hiroyuki Kobayashi<sup>3</sup>, Shuichi Machida<sup>1</sup>, Hisashi Naito<sup>1</sup>. <sup>1</sup>*Juntendo University, Tokyo, Japan.* <sup>2</sup>*The Open University of Japan, Chiba, Japan.* <sup>3</sup>*Mito Medical Center, Ibaraki, Japan.*

(No relationships reported)

Whey protein/peptide is often taken in after resistance exercise to enhance the muscle hypertrophy since it has benefits for the skeletal muscle protein synthesis. Recently, we found that whey peptide intake after resistance exercise activates intracellular signaling involved in protein synthesis in a dose-dependent manner in human skeletal muscle. However, the effects of whey peptide alone on the signaling in human skeletal muscle remains unclear. **PURPOSE:** To determine the effects of whey peptide intake on the phosphorylation status of mammalian target of rapamycin (mTOR) signaling in human skeletal muscle. **METHODS:** Healthy young men ( $n=5$ , weight= $64.5 \pm 4.1$  kg) and women ( $n=5$ , weight= $52.7 \pm 4.7$  kg) participated in this study. At 12-hours fasting, subjects were in resting supine position for 30 minutes. After resting, muscle biopsies (~15 mg) were obtained from the vastus lateralis, and blood samples were collected. Then, subjects took an equal amount of whey peptide solution (20g/200 mL water). One hour after intake of whey peptide, muscle and blood samples were collected. Muscle samples were used to determine the phosphorylation status of mTOR (Ser2448) and S6K1 (Thr389) by using Western blot analysis. Blood insulin and essential amino acid concentration were measured at commercially available laboratories. **RESULTS:** Whey peptide intake significantly increased the concentration of serum insulin in women ( $p < 0.05$ ), whereas it did not change in men. Plasma essential and branched-amino acids concentrations significantly increased after whey peptides intake in both men and women ( $p < 0.05$ ). At resting, there were no differences in the phosphorylation of mTOR and S6K1 between men and women. After intake of whey peptide, the phosphorylation of mTOR and S6K1 significantly increased in both muscles of men and women compared with those of resting levels ( $p < 0.05$ ), and the increase in S6K1 phosphorylation in women was significantly higher than that in men ( $p < 0.05$ ). The phosphorylation of S6K1 after whey peptide intake was significantly correlated with doses of whey peptide per body weight (g/kg) ( $r^2=0.7128$ ,  $p < 0.05$ ). **CONCLUSIONS:** Our results suggested that whey peptide intake activates mTOR signaling in dose-dependent manner in human skeletal muscle.

### D-37 Free Communication/Poster - Occupational/Firefighting Physiology

Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
Room: Exhibit Hall A/B

2080 Board #232 June 2, 2:00 PM - 3:30 PM

### Lower Body Strength-based Fatigue Responses Of A Typically Demanding, Multi-shift Work Period In Female Nurses.

Brennan J. Thompson<sup>1</sup>, Victoria K. Banuelas<sup>2</sup>, Matt S. Stock<sup>2</sup>. <sup>1</sup>*Utah State University, Logan, UT.* <sup>2</sup>*Texas Tech University, Lubbock, TX.*  
Email: brennan.thompson@usu.edu  
(No relationships reported)

Nurses sustain among the highest nonfatal injury rates of any profession, likely attributed to demanding work schedules. Previous authors have noted that work-induced fatigue may be a predominant factor for musculoskeletal injury from

demanding nursing work. However, the effects of long, successive work shifts have not been evaluated on lower body fatigue responses in nurses using functionally sensitive markers of fatigue, such as maximal and explosive muscular force production capacities. **PURPOSE:** To determine the effects of long, cumulative nursing work shifts on fatigue-related lower body strength responses in nurses. **METHODS:** Thirty-nine (age=32.25±10 yr) female nurses working as fulltime RNs, LVNs, and CNAs were recruited from hospitals. Nurses were familiarized on all strength assessments (on a separate day) and then performed the strength tests on the day before, and the day following (±24 hours) a demanding multi-shift work period. Specifically, nurses worked three 12 hour shifts over a four day period. Participants performed three maximal voluntary contractions (MVCs) on a dynamometer for both the leg extensors and flexors, in randomized order. MVCs were used to calculate peak torque (PT; Nm), and rate of torque development (RTD; Nm·s<sup>-1</sup>) at early (50ms; RTD50) and late (200ms; RTD200) phases of the torque-time curve. **RESULTS:** For the leg extensors, significant declines ( $P=0.01-0.025$ ) were found for PT (165.0 and 154.2 Nm for pre and posttest, respectively), RTD50 (1011.2 and 841.9 Nm·s<sup>-1</sup>), and RTD200 (643.2 and 559.2 Nm·s<sup>-1</sup>). For the leg flexors, significant declines ( $P=0.026$ ) were found for PT (81.4 and 77.5 Nm) but no changes were found for RTD50 or RTD200 ( $P=0.062$  and .183). **CONCLUSION:** These findings demonstrated that a demanding nursing work period induced strength-related fatigue of the lower body. Declines were more prominent for explosive strength ( $\Delta RTD50 = -16.8\%$ ) versus maximal strength ( $\Delta PT = -6.5\%$ ) characteristics of the leg extensors, and were generally less prominent for the leg flexors. Marked reductions in explosive strength capacities may contribute to increased injury risks resulting from a slower capacity to respond rapidly to sudden work-related perturbations (slips, patient handling events etc.), especially under fatigued conditions.

Supported by NIOSH Grant No. 3T42OH008421

2081 Board #233 June 2, 2:00 PM - 3:30 PM

**Development of an Aerobic Fitness Standard for Telecommunication Mast Climbers**

Sam D. Blacker<sup>1</sup>, Andrew T. West<sup>1</sup>, Nicola Cordell<sup>2</sup>, David M. Wilkinson<sup>1</sup>. <sup>1</sup>University of Chichester, Chichester, United Kingdom. <sup>2</sup>Corporate Health Limited, Slough, United Kingdom. Email: s.blacker@chi.ac.uk  
(No relationships reported)

**PURPOSE:** To quantify the aerobic energy demand during safe and effective mast climbing performance to develop a job-related aerobic fitness standard. **METHODS:** Following institutional ethics approval, 19 male and 2 female certified climbers volunteered (age 44 ± 11 years, stature 1.75 ± 0.08 m, body mass 84.7 ± 16.9 kg). The study was conducted in two phases. In both phases, the time taken to complete a 100 m ladder climb was recorded while heart rate and the rate of oxygen uptake (VO<sub>2</sub>) were measured. In Phase 1, 11 climbers heart rate was measured throughout a climbing assessment day, in which they completed a self-paced 100 m ladder climb. Subsequently, a panel of subject matter experts were consulted to set an appropriate standard for safe and effective 100 m ladder climbing performance (deemed to be 30 min). In Phase 2, 10 climbers completed a 100 m ladder climb only, under the instruction to complete the task at a steady pace in 25-35 min (i.e. approximately the proposed standard). **RESULTS:** During the training day in Phase 1, all participants' peak heart rates occurred during the 100 m climb. Participants completed the 100 m ladder climb faster in Phase 1 than Phase 2 (14:10 ± 01:58 28:56 ± 07:10 min:sec,  $P<0.001$ ) with no difference in a peak heart rate 2 (174 ± 14 vs. 162 ± 14 b·min<sup>-1</sup>,  $P=0.055$ ). The relationship between average VO<sub>2</sub> during climbing and 100 m climb time was established using Ordinary Least Product regression (Average 100 m climb VO<sub>2</sub> (mL·kg<sup>-1</sup>·min<sup>-1</sup>) = -0.0144 \* 100 m climb time (s) + 38.0,  $r=-0.80$ ,  $p<0.001$ ; SEE = 3.3 mL·kg<sup>-1</sup>·min<sup>-1</sup>). The mean VO<sub>2</sub> required to complete the 100 m ladder climb in 30 min was 20 mL·kg<sup>-1</sup>·min<sup>-1</sup>. Using the 90 % confidence interval and assuming a relative sustainable exercise intensity of 75 %VO<sub>2</sub>max it was estimated that climbers required a minimum VO<sub>2</sub>max of 27 mL·kg<sup>-1</sup>·min<sup>-1</sup> to safely and effectively complete the 100 m ladder climb in 30 min. **CONCLUSIONS:** The occurrence of all peak heart rates during the ladder-climbing task during the competency training confirmed this task was the most aerobically demanding and it should be used as the critical task to derive a job-related aerobic fitness standard. Adopting a common age-free and gender free job-related minimum aerobic fitness standard of ≥ 27 mL·kg<sup>-1</sup>·min<sup>-1</sup> will ensure that the fitness standard conforms to current equality legislation.

2082 Board #234 June 2, 2:00 PM - 3:30 PM

**Varying Bouts Of Occupational Sitting On Metabolic Risk Factors In Office Workers**

Saori Braun, Alyssa Kompelien, Amanda Nell, Marquell Johnson. University of Wisconsin-Eau Claire, Eau Claire, WI. (Sponsor: Stamatis Agiovlasis, FACSM) Email: braunsi@uwec.edu  
(No relationships reported)

With 70-75% of occupations requiring significant amount of computer use, amount of prolonged sitting an adult engages in each day has considerably increased over the last 50 years. **PURPOSE:** To determine the impact of varying bouts of sitting on metabolic risk factors in office workers. **METHODS:** A total of 35 office workers (age = 45.17 ± 12.47 years) who were required to sit for at least 50% of their work hours were recruited from the university and the local county offices. Metabolic risk factors [resting blood pressure (BP), body mass index (BMI), waist circumference, triglycerides, high-density lipoprotein, and fasting glucose] were obtained from each participant. A 5-workday behavioral monitoring occurred using activPAL devices during work hours. **RESULTS:** Average daily work hours (hrs) was 8.09 ± 0.48 hours. Mean sitting, standing, and walking times were 5.89 ± 1.52 hrs, 2.01 ± 1.57 hrs, and 1.09 ± 2.59 hrs, respectively. Daily step counts were 3710 ± 2259 steps. Average bouts of <10min, 10-60min, 60-90 min, and >90min of consecutive sitting were 25.58 ± 13.66 bouts, 9.72 ± 2.75 bouts, 0.59 ± 0.61 bouts, and 0.27 ± 0.34 bouts, respectively. Pearson's correlation analysis indicated inverse correlation between bouts of 10-60min sitting and triglycerides ( $r = -.43$ ). Walking time was inversely correlated with both systolic and diastolic BP ( $r = -.46$  and  $r = -.39$ , respectively). Bouts of 10-60min sitting was also inversely correlated with BMI ( $r = -.34$ ). **CONCLUSIONS:** Future interventions should be designed that are based on occupation-specific behavioral patterns to promote relatively shorter bouts of sitting (<60min) rather than solely emphasizing on reducing the total amount of sitting in a workplace. Varying sample characteristics (greater sample engaging in >90min of sitting) along with monitoring of leisure-time physical activity are also warranted to further understand the impact of occupational sitting patterns on metabolic risk factors.

2083 Board #235 June 2, 2:00 PM - 3:30 PM

**Decreased Ankle Strength Is Associated With Impaired Postural Balance In Firefighters**

Jung-Hyun Kim, Jeffrey Powell, Amanda Strauch, Coca Aitor. CDC/NIOSH/NPPTL, PITTSBURGH, PA. Email: inr3@cdc.gov  
(No relationships reported)

One of the leading causes for firefighter injuries reported in the United States is slips, trips and falls suggesting that maintaining postural balance is an important issue in firefighter safety and health. Little information is available about how ankle mobility and strength are affected by strenuous firefighter activity and its consequent influence on postural balance. **PURPOSE:** To assess changes in functional ankle mobility and strength and a consequent effect on postural balance following firefighter activities. **METHODS:** Eight healthy men completed a battery of firefighter activity simulations, consisting of uphill walking, weight carrying, crawling, stepping, and dummy dragging, lasting approximately 40 minutes to completion while wearing a full standard firefighter ensemble. Immediately before and after the simulation, subjects were assessed for ankle range of motion (ROM) and isometric peak power (IPP) of plantarflexion, dorsiflexion, inversion, and eversion using an isokinetic dynamometer, and for postural balance to determine overall stability index (OSI) under a dynamic perturbation condition using a Biodex balance system. **RESULTS:** Ankle ROM did not change significantly, but ankle IPP except dorsiflexion was significantly reduced in POST measurements. There was a significant difference between PRE and POST OSI (0.96±0.52, 1.22±0.80, respectively) ( $p=0.041$ ). **CONCLUSIONS:** Decrement in functional ankle ROM was minimal; however, ankle IPP was significantly reduced to which postural stability in a dynamic perturbation condition was impaired. This implicates that ankle fatigue developed due to strenuous firefighter activity is likely an important determinant for impaired postural balance in firefighters.

| Measurement | Plantarflexion | Dorsiflexion | Inversion | Eversion   |           |
|-------------|----------------|--------------|-----------|------------|-----------|
| PRE         | ROM (°)        | 23.4±6.7     | 16.4±5.0  | 23.7±9.1   | 30.6±9.1  |
|             | IPP (Nm)       | 141.5±43.0*  | 54.1±20.5 | 25.7±11.3* | 30.6±6.1* |
| POST        | ROM (°)        | 22.3±5.3     | 15.9±4.6  | 23.2±10.4  | 32.3±13.6 |
|             | IPP (Nm)       | 109.2±36.5*  | 43.7±11.6 | 19.5±7.1*  | 26.7±6.4* |

THURSDAY, JUNE 2, 2016

2084 Board #236 June 2, 2:00 PM - 3:30 PM  
**PSI As A Determinant Of Half-marathon Running Characteristics In Full Firefighting Kit: A Case Study**

Kimberly A. Pribanic<sup>1</sup>, Mark C. Fogarty<sup>2</sup>, Daniel P. Heil, FACSM<sup>3</sup>. <sup>1</sup>Montana State University/Montana Overland Research Foundation, Bozeman, MT. <sup>2</sup>University of Hull, Kingston-upon-Hull, United Kingdom. <sup>3</sup>Montana State University, Bozeman, MT.

Email: kim.pribanic@mor-foundation.org

(No relationships reported)

Numerous indices relate heat stress to changes in physical performance, but many are too complex to be practical for field use, or in cases where clothing creates a microclimate distinct from ambient conditions. The Physiological Strain Index (PSI), however, requires only rectal temperature ( $T_{re}$ ) and heart rate (HR) data, and has been shown to be accurate in predicting composite heat stress in a variety of conditions. This case study - in which a 37-year old male professional firefighter in the UK ran the 2015 Humber Bridge Half Marathon while wearing his full firefighting kit - allowed us to collect data needed to examine whether PSI (as a measure of overall physiological stress) is a determinant of changes in half-marathon running characteristics.

**PURPOSE:** To ascertain whether PSI is a determinant of changes in half-marathon running characteristics in full firefighting kit.

**METHODS:** A GPS-enabled heart rate monitor (HRM) and a rectal temperature probe were fitted to the subject, who wore his full kit of non-breathable turnout coat and pants, leather boots, helmet, and breathing apparatus (full-face mask, hoses, air tank). The subject planned to walk (not run) up hills and change air cylinders at 2.4 km intervals, or as needed. Heart rate (HR), speed (Sp), and distance (D) were recorded every two seconds.  $T_{re}$  was recorded when air cylinders were changed. Post hoc calculation of  $T_{re}$  progression and PSI were then descriptively compared to changes in running characteristics: Mean Speed (MSp), Run Time/Walk Time Ratio (RWR), and Run/Walk Oscillation Rate (OR).

**RESULTS:** Despite the generally cool ambient conditions (17.1 °C, 80% humidity), Mean PSI climbed steadily from 3.6 to 9.5 (on a scale of 0-10) over the course of the event. Peak MSp of 7.4 kph was reached at 9 km, with PSI = 8.7, RWR = 5.9 and OR = 2. From this point on, MSp and RWR declined steadily, while waves of rising speed and PSI - followed by dropping speed and PSI - became more prominent, especially as PSI neared 10.0, indicating that a physiological limit had been reached.

**CONCLUSION:** PSI was shown to be a strong determinant of changes in running characteristics. Given its ease of use (requiring only two direct physiological measures) and its applicability to varied environments, further investigation into the ability of PSI to predict physical performance decrement is warranted.

2085 Board #237 June 2, 2:00 PM - 3:30 PM  
**Impact Of A Flame Resistant Synthetic Material Base Layer On Heat Stress Factors**

Charles L. Dumke, FACSM<sup>1</sup>, Matthew C. Dorton<sup>1</sup>, Joseph W. Domitrovich<sup>2</sup>, Brent Ruby, FACSM<sup>1</sup>. <sup>1</sup>University of Montana, Missoula, MT. <sup>2</sup>USFS, Missoula, MT.

(No relationships reported)

Clothing worn by wildland firefighters (WLFF) may increase physiological strain and heat stress factors due to increased insulation and decreased ventilation. **PURPOSE:** To examine the effects of a flame resistant synthetic material base layer on heat stress factors. **METHODS:**

Ten recreationally active males (25 ± 1.9 yrs, 80.9 ± 2.7 kg, 11.1 ± 1.7% fat, 4.4 ± 0.6 L·min<sup>-1</sup> VO<sub>2</sub> max) completed two trials of intermittent (50 min walking, 10 min sitting) treadmill walking (4 km/hr, 4% grade) over 3 hours in a hot, dry environment (35°C, 30%RH). Participants wore standard WLFF Nomex green pants, Nomex yellow shirt with either a 100% cotton (C) or flame resistant synthetic material base layer (S), hard hat, gloves and carried a 16kg pack. Exercise was followed by a 30 minute rest period without the pack, hard hat, gloves, and Nomex yellow shirt. Core ( $T_c$ ) and skin ( $T_{sk}$ ) temperatures were measured continuously throughout the trial. Physiological strain index (PSI) was calculated using heart rate and  $T_c$ . Skin blood flow (SBF) was recorded for two minutes prior to walking, for five minutes during each break, and for three, five minute periods during the 30 minutes following exercise. Water was scripted at 8 ml/kg/hr. **RESULTS:** No interactions were found for  $T_c$  (p=0.077) and  $T_{sk}$  (p=0.086) between C and S. Significant increases were found for  $T_c$  (p<0.001) and  $T_{sk}$  (p=0.003) over time (37.8±0.07 vs 38.0±0.07°C and 36.5±0.17 vs 36.6±0.13 for C and S respectively). Significant main effects for time (p<0.001) and trial (p=0.04) were found for PSI with C being lower than S (4.5±0.3 vs 4.9±0.4 respectively). SBF increased S compared to C following the second hour of exercise, resulting in a time\*trial interaction (p=0.001). No significant differences for SBF were found between C and S post-exercise (p=0.089). **CONCLUSIONS:** These data indicate that a flame resistant synthetic material base layer negatively affects physiological factors that have been shown to indicate an increased risk of heat-related injuries.

Sponsored by the USDA FS and the Missoula Technology Development Center

D-38 Free Communication/Poster - Osteoarthritis, Knee Pain, Sports Injuries, and Rehabilitation

Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
 Room: Exhibit Hall A/B

2086 Board #238 June 2, 2:00 PM - 3:30 PM  
**Effects of Kinesio Taping on Pain and Function in Patients with Knee Osteoarthritis**

Anna L. Rahlf, Astrid Zech. Friedrich-Schiller-University Jena, Jena, Germany.

Email: anna.lina.rahlf@uni-jena.de

(No relationships reported)

**PURPOSE:** Knee osteoarthritis is one of the most frequent musculoskeletal disorders of elderly people (Woolf & Pfleger, 2003). The majority of patients suffers from pain and functional joint impairments. A therapeutic approach that has gained increasing attention among physicians and therapists is the treatment with kinesio taping. However, knowledge on the effectiveness of kinesio tape is limited and study results are inconsistent (Morris et al. 2013; William et al., 2012). The objective of this study was to determine the effects of kinesio taping on pain and function in patients with knee osteoarthritis. **METHODS:** 141 Patients (65.1±7 yrs) with a clinical and radiographic diagnosis of knee osteoarthritis were randomized into a kinesio group, placebo group or control group. Participants completed a baseline test and a post tests after receiving the tape and wearing it for three consecutive days. Primary outcomes were perceptions on pain, stiffness and physical function (Western Ontario and Mac Master Universities Osteoarthritis Index = WOMAC). Secondary outcomes were balance (Balance Error Scoring System = BESS), gait speed (10 meters walking test = 10MWT), maximum isometric quadriceps strength and knee range of motion (ROM). Differences between the groups were analyzed using ANCOVA on an intention-to-treat basis. **RESULTS:** At baseline, there were no statistically significant differences between groups. Significant effects were found for the tape group in WOMAC pain (tape vs. placebo p=0.053; tape vs. control p=0.047), stiffness (tape vs. placebo p=0.012; tape vs. control p<0.001) and physical function (tape vs. placebo p=0.034; tape vs. control p=0.004). No significant effects were found for the BESS-Test, strength, 10MWT or active ROM. **CONCLUSION:** The results showed, that wearing a kinesio tape has a positive effect on patient's perception regarding pain, stiffness and function. No improvements were found in functional balance, maximum isometric quadriceps strength, gait speed or active range of motion.

2087 Board #239 June 2, 2:00 PM - 3:30 PM  
**Relationship Between Hip Strength, Range of Motion, and Low Back Pain in Collegiate Women's Golfers**

Karlee Burns, Mac Pierson, James Becker, William Wu, Mimi Nakajima. California State University, Long Beach, Long Beach, CA.

Email: burns\_karlee@yahoo.com

(No relationships reported)

**PURPOSE:** The purpose of this study was to examine the relationship between hip ROM and strength of the lead leg with LBP in Division I collegiate women golfers. **METHODS:** Five in-season right-handed Division I collegiate women's golfers (age: 20 years ± 1.41, height: 164.08 cm ± 4.25 mass: 60.93 kg ± 6.76) participated in the study. During a single testing session, passive ROM (PROM) and strength were evaluated. PROM for hip IR and hip external rotation (ER) were measured using a standard goniometer in the prone position. Hip IR and ER strength were measured using a hand-held dynamometer in the same position; strength was normalized by body weight. LBP was assessed using a modified Micheli Functional Scale (MFS). Three athletes reported with having LBP, while two reported no LBP. **RESULTS:** An independent t-test revealed significant difference for hip IR strength ( $t(3) = -7.219$ ,  $p < .05$ ) of the lead leg for those with and without LBP. Athletes with LBP had weaker hip IR strength ( $M = 19.26 \pm 3.69$  %BW) compared to those without LBP ( $M = 22.41 \pm 5.45$  %BW). There were no significance differences for hip IR and ER ROM nor hip ER strength between athletes with and without LBP. **CONCLUSIONS:** The results of this study suggest a relationship between decreased lead leg hip IR strength and subjective LBP. This deficiency may affect training participation and competition performance. Due to the small sample size of this study, further research is needed to investigate LBP and the relationship between hip ROM and strength.

2088 Board #240 June 2, 2:00 PM - 3:30 PM  
**Activation Patterns In Muscles With Different Fiber Ratios: Implications For Rehabilitation And Sports Injuries**  
 Kelly Stratton, Pouran D. Faghri, FACSM, Tania B. Huedo-Medina. *University of Connecticut, Storrs, CT.*  
 Email: kelly.stratton@uconn.edu  
 (No relationships reported)

**Background:** Surface electromyography (sEMG) can be used to provide real-time muscle performance data and desirable feedback to patients and clinicians in rehabilitation or sports injury settings. However, a comparison of electrical activity patterns of muscles with different fiber type compositions has not been conducted, and the relationship between electrical outputs with muscles of different sizes is relatively unexplored.

**Purpose:** This study was designed to evaluate and compare the recruitment and activation patterns of large and small muscles with different fiber type combinations (proportion of type I and II fibers) during isometric contractions using sEMG.  
**Methods:** Participants (n=10, mean age: 24.4 ± 2.5 years) with no history of musculoskeletal injuries or cardiovascular problems were asked to perform progressive isometric contractions at 25%, 50%, 75%, and 100% of their maximal voluntary contraction (MVC) level. sEMG data was collected from the abductor pollicis brevis (APB) of the thumb and vastus lateralis (VL) of the upper leg. Raw force output, mean integrated EMG (iEMG), normalized electrical activity output, and median frequency were compared between these two muscles and four contraction levels.  
**Results:** APB, which consists of a higher percentage of Type I fibers, generated more electrical activity (mean iEMG: APB = 1187.57 ± 117.41 uV·s, VL = 175.93 ± 18.00 uV·s, p<0.001), but less force output at maximal contraction (p<0.001). Normalized electrical activity showed significantly different recruitment patterns between the two muscles (p<0.001), and the power spectra indicated a higher median frequency for APB (mean MDF: APB = 100.45 ± 3.30 Hz, VL = 77.24 ± 1.22 Hz, p<0.001).  
**Conclusion:** sEMG has been used as a biofeedback tool to help both patients and clinicians in documenting muscle recovery following sports injuries. However, it is important to realize there are muscle differences based on size and type of fiber. Changes in electrical activity used as an indication for strength improvement cannot be generalized across muscles. Smaller, predominately Type I muscles may require a higher muscle performance target during rehabilitation.  
 Supported by NSF EFRI 1332329.

2089 Board #241 June 2, 2:00 PM - 3:30 PM  
**Whole Body Vibration Improves Early Rate Of Torque Development In Individuals With ACL Reconstruction**  
 Derek N. Pamukoff<sup>1</sup>, Brian Pietrosimone<sup>2</sup>, Eric D. Ryan<sup>2</sup>, Lee E. Brown, FACSM<sup>1</sup>, J Troy Blackburn<sup>2</sup>. <sup>1</sup>*California State University, Fullerton, Fullerton, CA.* <sup>2</sup>*The University of North Carolina at Chapel Hill, Chapel Hill, NC.*  
 Email: dpamukoff@fullerton.edu  
 (No relationships reported)

Quadriceps rate of torque development (RTD) is reduced following anterior cruciate ligament reconstruction (ACLR), and contributes to diminished physical function. Whole body (WBV) and local muscle vibration (LMV) improve quadriceps function and may improve RTD, but their efficacy for doing so has not been compared. It is also unclear if WBV and LMV influence early or late RTD. Early RTD is important to force attenuation during gait, which contributes to the development of knee osteoarthritis. **PURPOSE:** To compare the acute effects of WBV and LMV on early and late RTD in individuals with ACLR. **METHODS:** 20 individuals with ACLR (age=21.1 (1.2) years, mass=77.2 (17.1) kg, time since injury=50.7 (21.3) months; 14 females, 16 patellar tendon autograft, 3 hamstring autograft, 1 allograft) volunteered for this study. Interventions (WBV, LMV, control) were delivered in a randomized order during 3 separate visits separated by 1-week washout periods. Quadriceps RTD was assessed during maximal voluntary isometric (MVIC) knee extension at 60° of knee flexion prior to and immediately after the intervention. Early RTD was defined as the slope of the torque signal during the first 100ms following contraction onset (RTD100), and late RTD was defined as the slope of the torque signal from 100-200ms following contraction onset (RTD200), and were normalized to body mass for analysis. Intervention effects were assessed using 3 (condition) x 2 (time) ANOVA, and Bonferroni post hoc adjustments were used to evaluate significant ANOVA models. **RESULTS:** There was a significant condition x time interaction for RTD100 (p=0.008) but not RTD200 (p=0.76). Post hoc analyses indicated a significant increase in RTD100 following WBV (+2.76 Nm/sec/kg, p=0.005). No differences were observed in the LMV (-1.28 Nm/sec/kg, p=0.13) or control conditions (-1.56 Nm/sec/kg, p=0.29), and no difference was observed between conditions at pretest or posttest. **CONCLUSIONS:** Results indicate that WBV acutely improves RTD100 in individuals with ACLR during an MVIC. The ability to rapidly produce knee extension torque is essential to force attenuation during gait. WBV may be appropriate to aid in the restoration of RTD following ACLR. Future studies are needed to determine the effects of repeated WBV exposure on quadriceps function.

ACSM May 31 – June 4, 2016

2090 Board #242 June 2, 2:00 PM - 3:30 PM  
**Sport Practice And Occurrence Of Bone Fracture In Adolescents During 9-months Of Follow-up**  
 Kyle R. Lynch, Ricardo R. Agostinete, Rafael Luiz-de-Marco, Mario A. Rodrigues-Junior, Bruna Turi-Lynch, Romulo A. Fernandes. *Sao Paulo State University, Presidente Prudente, Brazil.*  
 Email: kyle.lynch.sc@gmail.com  
 (No relationships reported)

**BACKGROUND:** Sports participation has many benefits for adolescent health, including improvement of skeleton. However, involvement in different levels of sport impact may attain suboptimal bone health, which could lead to an increased risk for bone fractures. **PURPOSE:** To analyze the risk of fractures in adolescents engaged in different levels of sports impact. **METHODS:** 137 adolescents (92 boys and 45 girls) with mean age of 12.8±1.7 years were selected at public schools and sport clubs and they were evaluated during a nine month period. The adolescents were divided into three groups according to sport practice: Sedentary (n= 29), Swimming (n= 19) and Impact Sports (n= 82 [soccer, basketball, judo, karate and kung-fu]). Maturation status was indicated by age at peak height velocity (APHV). The coaches, parents and adolescents themselves reported bone fractures. Statistical analysis was composed of chi-square test and Cox Regression (Hazard ratio [HR] and its 95%CI [95%CI]) adjusted by sex, age, engagement in resistance training and APHV. **RESULTS:** Seven fractures were observed during the cohort study (5.1% [95%CI= 1.4 to 8.8]). Sex (p-value= 1.000), APHV (p-value= 0.621) and engagement in resistance training (p-value= 0.387) were not associated to fracture, while sport practice was (Sedentary= 13.8%, Swimming= 3.8% and Impact Sports= 2.4%; p-value= 0.025). The risk of fracture after 9-months of follow-up was lower in adolescents engaged in impact sports than in non-active ones (Control HR=1.00; Swimming HR=0.049 [95%CI= 0.002 to 1.016]; Impact Sports HR=0.063 [95%CI= 0.006 to 0.675]). **CONCLUSION:** The occurrence of bone fractures was lower in adolescents involved in high-impact sports compared to low-impact sports and sedentary adolescents.

2091 Board #243 June 2, 2:00 PM - 3:30 PM  
**The Effect of a Full Length Soccer Season on Hip Adductor and Flexor Integrity**  
 Matthew M. Mitchell<sup>1</sup>, Rose Smith<sup>2</sup>, Jon Divine<sup>2</sup>, Sam Klosterman<sup>2</sup>, Sharon Strizak<sup>2</sup>. <sup>1</sup>*University of Cincinnati/ Villanova University, Cincinnati, OH.* <sup>2</sup>*University of Cincinnati, Cincinnati, OH.*  
 Email: mmm2185@aol.com  
 (No relationships reported)

**The Effect of a Full Length Soccer Season on Hip Adductor and Flexor Integrity: Groin Injuries in Male Soccer Players**

Matthew Mitchell, ATC  
 Jon Divine, MD  
 Rose Smith, PT, DPT, SCS, ATC  
 Sam Klosterman, BS, SPT  
 Sharon Strizak, BS, SPT  
 Department of Athletics, University of Cincinnati

**ABSTRACT**

**Objective:** To determine the effects of a collegiate level soccer season on hip musculature integrity.

**Design:** Retrospective study

**Setting:** College athletic training room in Cincinnati, OH.

**Subjects:** 46 male Division I collegiate soccer players.

**Methods:** Pre- and post- season assessments were taken of each player in the Fall and Spring seasons over a 3 year period (2011- 2013). Pain, flexibility, and strength were assessed in hip adductors, hip flexors, and abdominal muscles bilaterally. Flexibility of hip internal rotation (IR) was recorded during Fall and Spring seasons of 2013.

**Results:** Hip adductor musculature increased in length and was equal to or of decreased strength throughout the season with the left lower extremity demonstrating greater differences compared with the right. Hip flexor musculature demonstrated decreased length compared with normative data. Hip IR was noted to show decreased ROM/flexibility prior to seasons. Abdominal strength decreased from pre- to post-testing in all seasons measured. Upper classmen were on average stronger and more flexible in the hip adductors compared with Freshman but were weaker in abdominal strength testing.

**Conclusion:** Male collegiate soccer players are put at risk for groin or hip injury due to general increased muscle length paired with decreased muscle strength throughout the soccer season. This demonstrates the need for further research into an appropriate exercise program for these athletes.

Boston, Massachusetts

2092 Board #244 June 2, 2:00 PM - 3:30 PM  
**Reaction Forces In The Gait At Various Times During Rehabilitation Of Anterior Cruciate Ligament Surgery**  
 Yasser Alakhdar<sup>1</sup>, Iván Chulvi-Medrano<sup>2</sup>, Juan M. Cortell-Tormo<sup>3</sup>, Tamara Rial<sup>4</sup>. <sup>1</sup>University of Valencia, Valencia, Spain. <sup>2</sup>Benestar Wellness Institute, Valencia, Spain. <sup>3</sup>University of Alicante, Alicante, Spain. <sup>4</sup>International Hypopressive and Physical Therapy Institute, Pontevedra, Spain.  
 Email: yasser.uv.es@uv.es  
 (No relationships reported)

To be able to propel the body forwards during the gait, the foot unavoidably exerts a series of forces on the ground. At the same time, the ground returns these forces with the same magnitude, but in the opposite direction and course. These reaction forces produced during the gait are accountable for the body advancing, and their study is important to analyses human gait. **PURPOSE:**

the objective of this work is to compare the reaction forces produced during the gait in patients with a torn anterior crossed ligament at various times during the rehabilitation process.

#### METHODS:

The reaction forces of both legs were assessed (injured and healthy) in 11 subjects with a torn anterior crossed ligament using a dynamometric platform (NedSVE/IBV, Institute of Biomechanics, Valencia, Spain) before undergoing surgery, and at 2 and 6 months after surgery. The following reaction forces were analysed: initiation force (I), brake force (B) and propulsion force (P). An ANOVA of repeated measurements and a multiple pair comparison of the least significant difference were done to statistically analyses the data obtained.

#### RESULTS:

No significant differences were found in the reaction forces between both legs ( $p > 0.05$ ), although differences were noted at various times during rehabilitation when both legs together were compared ( $p < 0.05$ ). Significant differences were found 6 months after surgery (P: 109.17±17.17 N, B: 94.5±19.95 N, I: 779.22±92.23 N) compared to before surgery (P: 100.51±13.79 N, B: 81.56±16.5 N, I: 772.84±99.9 N) and 2 months after surgery (P: 100.93±15.95 N, B: 84.17±21.49 N, I: 767.11±97.34 N).

#### CONCLUSIONS:

As the results indicate, the three reaction forces analysed throughout the rehabilitation process improved. No differences were found between the values collected before surgery and those obtained 2 months after surgery, although those patients who underwent surgery improved after 6 months. Therefore, we can conclude that the gait alters owing to a torn anterior crossed ligament, and alterations in the gait are noted in both legs before surgery and 2 months after surgery, which noticeably recover 6 months after surgery.

2093 Board #245 June 2, 2:00 PM - 3:30 PM  
**Effects of Rotator Cuff Tear on Supraspinatus Muscle Contractility**  
 Ana P. Valencia, Shama R. Iyer, Mohit N. Gilotra, Richard M. Lovering. University of Maryland School of Medicine, Baltimore, MD. (Sponsor: Edward G. McFarland, FACSM)  
 (No relationships reported)

Rotator cuff (RTC) muscles provide stability and movement to the shoulder joint. RTC tears, particularly in the supraspinatus muscle (SS), are a common clinical problem, which includes poor functional outcomes and high re-tear rates after surgical repair. Tenotomy of RTC muscles is an established animal model for RTC tear. Such studies show changes in muscle histology, but there is limited data for muscle contractility of a tenotomized SS.

**PURPOSE:** To describe an *in vivo* method to assess muscle contractility of the SS after tenotomy, and to compare changes in muscle morphology and SS contractility.

**METHOD:** The histopathology of the SS better mimics the human condition of RTC tear if two of the tendons are cut; thus, the SS and infraspinatus tendons were surgically released in Sprague Dawley rats. The contralateral side was left intact and used as a control. The SS tendon was released and attached to a load cell. The muscle was stimulated with subcutaneous electrodes and, with the muscle at optimal length, maximal contractions (200ms pulse train) were obtained at progressively increasing the frequencies.

**RESULTS:** Two days after tenotomy we saw a 24% decrease in maximal contractile force (261.6 ± 20.3 g vs. 342.1 ± 16.8 g), yet no differences in SS mass compared to the intact, contralateral SS (313 ± 9 mg). Four weeks after tenotomy, maximal contractile force was 66% lower in the injured SS (111.3 ± 21.2 g), but mass was only 23% lower (389 mg ± 5 vs. 506 mg ± 5 mg).

**CONCLUSION:** The absolute quantity of muscle mass is generally well correlated to muscle force in healthy muscle, but these data show that impairment of contractile force precedes muscle atrophy in the acute period after tenotomy. Contractile force is further impaired at later time points, and to a greater extent than predicted by SS

mass. The results provide normative data on rat SS mass and contractility, but the most salient finding is that SS tears result in early and progressive deterioration in muscle function.

Supported by NIH grants to APV (T32AG000268-1S1) and to RML (1R01AR059179).

2094 Board #246 June 2, 2:00 PM - 3:30 PM  
**Assessment of Knee Osteoarthritis in Muscat**  
 Thuraya A. Al Shidhani<sup>1</sup>, Yahya Al Farsi<sup>2</sup>. <sup>1</sup>Diwan Health Complex, Muscat, Oman. <sup>2</sup>Sultan Qaboos University, Muscat, Oman.  
 (No relationships reported)

**Background:** Osteoarthritis (OA) is a common disease especially among elderly, and it has major public health burden and consequences.

**Objective:** The aim of the present study is threefold. First is to describe the socio-demographic and clinical profiles of patients suffering from OA in Oman. Second, is to evaluate the indicators of physical quality of life among patients of OA. Third, is to compare between female and male patients in terms of selected clinical characteristics and indicators of physical quality of life.

**Methods:** A cross-sectional study was conducted in two polyclinics in Muscat, Capital of Oman, over the period from January to December 2013. Socio-demographics were collected through a structured entry form. A standardized and validated Arabic version of *Knee Injury and Osteoarthritis Outcome Score- Physical Function Short Form (KOOS-PS) questionnaire* has been used to assess the physical disability of patients with knee osteoarthritis.

**Results:** Overall, the study included 213 participants, of them 171 (%) were females and 42 (%) were males. Compared to males, female participants tended to be older in age, less educated, with lower income, and more over weight. The majority had OA for duration of less than a year. About 12% reported history of trauma. About 22% reported using herbal medicine, and oil preparations constituted for 4.2%. Participants reported a range of indices of physical quality of life. Overall, severe indices were more common among females compared to males. The majority (75%) reported having pain getting out of bed. Having severe pain while getting out of bed was reported by 24% of participants, and it was more reported among females compared to males (22% vs. 12%, P-value 0.02). About 46% reported severe pain while bending, and it was more noted among males compared to females (55% vs. 44%, P-value 0.05). About 19% reported severe pain while kneeling, and it was significantly differential among females compared to males (22% vs. 5%, P-value 0.02). A similar pattern was also reported with severe pain while sitting cross leg.

**Conclusions:** The study provides a suggestive evidence for increased prevalence of severity of physical quality of life among patients suffering from OA in Oman. The severity of physical quality of life was more prominent among females compared to males.

2095 Board #247 June 2, 2:00 PM - 3:30 PM  
**Effects Of Two Different Aquatic Exercises Training On Cardiopulmonary Endurance And Anxiety & Depression Scores With Knee Osteoarthritis Patients**  
 Hulya Guvenir Şahin<sup>1</sup>, Zuhâl Kunduracılar<sup>2</sup>, Emel Sönmez<sup>3</sup>, Nafiz Akman<sup>4</sup>, Seyhan Sözer<sup>5</sup>, Şehri Ayaş<sup>5</sup>. <sup>1</sup>Yeni Doğan Special Education and Rehabilitation Center, Kocaeli, Turkey. <sup>2</sup>Bilent Ecevit Üniversitesi Health of School Department of Physical Therapy and Rehabilitation, Zonguldak, Turkey. <sup>3</sup>Başkent University Faculty of Health Science Department of Physical Therapy and Rehabilitation, Ankara, Turkey. <sup>4</sup>Bayındır Hospitals Group International Patient Center, Ankara, Turkey. <sup>5</sup>Başkent University Faculty of Medicine Department of Physical Therapy and Rehabilitation, Ankara, Turkey.  
 Email: zuhalkun@gmail.com  
 (No relationships reported)

Osteoarthritis is a common cause of disability. Aquatic exercise is thought to be beneficial and is often recommended for people with osteoarthritis; however, few studies have examined the effects on people with osteoarthritis, and these have yielded inconsistent results. Purpose: This paper reports a study of the effects of aquatic exercises on cardiopulmonary endurance and depression in adults with osteoarthritis of the knee. Methods. Participants were recruited from Başkent University Department of Physical Therapy and Rehabilitation and assigned to a 12-week aquatic programme. Data for 89 participants (who had been diagnosed as knee osteoarthritis) were collected at baseline, week 1, and week 12. The subjects included in the study were separated into three groups. 60 individuals were selected for the aquatic exercises groups, and, through random sampling technique, they were divided into two equal groups. Each including 30 individuals. The third group (58,23±7,55yrs) consisted of 29 individuals who were out patients, not receiving aquatic exercise treatment. As an aquatic exercise therapy; the first study group (63,20±7,59yrs) was given an

exercise training only for lower extremity, consisting of two phases and containing warm-up, stretching and strengthening periods in each phase. The second study group (60.46±6.82 yrs) was given exercises for upper extremity along with trunk exercise training, in addition to the lower extremity. Instruments were the 6-minute walk test and Hospital Anxiety and Depression scale. Hospital Anxiety and Depression scale was used for evaluation of emotional status and cardiopulmonary endurance was evaluated 6-minute walking test. Results: When Hospital Anxiety and Depression scale HAD depression scores and 6 walk test distance among the groups were examined before and after treatment there were statistically significantly improves in all the groups ( $p < 0.001$ ). Nevertheless, it was found out that depression status and 6 walk distance of the cases in the first study group were better when compared to the other groups ( $p < 0.05$ ). Conclusion: It was seen that the aquatic exercises therapy consisting of upper & lower extremity and trunk exercises were more effective in improvement of their exercise capacity and depression severity levels of the individuals were lessened.

2096 Board #248 June 2, 2:00 PM - 3:30 PM  
**Rehabilitative Exercise Training Increases Skeletal Muscle Contractile and Metabolic Function in Severely Burned Children**

Craig Porter, David N. Herndon, Armando Elizonda, Nisha Bhattarai, Karel D. Capek, Labros S. Sidossis, Oscar E. Suman, FACSM. *University of Texas Medical Branch, Galveston, TX.* (Sponsor: Oscar E Suman, FACSM)  
 Email: cr2porte@utmb.edu  
 (No relationships reported)

Wasting and deconditioning of skeletal muscle contributes to the prolonged morbidity observed in burn victims. PURPOSE: To study the impact of rehabilitative exercise training (RET) on skeletal muscle contractile and metabolic function in children recovering from major burns. METHODS: Twenty-one children (7-18 years) with burns covering  $\geq 30\%$  of their total body surface area were studied at approximately three and six months post-injury. Body composition, muscle strength (peak torque) and endurance (total work), insulin sensitivity (euglycemic-hyperinsulinemic clamp), and mitochondrial function (muscle biopsies) measurements were performed at each study. In the twelve intervening weeks,  $n=8$  patients received standard rehabilitative care including occupational and physical therapy (standard of care, SoC), while  $n=13$  patients performed a 12-week supervised outpatient RET program in addition to receiving standard care. RET consisted of progressive resistive and aerobic exercise performed at least 5-times weekly. RESULTS: Total and fat-free body mass significantly increased in the RET group only ( $P < 0.05$ ). Peak torque significantly increased with RET (+51%,  $P < 0.001$ ) but not in SoC (+35%,  $P = 0.08$ ). Total work significantly increased with RET (+66%,  $P < 0.001$ ) but not in SoC (+44%,  $P = 0.23$ ). Insulin stimulated glucose disposal tended to decrease in the SoC group ( $1.87 \pm 0.31$  vs.  $1.35 \pm 0.24$  mg/min/kg;  $P = 0.07$ ) but significantly increased in the RET group ( $1.12 \pm 0.11$  vs.  $1.59 \pm 0.10$  mg/min/kg;  $P = 0.004$ ). ADP-dependent mitochondrial respiration increased with RET ( $25.0 \pm 4.3$  vs.  $52.8 \pm 4.1$  pmol/s/mg;  $P < 0.001$ ) but not SoC ( $37.6 \pm 4.7$  vs.  $41.7 \pm 6.4$  pmol/s/mg). The mitochondrial respiratory control ratio for ADP increased with RET ( $1.54 \pm 0.12$  vs.  $2.27 \pm 0.12$  pmol/s/mg;  $P = 0.01$ ) but not SoC ( $1.72 \pm 0.12$  vs.  $1.45 \pm 0.07$ ). CONCLUSIONS: In agreement with previous studies, RET increases muscle strength and endurance in burn survivors. Here, we show that this is accompanied by increased peripheral insulin stimulated glucose disposal and skeletal muscle mitochondrial respiratory capacity and coupling control. These data demonstrate that in addition to contractile function, RET improves skeletal muscle metabolic function in burn survivors.

2097 Board #249 June 2, 2:00 PM - 3:30 PM  
**Effects of Tissue Loading due to Massage on Muscle Mechanical Property Recovery Following Eccentric Exercise**

Thomas M. Best, FACSM<sup>1</sup>, Yi Zhao<sup>1</sup>, Hechmi Toumi<sup>2</sup>, Scott K. Crawford<sup>1</sup>. <sup>1</sup>The Ohio State University, Columbus, OH. <sup>2</sup>Universite D'Orleans, Orleans, France.  
 (No relationships reported)

PURPOSE: Although massage is an increasingly popular modality for a variety of musculoskeletal disorders, including chronic low back pain and exercise-induced muscle injury, the relationship between the applied mechanical loading parameters and clinical outcomes have not yet been elucidated. The purpose of this work was to investigate the contributions of several kinetic parameters on the recovery of both active and passive mechanical properties of skeletal muscle following an intense bout of eccentric exercise (EEC).

METHODS: Twelve New Zealand White rabbits were subjected to EEC-induced muscle injury and randomly selected to undergo a 15 min constant compressive force massage (10 N) applied at a loading frequency of 0.5 Hz either immediately after EEC ( $n=6$ ) or 48 hrs post EEC ( $n=6$ ). The total amount of transverse loading (i.e. applied longitudinally along the muscle) was quantified by calculating the mechanical power

and what was termed the mechanical "dose". Recovery indices (RI), which compared the amount of recovery in active and passive mechanical properties to the initial change due to EEC, were calculated. The effects of the kinetic parameters on daily (RI) and between-day (RI') recovery indices of tissue stiffness and isometric torque production recovery following four days of massage were determined.

RESULTS: Transverse loading had moderate correlations with RI (tissue stiffness reduction) with immediate massage (power:  $r = -0.45$ ; dose:  $r = -0.42$ ), but weak relationships with delayed massage (power:  $r = -0.15$ ; dose:  $r = -0.29$ ). The increases in tissue stiffness between-day (RI') also had moderate correlations with transverse loading with immediate massage (power:  $r = 0.48$ ; dose:  $r = 0.49$ ), but weak correlations with delayed massage (power:  $r = -0.31$ ; dose:  $r = 0.22$ ). Total mechanical dose ( $r = -0.46$  and  $-0.40$  for immediate and delayed conditions, respectively) and average mechanical power ( $r = -0.39$  and  $-0.45$  for immediate and delayed conditions, respectively) over the 4 day massage protocol predicted an inverse relationship with active property recovery.

CONCLUSIONS: These findings provide evidence of the importance of mechanical loading, its effects on tissue and joint function, and further insight in aiding clinical decision-making for proper dosing of massage therapies following EEC injury.

2098 Board #250 June 2, 2:00 PM - 3:30 PM  
**Effect of Neuromuscular Electrical Stimulation on Anabolic Signaling in Skeletal Muscle of Stroke Survivors**

Sydney M. Bennett<sup>1</sup>, Joni A. Mettler<sup>1</sup>, Dillon M. Magee<sup>1</sup>, James S. Williams<sup>1</sup>, Barbara M. Doucet<sup>2</sup>. <sup>1</sup>Texas State University, San Marcos, TX. <sup>2</sup>Louisiana State University Health Sciences Center, New Orleans, LA. (Sponsor: Tinker D. Murray, FACSM)  
 Email: smb178@txstate.edu  
 (No relationships reported)

Stroke causes limited ability to produce voluntary muscle contraction and movement on one side of the body leading to further muscle wasting and weakness. Neuromuscular electrical stimulation (NMES) is often used to facilitate involuntary muscle contraction; however, the effect of NMES on muscle growth in hemiparetic muscle is not clear. PURPOSE: To determine the skeletal muscle anabolic response of an acute bout of NMES in individuals with chronic stroke and healthy older adults. METHODS: This study employed a two-group, pretest/posttest design. Ten individuals ( $59 \pm 2.81$  years old) were divided into two groups, a chronic stroke group (STROKE:  $n = 4$ ) or a healthy older adult control group (CON:  $n = 6$ ). A muscle biopsy was obtained from the *vastus lateralis* of the hemiparetic leg for STROKE and the right leg for CON before and 30 min after the NMES intervention. The NMES protocol consisted of a 60 Hz stimulation train of 10 seconds on and 15 seconds off which was repeated for 60 minutes. Phosphorylation of mTOR and p70S6K were analyzed using the SDS-PAGE Western blot technique. Phosphorylation is expressed as the ratio of phosphorylated to total protein content. Data were analyzed using two-way repeated measures analysis of variance. Data are reported as mean  $\pm$  SE with statistical significance set at  $p < 0.05$ . RESULTS: An acute bout of NMES increased the phosphorylation of mTOR after stimulation (CON:  $0.67 \pm 0.10$  vs.  $1.01 \pm 0.06$ ; STROKE:  $0.64 \pm 0.15$  vs.  $0.99 \pm 0.14$ ;  $p < 0.01$ ) and p70S6K (CON:  $0.85 \pm 0.13$  vs.  $2.18 \pm 0.32$ ; STROKE:  $1.03 \pm 0.29$  vs.  $2.56 \pm 0.96$ ;  $p < 0.01$ ) from resting levels to 30 min following the NMES treatment, respectively. Phosphorylated protein content was not different between STROKE and CON ( $p > 0.05$ ) following NMES. CONCLUSIONS: These findings suggest that NMES, in addition to facilitating muscle contraction, may initiate cellular processes that facilitate skeletal muscle growth and strengthening in healthy older and post-stroke populations.

Supported by: Texas State University College of Education Faculty Pilot Grant and Research Enhancement Program Grant (J.A. Mettler); Thesis Research Support Fellowship and College of Education Thesis Research Support Grant (S.M. Bennett)

2099 Board #251 June 2, 2:00 PM - 3:30 PM  
**Quadriceps Muscle Quality Does Not Reflect Self-report Or Muscle Function In Individuals With Acl Reconstruction**

Tory Blackburn<sup>1</sup>, Brian Pietrosimone<sup>2</sup>, Matthew Harkey<sup>1</sup>, Brittney Luc<sup>1</sup>, Derek Pamukoff<sup>3</sup>. <sup>1</sup>University of North Carolina, Chapel Hill, NC. <sup>2</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>3</sup>California State University, Fullerton, Fullerton, CA.  
 Email: brian@unc.edu  
 (No relationships reported)

Chronic quadriceps dysfunction following anterior cruciate ligament reconstruction (ACLR) leads to disability and has been implicated as a risk factor for knee osteoarthritis (OA). However, the most appropriate quadriceps function assessment for identifying individuals at heightened risk of OA and disability is unclear. Quadriceps muscle quality (QM) assessed via ultrasound imaging is associated with quadriceps strength and functional ability in the elderly, but has yet to be evaluated following

ACL. **PURPOSE:** To compare QMQ between limbs and evaluate relationships between QMQ, quadriceps function, and self-report function in individuals with ACL. **METHODS:** Twenty-six individuals with unilateral ACLR (73% females; age =  $23 \pm 3$  yr; time since ACLR =  $56 \pm 45$  months; International Knee Documentation Committee Index [IKDC] =  $87 \pm 9$ ) volunteered for this study. QMQ was calculated as the echo intensity of cross-sectional ultrasound images of the rectus femoris (RF) and vastus lateralis (VL), and averaged as a composite quadriceps value. Isometric (peak torque and rate of torque development) and isokinetic (peak torque and power at  $180^\circ/s$ ) quadriceps function was assessed in the ACLR limb and normalized to body mass. QMQ was compared between limbs via paired t-tests, and relationships between QMQ, quadriceps function, and self-report function (IKDC) were evaluated via Pearson correlations. **RESULTS:** QMQ did not differ between limbs for the RF (arbitrary grayscale units:  $110 \pm 8$  vs.  $110 \pm 7$ ,  $p = 0.472$ ), VL ( $112 \pm 9$  vs.  $113 \pm 9$ ,  $p = 0.203$ ), or quadriceps composite ( $111 \pm 8$  vs.  $112 \pm 7$ ,  $p = 0.326$ ), and was not correlated with any quadriceps function index ( $r = -0.283 - 0.122$ ,  $p > 0.05$ ). IKDC was not correlated with QMQ of the VL ( $r = -0.093$ ,  $p = 0.332$ ) or quadriceps composite ( $r = -0.242$ ,  $p = 0.127$ ), but poorer RF QMQ was associated with poorer self-report function ( $r = -0.376$ ,  $p = 0.035$ ). **CONCLUSIONS:** Poor QMQ of the RF is indicative of poor self-report function, but QMQ does not differ between limbs and is not associated with quadriceps function in individuals with ACLR. These data suggest that QMQ has limited clinical application for identifying individuals at heightened risk of OA and disability following ACLR. Previous reports of associations between QMQ and muscle function in elderly subjects likely reflect age-related sarcopenia.

### D-39 Free Communication/Poster - Physical Activity in Older Adults

Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
Room: Exhibit Hall A/B

#### 2100 Board #252 June 2, 2:00 PM - 3:30 PM Accelerometer Determined Levels of Physical Activity and Sedentary Behaviour in Older Care Home Residents

Jennifer Airlie, Anne Forster, Karen M. Birch. *University of Leeds, Leeds, United Kingdom.* (Sponsor: Keith George, FACSM)  
Email: sp09ja@leeds.ac.uk  
(No relationships reported)

**PURPOSE:** Health and social benefits of engaging in physical activity [PA] for older adults are well documented. Evidence from interventional studies supports the implementation of PA as a preventative and therapeutic intervention for care home residents but little is known about the level of PA residents typically engage in. This study described accelerometer determined levels of PA and sedentary behaviour and its associations with personal characteristics in care home residents.

**METHODS:** Care home residents [ $n = 110$ , aged 59 - 100 yr] were invited to wear an accelerometer on the hip for 7 days. The proportion of accelerometer wear time spent sedentary and engaging in PA was calculated. Residents completed the six item cognitive impairment test. Care home staff reported on residents' independence [Barthel Index (BI)] and mobility [Physical Activity and Mobility in Residential Care Scale (PAM-RC)].

**RESULTS:** 62 residents [aged  $85 \pm 8$  yr] provided valid accelerometer data [ $\geq 8$  hours 25 min  $\geq 2$  days]. Mean accelerometer wear time was 12 hours 23 min  $\pm 1$  hour 28 min. The largest proportion of wear time was spent sedentary [ $< 100$  counts per min (cpm): median: 94% (IQR: 9%)] followed by low intensity PA [100 - 759 cpm: median: 6% (IQR: 9%)]. Engagement in light [760-2019 cpm] and moderate-vigorous [MV: $\geq 2020$  cpm] intensity PA was  $< 1\%$ . Residents deemed independent [BI score  $\geq 11$ ] spent a higher portion of wear time engaging in low intensity PA [6%] and less time sedentary [93%] compared to those more dependent [4% and 96% respectively;  $P < 0.05$ ]. Level of cognitive impairment was positively associated with engagement in MVPA [ $P < 0.05$ ]. 34% of the sample engaged in  $\geq 30$  min of PA daily; however this was not MVPA or accumulated in bouts of  $\geq 10$  min as per the current PA guidelines. Residents who accumulated  $\geq 30$  min of PA were more independent and had walked outside [ $P < 0.05$ ].

**CONCLUSIONS:** Care home residents spent the majority of their time sedentary and the little PA they did engage in was predominantly of low intensity. Higher levels of independence, mobility and interestingly cognitive impairment were associated with more engagement in PA. 34% of the sample did manage to accumulate  $\geq 30$  minutes of daily PA which suggests there is potential to either increase the volume or intensity of PA for residents to engage in.

Supported by NIHR Grant P-PG-1210-12017

#### 2101 Board #253 June 2, 2:00 PM - 3:30 PM Prevalence Of Functional Fitness Deficiency Of The Us Older Adults And Its Relationship With Chronic Disease: A Diagnostic Analysis

Yan Yang, Weimo Zhu, FACSM. *University of Illinois at Urbana-Champaign, Urbana, IL.* (Sponsor: Weimo Zhu, FACSM)  
Email: yanyang5@illinois.edu  
(No relationships reported)

**PURPOSE:** To estimate functional fitness deficiency profile of US older adults using a diagnostic testing model and examine its relationship with major chronic diseases.

**METHODS:** Nationally representative data ( $N = 7,498$ , 45.88% male, 60 years or older) from the 2003-2012 National Health and Nutrition Examination Survey (NHANES) were used for the analysis. A Q-matrix representing four latent functional fitness aspects (mobility, strength, flexibility, and motor function) was first developed by coding the 20 NHANES physical functioning questionnaire items. Using the Q-matrix and the corresponding data, participants' functional fitness deficiency profiles were then determined by the DINA (Deterministic, Inputs, Noisy, "And" Gate; Macready & Dayton, 1977) Model. Finally, functional fitness deficiency characteristics by chronic diseases (asthma, cancer, heart disease, stroke, arthritis, and diabetes) were analyzed and compared.

**RESULTS:** The overall prevalence of US older adults' functional fitness deficiency are 24.26% for mobility, 30.72% for strength, 29.81% for flexibility, and 22.13% for motor function. Persons with chronic disease often illustrated a unique pattern of functional fitness deficiency, e.g., compared with persons with asthma, cancer, heart disease, arthritis, and diabetes, persons with stroke had the highest prevalence of functional fitness deficiency across all attributes (48.36% for mobility, 54.97% for strength, 53.49% for flexibility, and 46.51% for motor functioning), and persons with asthma and heart disease had higher prevalence of deficiency in the strength attribute (43.25% and 44.44%, respectively).

**CONCLUSIONS:** The diagnostic analysis provides rich information on functional fitness deficiency and its relationship with common chronic diseases of US older adults, which, in turn, should help health care systems and rehabilitation programs develop targeted and effective intervention and treatment programs for this population.

#### 2102 Board #254 June 2, 2:00 PM - 3:30 PM Awareness Of A Physical Activity Campaign, Physical Activity, And Sedentary Behavior In Japanese Elderly Adults

Takayuki Tajima<sup>1</sup>, Yuko Oguma<sup>1</sup>, Yoshinobu Saito<sup>2</sup>, Yayoi Kibayashi<sup>1</sup>, Riri Kato<sup>1</sup>, Motohiko Miyachi<sup>3</sup>, Toru Takebayashi<sup>1</sup>.  
<sup>1</sup>Keio University, Kanagawa & Tokyo, Japan. <sup>2</sup>Fujisawa City Health and Medical Foundation, Kanagawa, Japan. <sup>3</sup>National Institute of Health and Nutrition, Tokyo, Japan.  
Email: ttajima@keio.jp  
(No relationships reported)

**PURPOSE:** It is well known that physical activity (PA) and exercise are important for maintenance and improvement of health as well as prevention of non-communicable diseases. In Japan, the "Physical Activity Guidelines 2013 for Health Promotion" includes as a key message "4+10 (plus ten): Add 10 minutes PA for your health." We conducted a 2-year (2013-2015) community-wide campaign to promote PA based on these guidelines (PA campaign) in four areas of Fujisawa city, Kanagawa, Japan. The campaign involved information, education, and community support. In this study, we compare elderly adults who are aware of this PA campaign with those who are not, in terms of physical activity levels, through a questionnaire.

**METHODS:** Individuals 65 years or over were selected via population-based random sampling of 3000 adults living in Fujisawa, aged 20 years or over, and were asked to complete self-administered questionnaires. The sample consisted of 264 men (median age [25%-75%tile]: 73 [68-78] yrs) and 284 women. (73 [68-80] yrs). Total PA time was the sum of self-reported time spent in exercise or activities equivalent to walking per day. Total PA time and sedentary time were dichotomized by a median split; sex was also a dichotomous variable. Logistic regression analyses were used to calculate the adjusted odds ratios (ORs) and 95% confidence intervals (95% CI) of total PA time and sedentary time according to awareness of the PA campaign, stratified by sex and adjusting for socio-demographic variables.

**RESULTS:** The median total PA time was 90 minutes/day and 105 minutes/day in men and women, respectively, whereas the median sedentary time was 300 minutes/day in both sexes. Total PA did not significantly differ by campaign awareness (men: OR=0.85 (95%CI: 0.47-1.53), women: 0.99 (0.56-1.77), respectively). Sedentary time significantly differed by campaign awareness (men: 1.87 (1.05-3.32), women: 1.96 (1.13-3.41)).

**CONCLUSIONS:** Elderly adults who were aware of the PA campaign had lower sedentary time, although total PA time did not differ by campaign awareness. These findings could inform improvements of this PA intervention.

Supported by Comprehensive Research on Aging and Health Science Research Grants for Dementia R&D from the Japan Agency for Medical Research and Development (AMED).

2103 Board #255 June 2, 2:00 PM - 3:30 PM

### Comparing Physical Activity And Sedentary Time Between Elder Runners And Non-runners In Puerto Rico

Osvaldo J. Hernandez-Soto<sup>1</sup>, Farah A. Ramirez-Marrero, FACSM<sup>2</sup>, José J. Alequin-Cruz<sup>1</sup>, Yarelis Barreto-Cordero<sup>3</sup>. <sup>1</sup>Inter American University, San Germán, Puerto Rico. <sup>2</sup>University of Puerto Rico, Río Piedras, Puerto Rico. <sup>3</sup>University of Puerto Rico-Medical Sciences Campus, Río Piedras, Puerto Rico. Email: ojhsui@gmail.com

(No relationships reported)

Ageing is associated with dramatic reductions in physical activity (PA) and increased sedentary time (ST), both associated with poor health outcomes. Yet, a limited number of elders maintain high level PA through participation in long distance running. The evaluation of PA and ST between elder runners and non-runners using accelerometers is very limited. Purpose: To compare PA, ST, and anthropometric characteristic of Hispanic elder long distance runners and non-runners in Puerto Rico. Methods: Elder runners (n=14) from the Master's Athletic Federation and non-runners (n=15) from elderly home centers (66.5±6.8 and 67.2±4.8 years of age, respectively, P=0.75) wore an ActiGraph GT3X+ accelerometer on the right hip attached to an elastic belt during seven consecutive days. Runners self-reported an average of 5.5 miles/day, 3-6 days per week of running. Non-runners did not participate in formal PA program. Anthropometric measurements (height, weight, waist and hip circumferences) were obtained to determine body mass index (BMI), waist to hip ratio (WHR), and waist to height ratio (WHtR). Independent t-tests were used to determine differences between groups, and Spearman correlations to determine associations between variables. Results: Runners compared with non-runners had higher moderate to vigorous PA (101.5±33.4 vs. 12.5±4.2 min/week; P=0.01), less ST (6.9±2.0 vs. 8.4±1.3 hr/day, P=0.03), and lower BMI and WHtR (23.3±2.8 vs. 32.3±6.5 kg/m<sup>2</sup>, P=0.001; 0.49±0.05 vs. 0.65±0.09, P<0.0001; respectively). WHR was not different between groups (0.89±0.07 vs. 0.94±0.07, P=0.14). BMI and WHtR significantly correlated with PA (rs= -0.37, -0.44; respectively, P<0.05) and ST (rs= 0.36, 0.34; respectively, P<0.05). Conclusion: Although differences in PA, ST, and anthropometric characteristics between elder runners and non-runners were in the expected direction, runners did not achieve the minimal PA recommendation. Further evaluations must clarify the gap between accelerometer detection of PA and self-reported training among elder runners. Also, the dramatic low PA and high ST among elder non-runners highlights that elder home centers in Puerto Rico must integrate programs to increase PA and reduce ST in this population.

2104 Board #256 June 2, 2:00 PM - 3:30 PM

### Quantifying Longitudinal Patterns and Trends of Objectively Measured Physical Activity Across the Age Spectrum

Jennifer A. Schrack<sup>1</sup>, Luo Xiao<sup>2</sup>, Vadim Zipunnikov<sup>1</sup>, Eleanor M. Simonsick<sup>3</sup>, Stephanie Studenski<sup>3</sup>, Ciprian Crainiceanu<sup>1</sup>, Luigi Ferrucci<sup>3</sup>. <sup>1</sup>Johns Hopkins University, Baltimore, MD. <sup>2</sup>North Carolina State University, Raleigh, NC. <sup>3</sup>National Institute on Aging, Baltimore, MD. Email: jschrac1@jhu.edu

(No relationships reported)

**PURPOSE:** Physical activity is fundamental to maintaining health and functional status with aging. Accelerometers present new opportunities to define and quantify daily physical activity in older adults, and to better understand the associations among physical activity and health-related outcomes. The objective of this study was to examine the onset and magnitude of the age-related decline in physical activity, and corresponding changes in circadian patterns of activity, in a large cohort of well functioning adults.

**METHODS:** Physical activity was assessed in 308 participants (mean age 70.0, range 38 – 95, 47% male) in the Baltimore Longitudinal Study of Aging (BLSA) over a 7-day period using the Actiheart, a unidirectional chest-worn accelerometer. Activity was recorded in one-minute activity count epochs, a composite measure of physical activity intensity and duration. The primary outcome was physical activity decline over a mean three-year period (range 1-6 yrs). The association between the log of physical activity counts and age was modeled using linear regression models with generalized estimating equations for repeated measures, adjusted for age, sex, BMI, race, education, employment, functional status, and history of chronic conditions.

**RESULTS:** In fully adjusted population average models, physical activity declined 1.6% per year (p < 0.001). The decline was attenuated in those currently employed and those with better functional status (p < 0.001), but accelerated in participants

with higher BMI and those with a history of stroke (p < 0.01). Those who declined were older, more likely to be male, and to have had a history of stroke and peripheral neuropathy at baseline (p < 0.05). In models stratified by age and time-of day, the greatest decline occurred among those aged 75 and older (n = 90), specifically in the morning hours (8-12 am) (p = 0.02).

**CONCLUSIONS:** Among well functioning, community-dwelling older adults, age-related decline in physical activity is exacerbated by the presence of chronic conditions. Such decline is most evident in the morning hours, when volitional daily activity is typically highest. Use of accelerometers that can generate detailed data on activity patterns throughout the day may provide useful information for effective interventions for maintaining activity later into life.

2105 Board #257 June 2, 2:00 PM - 3:30 PM

### Associations Between Physical Activity, Sedentary Behaviour And The Environment: A Cross Sectional Study Of Uk Adults

Claire Griffiths<sup>1</sup>, Steven Zvolinsky<sup>1</sup>, Darren Greenwood<sup>2</sup>, Paul Norman<sup>2</sup>, Jim McKenna<sup>1</sup>. <sup>1</sup>Leeds Beckett University, Leeds, United Kingdom. <sup>2</sup>University of Leeds, Leeds, United Kingdom. Email: C.Griffiths@leedsbeckett.ac.uk

(No relationships reported)

**Purpose:** To investigate the association between physical activity (PA) and sedentary behaviour (SB) and opportunities for PA in the environment. **Methods:** Cross sectional study, September 2013 to August 2014. Participants were adults (16 years +) data on PA n=16245 and SB n=13041. PA and SB data was obtained using the short IPAQ. PA was classified as meeting the PA guidelines using a threshold of 7.5 MET-h.w<sup>-1</sup>. SB was classified as sitting for ≥ 5 hours/day. The PA environment was characterised using the Ordnance Survey Points of Interest (POI) data. PA opportunities within the study area were grouped into four categories, 'green space', 'specialised facilities', 'general PA facilities' and 'all POI combined'. Neighbourhoods were characterised using Lower Super Output Area of residence. Index of multiple deprivation, age, gender and population density were included as covariates within a causal framework. Random intercept models estimated associations between PA opportunities and PA and SB in separate models. **Results:** 67% of participants achieved current PA recommendations, while 56% were classified as sedentary. Compared to those living in the least deprived areas (IMD Q1), those living in the most deprived areas (IMD Q4) were less likely to meet the PA recommendations (OR=0.74 95%CI=0.67 to 0.83) but also less likely to be sedentary (OR=0.89 95%CI=0.80 to 1.00). One third (n=5633) of respondents and LSOAs (n=144) had no access to any PA opportunities. Only 30% (n=4799) of respondents and 11% of LSOA (n=50) had access to green space. The most deprived quintile had the lowest count of PA facilities across all categories. Individuals with access to 2+ opportunities for PA were slightly more likely to achieve the PA recommendations (OR=1.11 95%CI=1.01 to 1.22). There was no evidence of an association between PA opportunities (all POI combined) and SB nor between PA and SB, with green space specifically as the exposure. **Conclusions:** There is little evidence to suggest that access to opportunities for PA, including green space, substantially either increases PA or reduces SB, any associations observed were relatively small and unlikely to influence policy. The evidence is not well placed to support policy interventions.

2106 Board #258 June 2, 2:00 PM - 3:30 PM

### A Quantified Pre-frailty Prediction Score in Frailty Syndrome

Hung-Ju Chen, Wen-Hsu Sung, Shun-Hwa Wei. National Yang-Ming University, Taipei, Taiwan.

(No relationships reported)

Frailty syndrome is currently a novel but emerging concept in geriatrics and leads to disability of older adults and escalation of healthcare costs. Early Pre-frail detection is essential for Frailty prevention. Fried Frailty Criteria contained five clinical physiological items helps to determine whether an elder is in Frailty or Pre-frail stage; however, no quantitative index of Frailty has been developed so far.

**PURPOSE:** To organize common clinical physical performance tests and to form a quantitative score to indicate the degree of Pre-frail severity.

**METHODS:** Thirty-five community-dwelled elders were recruited and screened into Frailty (n=4, 72.5±5.52 y/o), Pre-Frail (n=19, 74.63±5.33 y/o) and Robust groups (n=12, 71.42±5.82 y/o). Only Pre-frail and Robust groups participated and performed six physical performance tests, including Single Leg Stand (SLS), Repeated Chair Rise (RCRT), Timed Up and Go (TUG), Self-selected Walking Speed (SWS), Functional Reach (FR), and Grip Power (GP). Differences between groups were compared using independent t-test and Mann-Whitney U test, and a binary logistic regression model were used to build a Pre-frail index, the "FAT score". Statistically significant level was set at .05. (α = .05)

**RESULTS:** Five tests were valid to detect Pre-Frail from Robust, i.e. RCRT (20.26 vs 9.25 sec, p = .001), TUG (19.58 vs 10.33 sec, p = .006), SWS (75.19±12.76 vs 111.09±26.1 m/s, p = .000), FR (17.59±2.7 vs 19.53±1.84

%,  $p = .037$ ), and GP ( $21.83 \pm 6.97$  vs  $30.27 \pm 9.54$  kg,  $p = .008$ ), and a Pre-frail predict equation was formulated:  $FAT\ score = 1/(1+e^{-(Z\_Robust)})$ ;  $Z\_Robust = -.80.857+0.188(CRT)+1.708(TUG)+0.482(SWS)+0.156(FR)+0.559(GP)$ . The average FAT score of Pre-Frail and Robust were  $90.73 \pm 19.95\%$  and  $15.01 \pm 25.25\%$  respectively. Coincidentally, one higher FAT Robust elder (46.88%) had suffered a pontine infarction in the 7th month after accomplishing the study.

**CONCLUSIONS:** FAT score gathered by five physical performance tests is a beneficial Pre-Frailty predictor, and the pontine infarcted Robust demonstrated the potential to predict Pre-frailty. It contributes to detect elders who are entering Pre-frail stage and determine intervention strategy before obvious signs arise. Further studies are needed to recruit more elders and organize other effective physical performance tests.

#### D-40 Free Communication/Poster - Physical Activity Interventions in Adults - Part II

Thursday, June 2, 2016, 1:00 PM - 6:00 PM

Room: Exhibit Hall A/B

2107 Board #259 June 2, 3:30 PM - 5:00 PM

##### The 10-week Lifestyle Intervention Fit For School: Impact On Obesity Indices, Biomarkers, And Blood Pressure

Elise C. Brown<sup>1</sup>, Duncan S. Buchan<sup>2</sup>, Frank B. Wyatt<sup>3</sup>, Jonathan Cavana<sup>4</sup>, Julien S. Baker<sup>2</sup>. <sup>1</sup>Oakland University, Rochester Hills, MI. <sup>2</sup>University of the West of Scotland, Hamilton, United Kingdom. <sup>3</sup>Midwestern State University, Wichita Falls, TX. <sup>4</sup>National Health Service Lanarkshire, Carluke, United Kingdom.

Email: elisebrown@oakland.edu

(No relationships reported)

#### SCIENTIFIC ABSTRACT

Although body mass index is frequently used by researchers to evaluate the effectiveness of lifestyle interventions, the inclusion of additional measures may provide a more thorough and valid assessment of intervention effectiveness.

**PURPOSE:** To examine changes in cardiometabolic risk in youth following a 10-week school-based lifestyle intervention. **METHODS:** Forty five participants ( $10.87 \pm 0.54$  yrs) including 27 boys and 18 girls took part in the study. All participants had obesity indices, biomarkers, and blood pressure assessed pre- and post-intervention. Intervention participants completed a weekly 10-week intervention consisting of healthy eating and physical activity education, physical activity, parental involvement, and behaviour change while control participants received no intervention. Changes in outcome measures between groups across time were assessed using general linear mixed models with repeated measures with adjustment for covariates and expectation maximization for missing data. **RESULTS:** A significant group x time interaction was observed for glucose ( $p < 0.05$ ,  $ES = 0.38$ ), TG ( $p < 0.05$ ,  $ES = 0.30$ ), TC ( $p < 0.05$ ,  $ES = 0.36$ ), HDL-C ( $p < 0.05$ ,  $ES = 0.26$ ), and LDL-C ( $p < 0.05$ ,  $ES = 0.41$ ). In the intervention group, TC decreased  $1.31$  mmol/L ( $CI = 0.77$  to  $1.86$ ,  $p < 0.001$ ), HDL increased  $-0.15$  mmol/L ( $-0.28$  to  $-0.02$ ,  $p < 0.05$ ), LDL decreased  $1.5$  mmol/L ( $0.93$  to  $2.07$ ,  $p < 0.001$ ), and WC decreased  $2.3$  cm ( $1.07$  to  $3.53$ ,  $p < 0.05$ ) post-intervention. Systolic BP increased in the control group  $-7.82$  mmHg ( $-14.25$  to  $-1.38$ ,  $p < 0.05$ ), but not in the intervention group. **CONCLUSION:** In conclusion, the 10-week lifestyle intervention, Fit for School, may be an effective way to prevent and reduce cardiometabolic risk factors in primary school children. Although the initial findings appear promising, further work over a longer period of time is required to determine the sustained impact of health enhancement interventions in children on cardiometabolic risk factors. These findings highlight the importance of using additional markers rather than BMI alone to measure intervention effectiveness.

2108 Board #260 June 2, 3:30 PM - 5:00 PM

##### Effects On Cardiovascular Risk Factors Of Three 48-week Community-based Exercise Interventions

Matthew Wade<sup>1</sup>, Steven Mann<sup>1</sup>, Alfonso Jimenez<sup>2</sup>, Sarah Domone<sup>1</sup>, Chris Beedie<sup>3</sup>. <sup>1</sup>ukactive Research Institute, London, United Kingdom. <sup>2</sup>Coventry University, Coventry, United Kingdom. <sup>3</sup>University of Essex, Colchester, United Kingdom.

Email: matthewwade@ukactive.org.uk

(No relationships reported)

A sedentary lifestyle is associated with cardiovascular disease (CVD). Blood pressure (BP) and blood lipids (cholesterols) are key mediators of CVD. A substantial body of evidence demonstrates reduced CVD risk following systematic physical activity (PA).

Despite this evidence, CVD continues to rise, and public health PA initiatives often fail to demonstrate clinically relevant effects. In short, laboratory efficacy often fails to translate into real-world effectiveness. **Purpose:** We investigated the effectiveness of three physical activity interventions. We did so using a Phase-IV clinical trial model, in which all treatments were administered in uncontrolled community settings, and in which all interventions and measures were delivered by, and conducted by, community health centre staff. **Methods:** Participants were sedentary individuals receiving no medication to reduce CVD risk ( $n=238$ , age  $43 \pm 5$  years). Participants selected a PA or exercise (EX) pathway. Those who selected PA were randomised to either fitness centre based PA counselling delivered by an exercise professional (PAC) or a wait-list control condition (CONT). Those who selected EX were randomised to either a structured exercise program (STRUC) or unstructured fitness centre use (FREE). Measures were mean arterial pressure (MAP: mmHg) estimated using the formula  $Diastolic\ Blood\ Pressure\ (BP) + (0.33 \times (Systolic\ BP - Diastolic\ BP))$ , and total cholesterol (TC: mmol/L). Measures were taken at baseline and 48 weeks. Data were analysed using paired-sample t-tests. **Results:** Data analysis for cholesterol indicated a small but statistically significant increase in TC in CONT ( $M=0.8\%$ ,  $SD=0.5$ ,  $p = .005$ ). TC was however approximately equivalent to baseline in PAC and FREE and reduced, although not significantly, in STRUC. Data for blood pressure indicated a statistically significant decrease in MAP in STRUC ( $M=2.5\%$ ,  $SD=8.3$ ,  $P = .004$ ). MAP was reduced, although not significantly, in all other treatments and CONT. **Conclusions:** Data suggest that over 48 weeks, all forms of exercise might be effective in offsetting increases in total cholesterol associated with inactivity. Furthermore, a structured exercise programme might be more effective than either unstructured exercise or physical activity counselling in reducing mean arterial blood pressure.

2109 Board #261 June 2, 3:30 PM - 5:00 PM

##### Changes in Physical Activity and Sedentary Behavior Associated with Exercise Interventions in Depressed Adults

Björg Helgadóttir<sup>1</sup>, David Dunstan<sup>2</sup>, Neville Owen<sup>2</sup>, Örjan Ekblom<sup>3</sup>, Mats Hallgren<sup>1</sup>, Yvonne Forsell<sup>1</sup>. <sup>1</sup>Karolinska Institutet, Stockholm, Sweden. <sup>2</sup>Baker IDI Heart and Diabetes Institute, Melbourne, Australia. <sup>3</sup>Swedish School of Sport and Health Sciences, Stockholm, Sweden.

Email: bjorg.helgadottir@ki.se

(No relationships reported)

**PURPOSE:** Exercise training programs are beneficial for depression, but less is known about their impact on non-intervention physical activity patterns and sedentary behavior patterns in depressed adults. We determined the extent to which participation in light-, moderate- and vigorous-intensity exercise intervention programs influenced the habitual physical activity and sedentary behavior patterns in depressed adults. **METHODS:** Accelerometer data were collected pre- and post-treatment from a subset of depressed participants randomized to one of three 12-week exercise intervention programs: light ( $n=21$ ), moderate ( $n=25$ ) and vigorous ( $n=22$ ) exercise. Mixed models examined changes in accelerometer-measured overall time spent in sedentary, light and moderate-to-vigorous physical activity (MVPA); accumulated sedentary and MVPA bouts; and number of MVPA bouts and interruptions in sedentary time. **RESULTS:** Overall sedentary time decreased while overall light activity increased across all intervention groups but neither significantly so. The light exercise intervention group reduced their MVPA minutes ( $-8.22$ , 95% CI:  $-16.44$ ,  $-0.01$ ), time in MVPA bouts ( $-8.44$ , 95% CI:  $-14.27$ ,  $-2.62$ ), and number of activity bouts ( $-0.43$ , 95% CI:  $-0.77$ ,  $-0.09$ ). The moderate exercise intervention group reduced the time in MVPA bouts ( $-6.27$ , 95% CI:  $-11.71$ ,  $-0.82$ ) and number of sedentary interruptions ( $-5.79$ , 95% CI:  $-9.11$ ,  $-2.46$ ). No changes were observed for the vigorous exercise intervention group. **CONCLUSIONS:** On the whole, participating in a structured exercise intervention did not lead people who are affected by depression to significantly reduce their overall light physical activity nor to increase their sedentary time. Participation in the light and moderate exercise intervention programs was associated with reductions in overall MVPA, but this was not evident for the vigorous exercise intervention program.

2110 Board #262 June 2, 3:30 PM - 5:00 PM

##### Resting Vagal Tone Following a 16-Week High-Intensity Functional Training Intervention

Emily Bechke, Hannah Mimms, Wade Hoffstetter, Paul Serifani, Mathew Smith, Yuri Feito, FACSM, Brian Kliszczewicz.

Kennesaw State University, Kennesaw, GA. (Sponsor: Dr. Yuri Feito, FACSM)

(No relationships reported)

High-Intensity Functional Training (HIFT) has become popular among the general fitness community over the last several years. A commonly known form of HIFT is CrossFit™ (CF), which can be described as a functional training program of high-intensity and mixed modality. Although popularity has increased, little empirical evidence exists in regards to the autonomic nervous system's (ANS) adaptation to

**HIFT. PURPOSE:** The purpose of this study was to examine alterations in resting vagal tone through the measurement of heart rate variability (HRV) over a 16-week CF training program.

**METHODS:** Nine apparently healthy females ( $35.8 \pm 9.25$  years) participated in this study. On two separate occasions, Pre and Post 16-week, participants attended the Exercise Science lab in order to obtain a 10-minute resting HRV recording using Polar Team2 monitors (Lake Success, NY). In order to quantify HRV, the last five-minute segments of each 10-minute recording were analyzed using online Kubios software (Version 2.2). The markers used to quantify HRV were the time domain of the Root Mean Square of Successive Differences (RMSSD) and the High-frequency (HF) of the power spectrum density.

**RESULTS:** Data was log transformed due to a violation of normality and expressed as lnRMSSD and lnHF. Paired sample t-tests showed no significant differences between pre and post lnRMSSD (Pre:  $1.60 \pm 0.24$  ms<sup>2</sup>, Post:  $1.64 \pm 0.20$  ms<sup>2</sup>;  $p = 0.510$ ) and lnHF (Pre:  $1.68 \pm 0.18$  ms<sup>2</sup>, Post:  $1.70 \pm 0.19$  ms<sup>2</sup>;  $p = 0.765$ ).

**CONCLUSIONS:** 16-weeks of HIFT was not sufficient enough to significantly influence markers of resting vagal tone.

2111 Board #263 June 2, 3:30 PM - 5:00 PM

### The Evaluation of a Behavioral Intervention on Self-Regulation for Physical Activity Among Overweight and Obese Adults with Type 2 Diabetes

Devin J. Laurent<sup>1</sup>, Valerie J. Silfee<sup>2</sup>, Timothy R. Shaub<sup>1</sup>, Dr. Rick V. Petosa<sup>1</sup>, Dr. Brian C. Focht, FACSM<sup>1</sup>. <sup>1</sup>Ohio State University, Columbus, OH. <sup>2</sup>University of Massachusetts, Worcester, MA. (Sponsor: Dr. Brian Focht, FACSM)  
(No relationships reported)

In the United States, 1 out of every 3 adults will develop type 2 diabetes (T2DM) in their lifetime. Physical activity is an important part of managing T2DM among adults with the prevalence of sedentary lifestyle increasing. Self-regulation has been an important tool of T2DM management, as adults with T2DM are often required to monitor their diet and physical activity. Therefore, it is important for health professionals to focus on advancing any pre-existing use of self-regulatory strategies to also include exercise behavior. **PURPOSE:** To evaluate the effect of a brief, behavioral intervention on dimensions of self-regulation for physical activity in a sample of overweight and obese adults with T2DM. **METHODS:** A total of 23 participants were randomly assigned to intervention ( $n=12$ ) and control ( $n=11$ ). Individuals in both groups met with researchers individually during fifteen-minute sessions once a week for four weeks. The intervention group engaged in a behavioral intervention that targeted self-regulation variables by incorporating exercise diaries to plan and log weekly physical activity that used goal setting and self-monitoring. The control group only received information regarding their own weekly physical activity habits and was excluded from self-regulation strategies provided in the intervention group. Measures of physical activity, in minutes, using a BodyMedia Armband and dimensions of perceived self-regulation were taken at pretest and 4-week posttest. **RESULTS:** The effect of the intervention on self-regulation scores was significant,  $F(1, 21) = 7.011$ ,  $p = .015$ . This implies that there were significant differences in self-regulation between the intervention and control groups. Inspection of Cohen's  $d$  effect sizes reveals a large effect ( $d = .581$ ) of the intervention on all dimensions of self-regulation. **CONCLUSIONS:** This study demonstrated the ability of a behavioral intervention to improve self-regulation for physical activity scores among a sample of overweight and obese adults with T2DM. This is critical as health promotion programs can adopt similar strategies to improve self-regulation for physical activity in this population and for future research.

2112 Board #264 June 2, 3:30 PM - 5:00 PM

### An Intervention To Reduce Sedentary Time And Change Perceived Wellness In Women Office Workers

Joyan Urda, Jeffrey Lynn, Beth Larouere. *Slippery Rock University, Slippery Rock, PA.* (Sponsor: Patricia Pierce, FACSM)  
Email: joyan.urda@sru.edu  
(No relationships reported)

Physical activity and exercise reduce the risk of chronic disease. Sedentary behavior has emerged as an independent risk factor for chronic disease and premature death. **PURPOSE:** To determine whether an intervention to disrupt sedentary time at work would reduce sedentary time during working hours, non-working hours, number of sit-stand transitions during working hours, and change in perceived wellness. **METHODS:** Office staff and administrators who worked in office buildings at a University with a sedentary job description, consisting of sitting at a desk for the majority of the workday were recruited. Participants ( $n = 44$ ) were randomly assigned to the control-control group (CC) ( $n=22$ ), or the control-intervention group (CI) ( $n=22$ ). Both groups wore an activPAL3 activity monitor, functioning as both an accelerometer and inclinometer continuously for 2 weeks. The CC group maintained normal behaviors. The CI group maintained normal behaviors during week 1, but

responded to the hourly alerts on their computer throughout the workday during week 2. The hourly audible alert was a reminder to get up and move for a short duration. Both groups completed a perceived wellness survey at the beginning of the study and after weeks 1 and 2. **RESULTS:** Participants were women aged  $48 \pm 10$  with a BMI of  $30.5 \pm 8.2$ . A repeated measures ANOVA (group x time) found no differences during week 2 in sit time during non-work hours (CC  $13.82 \pm 1$ ; CI  $13.54 \pm 1$ ;  $p = .444$ ) or sit-to-stand transitions at work (CC  $39 \pm 12$ ; CI  $41 \pm 13$ ;  $p = .673$ ). There was a between groups difference in sedentary time at work during week 2 (CC  $6.05 \pm .74$ ; CI  $5.42 \pm 1.19$ ;  $p = .012$ ). However, neither group changed from week 1 to week 2 ( $p = 0.509$ ). Perceived wellness was not different between groups ( $p > 0.05$ ). A significant difference was found in perceived wellness from day 0 to day 16 ( $p < 0.001$ ) in both groups. **CONCLUSIONS:** The intervention had no effect on sitting time or sit-to-stand transitions during the workday. There was no change in any variable during non-work hours. Perceived wellness scores improved over time for both groups in the absence of behavior change.

2113 Board #265 June 2, 3:30 PM - 5:00 PM

### A Minimal Intervention to Promote Healthy Lifestyles among Medical Students in Bogota

Diana C. Paez<sup>1</sup>, Tatiana García-Betancourt<sup>2</sup>, Sebastian Cortés<sup>2</sup>, Mario A. Jimenez<sup>1</sup>, Felipe Lobelo<sup>3</sup>, John Duperly<sup>4</sup>. <sup>1</sup>School of Medicine, Universidad de los Andes, Bogota, Colombia. <sup>2</sup>Fundación Santa Fe de Bogotá, Bogota, Colombia. <sup>3</sup>Hubert Department of Global Health, Rollins School of Public Health, Emory University, Atlanta, GA. <sup>4</sup>School of Medicine, Universidad de los Andes - Fundación Santa Fe de Bogotá, Bogota, Colombia.  
Email: paez.d.carolina@gmail.com  
(No relationships reported)

#### Scientific Abstract

Physical Activity (PA)  
Body Mass Index (BMI)

**PURPOSE:** To evaluate the impact of an intervention to promote healthy lifestyles among medical students at Universidad de los Andes in Bogota, Colombia. **METHODS:** A longitudinal, exploratory study was conducted between May 2014 and June 2015. The sample contained 156 medical students enrolled in the Medical Physiology course. The curriculum intervention comprised a healthy lifestyle promotion strategy. One class was dedicated to Exercise Physiology. Students were asked to conform groups to research topics related to PA, nutrition and tobacco. The professor gave a formative sport incentive (10% of the final grade) to the student who regularly practiced PA and adopted healthy behaviors during the semester. A quantitative approach was used to measure health and fitness-related variables (i.e. BMI, Body fat,  $\dot{V}O_2$ max, Handgrip strength, Sit-up strength) at the beginning and at the end of the course. A qualitative approach was used to assess perceptions about the curriculum intervention and PA practices. Data was collected through self-reported evaluations ( $n=130$ ) and semi-structured interviews ( $n=36$ ). **RESULTS:** Of students, 57% were females, with age average of  $20 \pm 1.5$  years. Body fat decreased in 1.24% [CI: -1.81 to -0.67;  $p$ -value<0.01], estimated  $\dot{V}O_2$ max improved in 3 ml/kg/min [CI: 2.45 to 3.57;  $p$ -value<0.01]; Handgrip strength increased in 2.8 kg [CI: 1.83 to 3.83;  $p$ -value<0.01]; and Sit-up strength in 30 seconds increased in 3 Sit-ups [CI: 2.43 to 3.72;  $p$ -value<0.01]. No differences observed in BMI. All students reported to have practiced PA during the semester –on average three times a week– influenced by the curriculum intervention; particularly the academic incentive and physical fitness tests. Students reported to practice a vast variety of PA activities –sports, workouts, aerobic– mainly accompanied by friends, classmates and family members. Lack of time was the main barrier to practice PA. The intervention increased student's recommended levels of PA (83% students post class compared to 36% students pre class). **CONCLUSION:** A minimal curricular intervention was effective in improving medical students' personal PA habits and fitness. It remains to examine whether achievements of healthy lifestyles among students are maintained over time.

2114 Board #266 June 2, 3:30 PM - 5:00 PM

### Long-term Effectiveness Of A Primary-care Health Intervention In New Zealand

Michael J. Hamlin, Elise G. Yule, Catherine A. Elliot. *Lincoln University, Canterbury, New Zealand.* (Sponsor: Dominic Micklewright, FACSM)  
Email: Michael.Hamlin@lincoln.ac.nz  
(No relationships reported)

The continued increase in the number of adults suffering from chronic diseases is a major health concern for most countries. The 'Green Prescription', New Zealand's primary-care health initiative has been operating for 16 years, yet its long-term effectiveness on physical activity behavior has not been investigated. **PURPOSE:** To quantify the effectiveness of the Green Prescription program on changes in physical activity levels over 2-3 years. **METHODS:** Physical activity and health information

was gathered via telephone interviews from patients that were offered a Green Prescription program up to 3 years ago. Respondents were classified as either having completed the program (intervention group,  $n = 93$ ), or not completed the program (control group,  $n = 56$ , either declined enrolment, or dropped out after a few sessions). **RESULTS:** Participants who had completed the Green Prescription program 2-3 years ago reported  $64 \pm 48$  additional minutes per week (mean  $\pm$  95% CI) of physical activity compared to those that dropped out. Forty-two percent of participants in the intervention group reported increased physical activity levels since being prescribed the Green Prescription compared to 29% in the control group. The control group were more likely to be sedentary than the intervention group (Odds Ratio 1.8, 95% CL 1.2-2.9) and less likely to meet the current physical activity guidelines of at least 150 minutes of physical activity per week (comprising of at least 30 min per day on 5 or more days) (OR = 0.7, 95% CL 0.3-1.4). **CONCLUSION:** After being offered a Green Prescription 2-3 years ago, participants who completed the program were substantially more physically active and less sedentary than those that dropped out of the program, indicating a long-term benefit of the Green Prescription program. While physical activity levels were higher in the intervention group compared to the control group, further research is required to identify why only a small proportion of either group currently meet physical activity guidelines.

2115 Board #267 June 2, 3:30 PM - 5:00 PM

### Effects On Aerobic Capacity Of Three 48-week Community-based Exercise Interventions

Alfonso Jimenez<sup>1</sup>, Steven Mann<sup>2</sup>, Sarah Domone<sup>2</sup>, Matthew Wade<sup>2</sup>, Chris Beedie<sup>3</sup>. <sup>1</sup>Coventry University, Coventry, United Kingdom. <sup>2</sup>ukactive Research Institute, London, United Kingdom. <sup>3</sup>University of Essex, Colchester, United Kingdom. Email: ab9935@coventry.ac.uk  
(No relationships reported)

A sedentary lifestyle is associated with cardiovascular disease (CVD). A substantial and compelling body of evidence demonstrates reduced CVD risk following systematic physical activity (PA). Despite this evidence, CVD continues to rise, and public health PA initiatives appear to be failing to demonstrate clinically relevant effects. **Purpose:** A core component of cardiovascular health is the ability to utilise oxygen, termed 'oxygen uptake' or  $VO_2$ . We investigated the effectiveness of three physical activity interventions on oxygen uptake. We did so using a Phase-IV clinical trial model, in which all treatments were administered in uncontrolled community settings, and in which all interventions and measures were delivered by, and conducted by, community health centre staff. **Methods:** Participants were sedentary individuals receiving no medication to reduce CVD risk ( $n=238$ , age  $43 \pm 5$  years). Participants selected a PA or exercise (EX) pathway. Those who selected PA were randomised to either fitness centre based physical activity counselling delivered by an exercise professional (PAC) or a wait-list control condition (CON). Those who selected EX were randomised to either a structured exercise program (STRUC) or unstructured fitness centre use (FREE). The dependent measure was predicted maximum oxygen uptake ( $VO_2$  max; ml/kg/min), measured using the COSMED Fitmate. Measures were taken at baseline and 48 weeks. **Results:** Repeated measures ANOVA indicated no statistically significant difference between treatments ( $F [3,215] = 1.173$ ,  $p = .321$ ), and paired-sample t-tests indicated no significant pre-post effects for any treatment. When data were grouped using a quartile split by baseline  $VO_2$  max however, repeated measures ANOVA indicated significant differences between groups ( $F [3,215] = 16.1$ ,  $p < .001$ ), specifically that whilst in the highest two quartiles  $VO_2$  max was reduced ( $M = -2.7$ ,  $SD = 7.0$ ,  $p = .05$  and  $M = -2.6$ ,  $SD = 6.0$ ,  $p = .008$  respectively), and no significant change was observed in the third quartile ( $M = -0.1$ ,  $SD = 5.0$ ,  $p = .89$ ), in the lowest quartile,  $VO_2$  max was significantly increased ( $M = 4.1$ ,  $SD = 6.6$ ,  $p < .001$ ). **Conclusions:** Data suggest that in terms of  $VO_2$ , treatments in the current study were more effective with the least fit participants at baseline, and actually counter-productive for the most fit.

2116 Board #268 June 2, 3:30 PM - 5:00 PM

### Utilizing Blood Flow Restriction Training As An Intervention For Sedentary Individuals: A Protocol Assessment

Guillermo E. Perez<sup>1</sup>, Murat Karabulut<sup>2</sup>. <sup>1</sup>University of Texas Health Science Center Houston School of Public Health, Houston, TX. <sup>2</sup>University of Texas Rio Grande Valley, Brownsville, TX.  
(No relationships reported)

Increased levels of strength have demonstrated positive effects on body fat, resting metabolic rate, blood pressure, glucose metabolism, and insulin resistance. Many people, however, do not participate in strength training due to fear of re-injury, disabilities, and lack of time and/or motivation. A novel exercise technique known as blood flow restriction training (BFR) that consists of restricting the circulatory pathways by way of pneumatic cuffs or elastic wraps has gained popularity. It has been found that BFR increases skeletal muscle activation and strength while using shorter training times, a relatively low intensity (20% 1RM), as well as low intensity walking

and biking making it a viable intervention for sedentary individuals. However, a proper protocol has not been developed. The protocol currently in use did not evaluate initial restrictive pressure (IRP), an important variable, in its design. Additionally, individuals that have used BFR report high levels of pain or discomfort. **PURPOSE:** To examine the current protocol with the inclusion of various IRP, while observing changes in electromyography (EMG), maximal voluntary contraction (MVC), rate of perceived exertion (RPE), and discomfort/pain (DP). **METHODS:** Sixteen healthy male (age = 26.63 (5.8) yrs.) participants performed four sets of bilateral knee extensions on three separate occasions separated by at least 48 hours. Each session was randomized into the following conditions: IRP50@FRP+20, IRP65@FRP-20, and IRP50 (Control). During each condition RPE and DP were recorded. MVC was recorded pre and post exercise. EMG was recorded at the vastus lateralis with a focus on motor unit activation (RMS) and muscle firing rate (MDF). **RESULTS:** No significance was found between conditions for RPE, DP, or MDF. The strength of knee extensors was significantly decreased by IRP65@FRP-20. **CONCLUSION:** The results suggest that IRP may be used to elicit a greater effect during BFR exercise without changing the level of exertion or discomfort felt by the subject. Further research is needed for the development of a proper protocol, which includes IRP in its design, so that BFR may be utilized as an intervention technique in a sedentary population.

2117 Board #269 June 2, 3:30 PM - 5:00 PM

### Influence of a Physical Activity Intervention on Perceived Barriers and Benefits in Women

Kathryn E. Lundberg, Tanis J. Walch, John S. Fitzgerald, James R. Whitehead, FACSM. University of North Dakota, Grand Forks, ND.  
(No relationships reported)

Young adults face an abundance of behavior choices when entering college. One important decision is to regularly participate in physical activity. Common barriers to physical activity may hinder an individual's decision to make healthy behavior choices, such as physical activity.

**PURPOSE:** To examine the impact of a women's physical activity intervention on perceived benefits and barriers, body composition, and energy expenditure.

**METHODS:** Non-randomized experimental design was used between two groups ( $n=50$ ) of college-aged women. The first group was enrolled in one of two one-credit physical activity courses (intervention;  $n=15$ , age=21.93 years). The second group was enrolled in a freshman general requirement course (control;  $n=35$ , age=19.8 years). The intervention included a 7-week physical activity program (150 minutes/week) developed based on the Health Belief Model, which targeted perceived barriers and benefits to exercise. Each session highlighted behavior change strategies targeting barriers and benefits, followed by a physical activity session. Pretest and posttest measurements included: Exercise Benefits/Barriers Scale to assess barriers and benefits to physical activity, BODPOD to measure body composition, and accelerometry to estimate daily energy expenditure (SenseWear armband). ANCOVA was used to evaluate differences between groups after the intervention (SPSS).

**RESULTS:** Intervention women increased fat-free mass (0.49kg) compared to a loss of fat-free mass in control (-2.5kg;  $p=0.03$ ). Physical performance, a benefit subscale to exercise, also showed a trend (control=-0.07; intervention= 0.13,  $p=0.07$ ). There was no significant difference in energy expenditure between groups.

**CONCLUSIONS:** The increase in fat-free mass is a significant finding when looking at energy balance and weight management over time. Resting metabolic rate is strongly associated with fat-free mass; accounting for 70% of resting metabolic rate. A trending increase in physical performance suggests a physical activity intervention may be effective for preventing sedentary behavior and promoting physical activity in college-age populations. Policies that mandate a physical activity course for freshman students may be one way to protect against chronic disease and overweight/obesity.

2118 Board #270 June 2, 3:30 PM - 5:00 PM

### Comparison Of A Soccer-lead Community-based Intervention Vs. Commercial Programme For Weight-loss In Men And Women.

Zoe Rutherford, Jim McKenna, Andy Pringle. Leeds Beckett University, Leeds, United Kingdom. Email: z.h.rutherford@leedsbeckett.ac.uk  
(No relationships reported)

For many years, Public Health in the UK has used weight management interventions and therefore weight loss as the key mechanism for reducing cardiovascular disease (CVD) risk. While traditional interventions have focussed on nutritional support and feminised commercial weight loss groups, many commissioners now look to more innovative sport-based alternatives to engage harder to reach groups in improving CVD risk. Despite this, little direct comparison has been made between the two types of programme as to their effectiveness. **PURPOSE:** To compare the effectiveness of Motivate, a 12-week weight management programme, delivered by a professional soccer club (MOT), with a commercial weight loss group (COM) in reducing the body weight of community dwelling men and women 35 years and older.

**METHODS:** One hundred and seventy three men and 98 age-matched women (mean age = 52.28 ± 9.74 and 51.19 ± 9.04) attending the MOT and COM programmes during March 2012- February 2013 were included. Height (m) and weight (kg) were measured at weeks 1 and 12 as part of both interventions. Changes in body weight were compared over the 12 weeks and between the two interventions using a 2-way RM ANOVA, with significance set to  $p < 0.05$ .

**RESULTS:** Body Weight significantly improved over time in both MOT (4.76kg,  $p < 0.05$ ) and COM programmes (4.55 kg,  $p < 0.05$ ). Men were significantly heavier than women ( $p < 0.00$ ) in both programmes, but there was no significantly different change in weight loss between genders. There was a significant difference in weight loss between programmes ( $p < 0.05$ ), but not when controlling for starting weight ( $p = 0.903$ ). Attendance was similar for both programmes and there was a significant relationship between the number of sessions attended and weight loss in men ( $r = 0.513$ ,  $p < 0.00$ ) and women ( $r = 0.559$ ,  $p < 0.00$ ).

**CONCLUSIONS:** Despite larger numbers of men and women achieving 5% weight loss in the commercial weight loss group, innovative community weight management interventions aimed at reducing CVD risk via weight loss programmes using high intensity exercise as well as nutrition education are equally as successful at reducing body weight in men and women, when controlling for starting body weight. When comparing solely weight loss, the wider cardiovascular health benefits of such interventions may be masked.

2119 Board #271 June 2, 3:30 PM - 5:00 PM

### A 5-week Zumba Fitness® Intervention Improves Quality Of Life In Inactive Ecuadorian Workers

Emilio Villa-González, Susana Paz-Viteri, Vinicio Sandoval, Marcela Guerendiain, Yaira Barranco-Ruiz. *National University of Chimborazo, Riobamba, Ecuador.*

Email: emiliovillagon@gmail.com

(No relationships reported)

Zumba Fitness® is a highly popular aerobic dance fitness program that combines different Latin Rhythm. Despite the attractiveness of Zumba, there is little evidence supporting the potential health benefits of this relatively new exercise approach. Purpose: To investigate the effects of a Zumba Fitness® intervention on quality of life in inactive Ecuadorian workers. Methods: A total of 69 inactive (<150 min of physical activity /week) participants (age 38.8±0.93 yrs; women, 81.2%; men, 18.8%) completed a 5-week intervention attending Zumba Fitness classes 3 days/week, 60 minutes/class out from working hours. Quality of life using the SF-36 Health Survey was measured at pre-intervention, post- intervention and 2-months follow-up. The rating of perceived exertion by Borg Scale (0-10) was recorded after each Zumba class (mean RPE=6.35±0.10). Repeated measures ANOVA test was used to compare variables before, after and follow-up of the intervention. Results: Significant differences ( $p < 0.05$ ) were observed immediately after intervention (mean differences post-intervention — pre-intervention) in physical role (17.89±7.03), vitality (12.89±3.81) mental health (6.37±2.27) and health transition (16.96±4.50) subscales from SF-36. In addition, social function (10.37±4.13) and mental health (9.76±3.42) subscales showed a significant increase at 2-months follow-up (mean differences 2-months follow-up — pre-intervention). No interaction on the effects of the intervention was observed by sex. Conclusions: A 5-week Zumba Fitness® intervention improves quality of life in Ecuadorian inactive workers at short and long-term. Funding was provided by the National University of Chimborazo, Ecuador (29-CI-2014-10-17-22).

2120 Board #272 June 2, 3:30 PM - 5:00 PM

### Reductions In Diabetes And Cardiovascular Risk Following An Exercise And Diet Intervention For Diabetes Prevention

Elroy J. Aguiar, Philip J. Morgan, Clare E. Collins, Ronald C. Plotnikoff, Myles D. Young, Robin Callister. *The University of Newcastle, Callaghan, NSW, Australia.*

Email: elroy.aguiar@uon.edu.au

(No relationships reported)

**PURPOSE:** To determine the impact of the type 2 diabetes (T2D) Prevention Using LifeStyle Education (PULSE) program for men on T2D and cardiovascular disease (CVD) risk.

**METHODS:** A 6-month parallel-group RCT was conducted. Eligible men were aged 18-65 years, BMI 25-40 kg m<sup>-2</sup> and at high-risk for T2D (Australian T2D Risk Assessment Tool). Men were randomized (stratified by age and BMI) to the intervention (n=53) or wait-list control (n=48) groups. The PULSE Program consisted of print and video resources on weight loss, diet and exercise for T2D prevention. Men were provided with a home-based unsupervised aerobic and resistance training program. Participants provided written informed consent. Assessments were conducted at baseline, 3 and 6 months (primary time point). Linear mixed models (intention-to-treat) were used to determine significant ( $P < 0.05$ ) group-by-time interactions. Effect sizes were calculated using Cohen's *d*. Chi-square ( $X^2$ ) tests were used to detect

significant differences ( $P < 0.05$ ) between groups for classification of prediabetes, MetS and CVD risk (Framingham 10-year risk [next highest, >10%], and Australian 5-year risk [moderate, >10%]).

**RESULTS:** Baseline characteristics (mean±SD) were: age (52±10 yrs), weight (103.0±13.1 kg) and HbA<sub>1c</sub> (5.8±0.5%). At baseline there were no between group differences for prediabetes, MetS, Framingham or Australian CVD risk score (all  $p < 0.05$ ). Group-by-time differences at 6 months (mean [95% CI]) favored the intervention for weight (-5.50 kg [-7.40, -3.61],  $p < 0.01$ , Cohen's *d*=0.42, primary outcome), HbA<sub>1c</sub> (-0.2% [-0.3, -0.1],  $p < 0.01$ ,  $d = 0.41$ ), waist (-6.2 cm [-8.7, -3.7],  $p < 0.01$ ,  $d = 0.98$ ), VO<sub>2max</sub> (3.43 mL.kg<sup>-1</sup>.min<sup>-1</sup> [0.73, 6.13],  $p = 0.01$ ,  $d = 0.51$ ) and lower body muscular fitness (17 repetitions [9, 25],  $p < 0.01$ ,  $d = 0.74$ ). At 6 months there was a significant between group difference favoring the intervention for the Australian CVD risk score ( $X^2 = 5.76$ ,  $p = 0.02$ ) and Framingham CVD risk score trended towards significance ( $X^2 = 3.34$ ,  $p = 0.07$ ), but no differences in prediabetes ( $X^2 = 0.08$ ,  $p = 0.78$ ) or MetS ( $X^2 = 0.01$ ,  $p = 0.94$ ) classification.

**CONCLUSION:** A self-administered lifestyle intervention induced improvements in T2D and CVD risk. This has important implications, as self-administered programs have great potential for dissemination.

Supported by HMRI

2121 Board #273 June 2, 3:30 PM - 5:00 PM

### Qualitative Analysis of Health Coaches' Experiences during a Workplace Wellness Intervention

Justine Vosloo<sup>1</sup>, William Way<sup>1</sup>, Alessandro Quartiroli<sup>2</sup>, Jessica Ford<sup>1</sup>, Sierra Yaple<sup>1</sup>, Sydney Masters<sup>1</sup>, Patrick McConnell<sup>1</sup>, Gary A. Sforzo, FACSM<sup>1</sup>. <sup>1</sup>*Ithaca College, Ithaca, NY.* <sup>2</sup>*University of Wisconsin, La Crosse, La Crosse, WI.*

Email: jvosloo@ithaca.edu

(No relationships reported)

Health coaching is an emerging field not yet examined as intensively as specific theoretical approaches (e.g., motivational interviewing) known to facilitate health behavior change, though evidence supporting coaching's effectiveness is positive. There is little study of the health coach's perspective on the coaching experience and such knowledge would be valuable to advancing this young profession. **PURPOSE:** To examine health coaches perceptions and experiences with clients during a workplace wellness program (WWP). **METHODS:** Professional health coaches (N=13; trained by Wellcoaches methods and with at least one-year in practice) were interviewed individually after being employed to provide up to 6 mo coaching to over 300 participants in a workplace wellness program. The interview inquired about their experiences and approaches in 30-35 min weekly coaching sessions with their clients from diverse socio-economic backgrounds. The semi-structured interviews lasted between 40-60 min. Consensual Qualitative Research (CQR) procedures were used to analyze interview data in developing higher order themes and subthemes. **RESULTS:** Four domains were revealed: 1) treatment approaches, tools and skillsets used during coaching; 2) challenges and experiences with WWP intervention; 3) Coach experiences towards own journey to wellbeing; 4) client-coach connections and positive/negative experiences with clients. Subthemes identified factors coaches described as important components of the coaching process (e.g., client driven approach), the navigation of challenging interactions or experiences during the coaching process (e.g., clients not wanting coaching), and the experiences associated with implementing a treatment approach/philosophy with clients from WWP that differed compared to typical clients. **CONCLUSION:** Providing coaching in the workplace presents various challenges related to flexibility of coaching within the program structure. However, coaches interviewed were generally positive about working with their clients. Relationship building was identified as critical to success in the coaching process. Future work should compare coach and client experiences in the coaching process. Funding provided by: Institute of Coaching at McLean Hospital, a Harvard Medical School affiliate

2122 Board #274 June 2, 3:30 PM - 5:00 PM

### A Randomized Controlled Trial to Test the Feasibility of the Trans-Contextual Model in Physical Activity

Sami Yli-Piipari<sup>1</sup>, Todd Layne<sup>2</sup>, Carol Irwin<sup>2</sup>. <sup>1</sup>*University of Georgia, Athens, GA.* <sup>2</sup>*University of Memphis, Memphis, TN.*

(Sponsor: Dr. Rodney Dishman, FACSM)

Email: syp@uga.edu

(No relationships reported)

One of the key questions in human behavior is how social environment facilitates individuals' behavior change. Trans-contextual model (TCM) is an integration of social psychological theories; self-determination theory (SDTD), hierarchical model of intrinsic and extrinsic motivation (HMIEM), and theory of planned behavior (TPB), and it is designed to determine the role of social agents on motivation and intended behavior. Specifically, TCM is a multi-theory approach to understanding the processes by which forms of motivation toward educational activities in a classroom context lead to motivation toward similar activities and behaviors in out-of-school contexts.

**PURPOSE:** The present study was a randomized controlled trial to examine the feasibility of the TCM on predicting physical education (PE) students' autonomous motivation and its transfer to intended physical activity (PA) participation.

**METHODS:** A three-wave data comprising six schools (3 experiment and 3 delayed treatment schools) and 408 (experimental = 198; ncontrol = 210) school students (Mage = 12.29). Participants were recruited based on their affiliation in a local school district, and the data were collected in a middle school setting in the mid-south United States during a seven week period. Primary outcomes of this parallel group study were student autonomous motivation in PE and exercise, PA intention, and PA.

**RESULTS:** Firstly, the results showed that the intervention had a positive effect on students' autonomous PE motivation via their perception of autonomy ( $\beta = .29, p < .01$ ) explaining 51% in the changes in the students' autonomous PE motivation (SDT premise). Secondly, autonomous motivation in PE was shown to predict autonomous motivation in exercise ( $\beta = .63, p < .01; R^2 = .44$ ). (HMIEM premise). Finally, autonomous motivation in exercise predicted PA through PA intention (TPB premise) explaining 35% of the changes in the variance of PA. In addition, a moderate indirect effect from autonomous exercise motivation via PA intention to PA emerged ( $\beta = .17, p < .01, CI\ 95\% [.11, .22]$ ).

**CONCLUSIONS:** This study corroborated the central tenets of the TCM, and supported its feasibility on real life PE context. Future studies are needed to examine the long lasting effects of autonomy support on PA.

2123 Board #275 June 2, 3:30 PM - 5:00 PM  
**Telephone Coaching to Enhance Physiotherapy-Prescribed Physical Activity for Knee Osteoarthritis: A Randomised Controlled Trial**

Gregory S. Kolt, FACSM<sup>1</sup>, Penny K. Campbell<sup>2</sup>, Thorlene Egerton<sup>2</sup>, Ben Metcalf<sup>2</sup>, Jessica Kasza<sup>3</sup>, Andrew Forbes<sup>3</sup>, Caroline Bills<sup>4</sup>, Janette Gale<sup>4</sup>, Anthony Harris<sup>3</sup>, Stephen J. Bunker<sup>5</sup>, David J. Hunter<sup>6</sup>, Caroline A. Brand<sup>2</sup>, Rana S. Hinman<sup>2</sup>, Kim L. Bennell<sup>2</sup>. <sup>1</sup>Western Sydney University, Sydney, Australia. <sup>2</sup>The University of Melbourne, Melbourne, Australia. <sup>3</sup>Monash University, Melbourne, Australia. <sup>4</sup>HealthChange Australia, Sydney, Australia. <sup>5</sup>Medibank Health Solutions, Melbourne, Australia. <sup>6</sup>University of Sydney, Sydney, Australia.  
 Email: g.kolt@westernsydney.edu.au  
 (No relationships reported)

Clinical and general health guidelines recommend physical activity (PA) and exercise for osteoarthritis (OA). Among people with OA, PA levels are low, there is a global underutilisation of exercise, and benefits are generally not sustained due to suboptimal adherence that declines over time. Telephone delivered health coaching can be used in chronic disease management to improve adherence to treatment recommendations and to facilitate health behaviour change.

**PURPOSE:** To investigate whether telephone coaching improves effectiveness of a physiotherapy-prescribed home-based PA and exercise program for people with knee OA.

**METHODS:** A 2-arm pragmatic randomised controlled trial was carried out with 168 inactive adults aged 50 years and older with knee pain and clinically-diagnosed knee OA. After randomisation to a Coaching (N=84) or Control (N=84) group, all participants received 5 x 30-minute individual consultations with a physiotherapist over 6 months for education, home-based exercise prescription, and advice to increase PA. Those in the Coaching group also received 6-12 telephone coaching sessions by trained health coaches for behaviour change support around PA. Primary outcomes were self-reported knee pain (numeric rating scale) and physical function (WOMAC) at 6 months. Secondary outcomes included these same measures at 12 and 18 months, other pain measures, PA, and quality of life.

**RESULTS:** 142 (85%), 136 (81%), and 128 (76%) participants completed 6-, 12- and 18-month measurements, respectively. Change in pain (mean difference 0.4 units; 95%CI -0.4, 1.3) or WOMAC function (1.8; 95%CI -1.9, 5.5) did not differ between groups at 6 months, with both showing clinically relevant improvements. Results were similar at 12 and 18 months. Coaching improved self-reported PA (Physical Activity Scale for the Elderly -28.3; 95%CI -54.9, -1.8) more at 6 months, and home exercise adherence (percentage of prescribed sessions completed) was higher in Coaching (mean 69%; 95%CI 63, 75) versus Control (mean 55%; 95%CI 47, 61) during the 6-month intervention but not follow-up.

**CONCLUSION:** Although addition of telephone coaching to a physiotherapist-prescribed PA program increased self-reported PA and exercise adherence in the shorter-term, it did not augment pain and function benefits.

2124 Board #276 June 2, 3:30 PM - 5:00 PM  
**Changes In Physical Activity And Smoking Behaviors In A Randomized Controlled Trial**

Ernestine Jennings<sup>1</sup>, Shira Dunsiger<sup>2</sup>, Beth Bock<sup>1</sup>. <sup>1</sup>The Miriam Hospital/ Brown Medical School, Providence, RI. <sup>2</sup>The Miriam Hospital/ Brown University, Providence, RI.  
 Email: ejennings1@lifespan.org  
 (No relationships reported)

**Purpose:** The present study examined the reported changes in moderate to vigorous physical activity (MVPA) and smoking behaviors at the end of an 8-week treatment as part of an ongoing study. **Methods:** Healthy sedentary smokers (N= 57) were randomly assigned to an 8-week cognitive behavioral smoking cessation program (CBT) plus either an Iyengar yoga program (Yoga) or a health & wellness control (CTL). **Results:** Participants averaged 46.9 years of age (SD=11.5), were predominantly women (54.4%), mean BMI was 27.8 (SD=4.6). Participants reported smoking an average of 17.8 (SD=10.1) cigarettes per day at baseline. Self-reported minutes/week of MVPA was collected via the 7 day Physical activity recall (PAR) at baseline and 8 weeks, along with cigarettes/smoked per day and confidence to quit. The yoga program was designed for sedentary novices and was considered as light activity on the PAR. Using a generalized linear model, we tested the association between treatment group and changes in MVPA over the 8 week treatment phase. At baseline there were no significant differences in MVPA between groups (Yoga = 122 min/week; CTL = 154 min/week). Results did not show significant between-group differences in MVPA ( $p > .05$ ), we tested the association between changes in MVPA and changes in cigarettes smoked/ day over the same treatment period, amongst the aggregated sample. A similar modeling approach was used in which mean cigarettes/day at 8 weeks was regressed on changes in min/week of MVPA from baseline to 8 weeks, controlling for baseline smoking levels. Results revealed a significant negative association such that those with greater increases in MVPA over 8 weeks reported lower mean cigarettes smoked/day at end of treatment ( $b = -0.02, SE = 0.01, p = 0.02$ ). Furthermore, there was a trend for a positive association between changes in MVPA and changes in mean confidence to quit smoking,  $b = .01, SE = .004, p = .09$ . **Conclusion:** These results provide an indication that self-initiated changes in moderate-to vigorous physical activity among a sample of adult smokers may be associated with reductions in smoking behavior and increased confidence to quit.

Supported by NIH R01 AT006948

2125 Board #277 June 2, 3:30 PM - 5:00 PM  
**BodyPump And Resistance Training With And Without A Personal Trainer - A Randomized Controlled Trial**

Anne Mette Rustaden, Lene Anette Haakstad, Gøran Paulsen, Kari Bø. Norwegian School of Sports Sciences, Oslo, Norway.  
 Email: anne.mette.rustaden@nih.no  
 (No relationships reported)

**PURPOSE:** To compare the effect of BodyPump and traditional resistance training with and without a personal trainer to a non-exercising control group, on muscle strength and body composition in overweight previously inactive females.

**METHODS:** Healthy, non-exercising women with a BMI  $\leq 25$  (n=143) were randomized into one of four groups; BodyPump (BP) (n=37), resistance training with a personal trainer (PT) (n=35), non-supervised resistance training (NS) (n=35) or control group (C) (n=36). Participants in the BP group followed a high repetition (20-100 in each muscle group), low- to moderate group resistance program. Participants in the PT and NS group followed a non-linear resistance program (repetitions 3-15, series 2-4). The interventions included three sessions (45-60 minutes) weekly for a period of 12 weeks. Primary outcome was maximal muscle strength measured with one repetition maximum (1RM), and 70 % submaximal muscle strength in squat and bench press. Secondary outcome was body composition measured with Inbody 720.

**RESULTS:** Loss to follow-up were 32 %, 17 %, 40 % and 36 % in BP-, PT-, NS- and C group, respectively. Of totally 36 exercise sessions prescribed adherence were 21.1 (SD 7.8) in BP, 32.2 (SD 5.6) in PT and 26.9 (SD 7.6) in NS. The BP group did not show any effect in muscle strength compared to controls, but significant improvements were seen in the PT and NS group. The PT group increased 35 % in 1RM squat (kg) (95 % CI 15.8 - 33.0,  $p \leq 0.001$ ), 21 % in 1RM bench press (95 % CI 3.5 - 9.3,  $p \leq 0.001$ ), 60 % in submaximal strength squat ( $kg^{\frac{1}{2}}$  reps) (95 % CI 47.2 - 771.7,  $p = 0.018$ ) and 27 % in submaximal bench press (95 % CI 25.1 - 216.3,  $p = 0.028$ ). The NS group increased 18 % in 1RM squat (95 % CI 1.1 - 19.6,  $p = 0.020$ ), 21 % in bench press (95 % CI 2.9 - 9.4,  $p \leq 0.001$ ), 51 % in submaximal strength squat (95 % CI -28.9 - 807.7,  $p = 0.028$ ) and 38 % in submaximal strength (95 % CI 32.5 - 248.0,  $p = 0.004$ ) bench press. None of the groups showed improvements in body composition.

**CONCLUSION:** Resistance training with and without a personal trainer showed the best results in muscle strength. None of the groups differed from control group in body composition. Adherence to resistance training was highest in the personal trainer group.

2126 Board #278 June 2, 3:30 PM - 5:00 PM  
**A Single-blinded Randomized, Controlled Study Of The Effects Of Stretch Refle Air On Flexibility**  
 Ethan Ogden, Brett Dolezal, David Boland, Adam Osmond, Edward Jo. *Cal Poly Pomona, Pomona, CA.*  
 (No relationships reported)

Ethan Ogden, Brett Dolezal, David Boland, Adam Osmond, Edward Jo  
 California State Polytechnic University Pomona, CA, AND Human Performance  
 Research Laboratory, Pomona, CA

Lower back pain is a condition that affects between 22-65% of the global population and accounts for \$20-\$120 billion spent by Americans in an attempt to solve this problem. Traditionally, many people have turned to medical practitioners when experiencing low back pain but recently, more attention is being placed on finding cheaper home remedies and preventative measures.

**PURPOSE:** To test a new fitness device that can be used as a home remedy alleviating back pain by increasing low back flexibility **METHODS:** 60 healthy subjects were tested with measures of height, weight, waist-to-hip ratio, posture, flexibility, and perceived back stiffness before and after use of the new fitness device. The 3 treatments were a back treatment (laying down on the device), a foot treatment (standing on the device), and a control (laying down on a foam pad). Subjects were tested 3 times, once for each treatment. **RESULTS:** Flexibility was found to be significantly better after the back (7.63% improvement;  $p < 0.05$ ) and foot (6.01% improvement;  $p < 0.05$ ) treatments compared to the control (2.42% improvement). Furthermore, subjects with high body mass index ( $BMI > 30$ ) exhibited a significantly greater increase in flexibility than subjects with lower BMI. These subjects also exhibited a significant increase in posture following the back and foot treatments. Finally, perceived stiffness, as measured by a Visual Analog Scale (VAS), decreased significantly (11.8%;  $p < 0.05$ ) following the back treatment. **CONCLUSION:** The fitness device succeeded in increasing flexibility and decreasing perceived lower back stiffness in all subjects. Overall, this device could be one efficacious means in increasing lower back range-of-motion and ultimately preventing costly disability.

2127 Board #279 June 2, 3:30 PM - 5:00 PM  
**Kinanthropometric Responses To Moderate-intensity Resistance Training In Postmenopausal Women**  
 Brandon S. Shaw<sup>1</sup>, Ina Shaw<sup>2</sup>, Monique Gouveia<sup>1</sup>, Shannon McIntyre<sup>1</sup>, Gregory A. Brown, FACSM<sup>3</sup>. <sup>1</sup>University of Johannesburg, Johannesburg, South Africa. <sup>2</sup>MMI Holdings and University of Johannesburg, Johannesburg, South Africa. <sup>3</sup>University of Nebraska at Kearney, Kearney, NE.  
 Email: brandons@uj.ac.za  
 (No relationships reported)

The decline in estrogen levels that follows menopause leads to a deleterious increase in total and central fat, and a concomitant decrease in muscle and bone mass. These changes in body composition are compounded by reducing basal metabolic rates and decreasing levels of habitual physical activity. **PURPOSE:** The study aimed to determine the effects of a six-week resistance training program on body composition in postmenopausal women. **METHODS:** Thirty-seven postmenopausal women were randomly assigned to a six-week moderate-intensity resistance training group (RT) ( $n = 19$ ) or a non-exercising control group (CON) ( $n = 18$ ). The RT group participants participated in two, non-consecutive, 40-minute moderate-intensity (67-85% 1-RM) resistance training sessions each week for six weeks using three sets of 12 repetitions for dumbbell presses, lateral rows, lateral pulldowns, curl-ups, pelvic lifts, machine leg press, body weight squats, hip adductor and hip abductor machine and standing calf raises. **RESULTS:** Results indicated that six-weeks of resistance training resulted in significant ( $p \leq 0.05$ ) improvements in fat mass (from  $21.531 \pm 7.072$  kg to  $19.750 \pm 6.398$  kg,  $p = 0.001$ ), percentage body fat (from  $30.658 \pm 5.076\%$  to  $25.494 \pm 9.886\%$ ,  $p = 0.026$ ), body mass index (from  $24.497 \pm 3.850$  kg.m<sup>-1</sup> to  $24.274 \pm 4.041$  kg.m<sup>-1</sup>,  $p = 0.050$ ) and sum of skinfolds (from  $22.908 \pm 6.054$  mm to  $20.723 \pm 5.264$  mm,  $p = 0.000$ ) from pre-test to post-test, while the CON observed no significant changes in any of the measured variables. **CONCLUSIONS:** Six weeks of moderate-intensity resistance training can effectively be used to improve several kinanthropometric variables simultaneously in apparently healthy postmenopausal women and may be an effective tool at reducing the prevalence of overweight and obesity in this at-risk population.

2128 Board #280 June 2, 3:30 PM - 5:00 PM  
**Effects Of High-velocity Resistance Or Dual-task Balance Training On Self-perception And Executive Function**  
 Larissa Boyd<sup>1</sup>, Bert Jacobson, FACSM<sup>2</sup>, Jason DeFreitas<sup>2</sup>, Mwarumba Mwavita<sup>2</sup>. <sup>1</sup>University of Central Oklahoma, Edmond, OK. <sup>2</sup>Oklahoma State University, Stillwater, OK.  
 (Sponsor: Bert Jacobson, FACSM)  
 Email: lboyd6@uco.edu  
 (No relationships reported)

Fall prevention and quality of life (QoL) are both important aspects of aging. Fear of falling may detrimentally impact balancing capabilities and physical activity participation. Limited ability to produce quick postural actions along with cognitive costs from attempting to dual-task may further exacerbate falls risk and other declines from aging. Strong evidence exists regarding the requirement of cognitive resources for balance and gait activities, but the impacts of high-velocity resistance training (HVRT) and dual-task balance training (DTBT) are not well understood. **PURPOSE:** The purpose of this study was to compare the effects of HVRT and DTBT on quality of life, balance confidence, and executive function. Participants were randomly assigned to a high-velocity (HV,  $n=5$ ), dual-task (DT,  $n=9$ ), or control (CG,  $n=8$ ) group. The HV performed five different lower extremity exercises at 40% 1RM. The DT performed cognitive and physical tasks simultaneously. Both groups trained twice a week for 30 minutes over 16 weeks. Executive function was assessed using the Trail-Making Test part B (TMT-B). The Activities Specific Balance Confidence Scale (ABC) and RAND-36-Item Health Survey® (RAND-36®) evaluated confidence and quality of life (QoL), respectively. Participants were assessed at pre-test, every 4 weeks, and 4 weeks following detraining. **RESULTS:** No significant group x time interactions occurred on the TMT-B ( $F_{8, 21} = 1.59, p = .23$ ), ABC ( $F_{10, 21} = 1.64, p = .20$ ), or RAND-36® ( $F_{10, 21} = 1.87, p = .18$ ). The HV group experienced a moderate change ( $d = 0.38$ ) on the TMT-B pre- to post-test. A large effect was observed for QoL ( $d = .85$ ) in the DT group and for balance confidence ( $d = .82$ ) in the HV group. The HV group improved on the ABC (5.03%) and RAND-36 (2.3%), while the DT declined in by 10.16% and 2.4%, respectively. However, the DT group was able to improve TMT-B time following. **CONCLUSIONS:** Quality of life was changed to a greater extent in the DT group, while the HV group experienced the greatest improvements in executive function and balance confidence. Further research should examine changes in perceived outcomes following DT training and executive function following HV training.

2129 Board #281 June 2, 3:30 PM - 5:00 PM  
**The Effects of Stretch Training on Cardiac Autonomic Function in Obese Postmenopausal Women**  
 Alexei Wong<sup>1</sup>, Stacey Alvarez-Alvarado<sup>2</sup>, Michael Nordvall<sup>1</sup>, Michelle Walters-Edwards<sup>1</sup>, Arturo Figueroa, FACSM<sup>2</sup>.  
<sup>1</sup>Marymount University, Falls Church, VA. <sup>2</sup>Florida State University, Tallahassee, FL. (Sponsor: Arturo Figueroa, FACSM)  
 Email: awong@marymount.edu  
 (No relationships reported)

Menopause and obesity are associated with autonomic dysfunction and are independent risk factors for cardiovascular disease. Heart rate variability (HRV) is a non-invasive tool for the evaluation of cardiac autonomic function. HRV is adversely influenced by menopause and obesity in women. Many obese and postmenopausal women lack the self-motivation needed to adhere to conventional endurance and resistance exercise programs, especially at high intensity. Previous studies have shown an acute increase in cardiac vagal activity after a single session of stretching in healthy individuals and patients with ischemic heart disease. **PURPOSE:** The purpose of this study was to examine the effects of stretch training (ST) on HRV and flexibility in obese postmenopausal women. **METHODS:** Twenty-four obese postmenopausal women [age ( $57 \pm 1$  years) and body mass index ( $34 \pm 0.7$  kg/m<sup>2</sup>)] were randomized to either ST ( $n = 12$ ) or no-exercise control group ( $n = 12$ ) for 8 weeks. ST consisted on 35 different active (unassisted) and passive (assisted) stretches for the major muscle groups per session 3 x week. The muscle was held in the stretched position for 30 seconds followed by a 15-second relaxation period. Total power (TP), low-frequency power (LF), high-frequency power (HF) (vagal tone), the LF to HF ratio (LF/HF) (sympathovagal balance), heart rate (HR) and sit and reach score (SRS) were measured before and after 8 weeks. LF and HF were normalized to TP resulting in nLF (sympathetic activity) and nHF. Logarithmic transformation (Ln) was performed to normalize the HRV variables in absolute units. **RESULTS:** There were significant group-by-time interactions ( $P < 0.05$ ) for nLF, nHF, LnLF/LnHF, LnRMSSD (vagal tone), and ( $P < 0.01$ ) for SRS. There were significant decreases ( $P < 0.01$ ) in nLF and LnLF/LnHF as well as significant increases ( $P < 0.01$ ) in nHF, LnRMSSD and SRS following ST compared with no changes after control. The changes in SRS were correlated with changes in LnLF/LnHF ( $r = 0.65, P = 0.03$ ). No significant changes were observed in LnTP or HR after 8 weeks for both groups. **CONCLUSIONS:** Our findings indicate that ST improves cardiac autonomic modulation by increasing vagal tone and decreasing sympathetic activity in obese postmenopausal women. The improvement in SRS partially explained the decrease in sympathovagal balance.

- 2130 Board #282 June 2, 3:30 PM - 5:00 PM  
**Impact of Hockey Fans in Training Program on Steps and Self-rated Health in Overweight Men**  
 Dawn P. Gill<sup>1</sup>, Ashleigh De Cruz<sup>1</sup>, Brendan Riggan<sup>1</sup>, Stephanie Muise<sup>1</sup>, Roseanne Pulford<sup>1</sup>, Cassandra Bartol<sup>1</sup>, Kate Hunt<sup>2</sup>, Sally Wyke<sup>2</sup>, Cindy M. Gray<sup>2</sup>, Christopher Bunn<sup>2</sup>, Shaun Treweek<sup>3</sup>, Merrick Zwarenstein<sup>1</sup>, Guangyong Zou<sup>1</sup>, Karen Danylchuk<sup>1</sup>, Robert J. Petrella, FACSM<sup>1</sup>. <sup>1</sup>Western University, London, ON, Canada. <sup>2</sup>University of Glasgow, Glasgow, United Kingdom. <sup>3</sup>University of Aberdeen, Aberdeen, United Kingdom. (Sponsor: Robert Petrella, FACSM)  
 Email: dawn.gill@uwo.ca  
 (No relationships reported)

Football Fans in Training (FFIT) is an effective, gender-sensitized, weight loss and healthy living program for overweight/obese men, delivered via professional football clubs. Hockey Fans in Training (Hockey FIT) is a new program adapted from FFIT for Canadian hockey. **PURPOSE:** To examine the impact of Hockey FIT on steps, self-esteem, mood, and self-rated health, 12 weeks after baseline (post program). **METHODS:** 80 male fans [35-65 years; body mass index (BMI)  $\geq$  28 kg/m<sup>2</sup>] of 2 Ontario Junior A hockey clubs were randomized to either intervention (Hockey FIT) or comparator (wait-list control), within a pilot, pragmatic randomized controlled trial (RCT). Hockey FIT involved 12 weekly, 90-minute group sessions delivered by trained coaches using club facilities. Each session combined classroom material, including evidence-based behaviour change techniques (e.g., self-monitoring, goal setting) and healthy eating advice (e.g., reducing portion size), with physical activity sessions. Prescriptive exercise (e.g., individualized target heart rates and pedometer-based incremental step targets) was incorporated throughout. We examined between-group differences in mean steps/day (7-day pedometer monitoring), self-esteem (Rosenberg scale), positive and negative affect (I-PANAS-SF scale), and self-rated health (EQ-5D-3L VAS score) using linear mixed effects regression models that accounted for club and age. **RESULTS:** Groups were similar at baseline [median (interquartile range): age: 48.0 (17.0) years; BMI: 35.1 (6.3) kg/m<sup>2</sup>]. 75% of men in the intervention group attended  $\geq$  6 sessions. At 12 weeks, the intervention group increased their daily steps to a greater extent than the comparator [difference between groups in mean change: 3127 (95% confidence interval: 1882 to 4372) steps/day,  $p < 0.001$ ]. The intervention group also improved their self-rated health (scale 0 to 100; 100 = best) to a greater extent than the comparator [difference between groups in mean change: 7.0 (2.1 to 11.9) points,  $p = 0.005$ ]. There were no differences between groups in self-esteem or positive/negative affect post program. **CONCLUSION:** Hockey FIT has the potential to help overweight/obese men increase their physical activity levels and improve their self-rated health. Long-term follow-up and a full-scale pragmatic RCT is warranted.

- 2131 Board #283 June 2, 3:30 PM - 5:00 PM  
**Influence of Resistance Training Initiation and Maintenance on Spontaneous Dietary Intake Changes among Prediabetes Adult**  
 Tanya M. Halliday<sup>1</sup>, J. Tina Savla<sup>1</sup>, Elaina L. Marinik<sup>1</sup>, Mary E. Baugh<sup>1</sup>, Sheila Winnett<sup>2</sup>, Richard A. Winnett<sup>1</sup>, Brenda M. Davy, FACSM<sup>1</sup>. <sup>1</sup>Virginia Tech, Blacksburg, VA. <sup>2</sup>PCR, Inc, Blacksburg, VA.  
 Email: tanyamhalliday@gmail.com  
 (No relationships reported)

We have previously shown that initiation of resistance training (RT) is associated with short-term dietary intake changes. Evidence examining longer-term dietary behaviors in response to maintenance of RT is lacking.

**PURPOSE:** To evaluate dietary intake modifications in response to two RT maintenance interventions among adults with prediabetes. **METHODS:** Previously sedentary, overweight adults with prediabetes ( $n=170$ , BMI = 33.0 $\pm$ 3.8 kg/m<sup>2</sup>, age: 60 $\pm$ 5 yrs, 73% female) were enrolled in a 15-month RT program. After completing a supervised 3-month RT initiation phase, participants were randomized to a 12-month higher-contact social cognitive theory (SCT) or lower-contact standard care (STD) maintenance intervention. Participants were not given dietary advice or encouraged to change eating behaviors. Three non-consecutive 24-hour diet recalls were collected and analyzed (NDSR software), and body mass (BM) and composition (DXA) were measured at baseline (bsl) and month 15 (M15). Changes were assessed using paired sample t-tests. Data are expressed as mean $\pm$ SD. **RESULTS:** Participant retention (midpoint: 81%; M15: 76%) and adherence to the 2x/week RT protocol (midpoint: 74%, M15: 53%) did not differ between groups. No change in BM occurred in either group from bsl to M15, but % fat mass decreased (SCT: 43.7 $\pm$ 6.9 vs. 42.8 $\pm$ 6.6%; STD: 43.8 $\pm$ 6.8 vs. 42.9 $\pm$ 7.1%) and % fat-free mass increased (SCT: 56.3 $\pm$ 6.8 vs. 57.2 $\pm$ 6.6%; STD: 56.2 $\pm$ 6.8 vs. 57.1 $\pm$ 7.1%) (all  $p < 0.05$ ). In STD, total energy intake decreased (1,850 $\pm$ 517 vs. 1,720 $\pm$ 471 kcal,  $p < 0.000$ ) and % energy from carbohydrate was unchanged (42.8 $\pm$ 8.4 vs. 42.9 $\pm$ 10.7,  $p = 0.69$ ). Trends were noted for a reduction in % energy from fat (37.4 $\pm$ 6.9 vs. 35.6 $\pm$ 7.2%,  $p = 0.08$ ) and increased % energy from protein (17.9 $\pm$ 4.1 vs. 19.3 $\pm$ 6.0%,  $p = 0.08$ ) from bsl to M15.

In SCT, no changes in total energy (1,762 $\pm$ 494 vs. 1,740 $\pm$ 527 kcal), or % energy from carbohydrate (44.2 $\pm$ 7.4 vs. 43.3 $\pm$ 9.7), fat (36.0 $\pm$ 7.0 vs. 36.4 $\pm$ 7.5) or protein (18.2 $\pm$ 4.5 vs. 18.0 $\pm$ 0.44) (all  $p > 0.05$ ) occurred. **CONCLUSIONS:** RT initiation and maintenance are associated with changes to total energy intake and macronutrient composition in adults with prediabetes assigned to a lower-contact intervention. Intervention characteristics and participant burden may influence whether or not dietary modifications occur with maintenance of RT.

- 2132 Board #284 June 2, 3:30 PM - 5:00 PM  
**Influence of a Body Type Training Program on Body Image Dissatisfaction**  
 Bailey M. Theall<sup>1</sup>, Arnold G. Nelson, FACSM<sup>1</sup>, Kate S. Early<sup>1</sup>, Annie B. Simoneaux<sup>1</sup>, Neil M. Johannsen<sup>1</sup>, Nicole Y. Wesley<sup>2</sup>, Tiffany M. Stewart<sup>2</sup>. <sup>1</sup>Louisiana State University, Baton Rouge, LA. <sup>2</sup>Pennington Biomedical Research Center of the Louisiana State University System, Baton Rouge, LA.  
 Email: btheall1@gmail.com  
 (No relationships reported)

Combined aerobic and resistance training (ATRT) programs are recommended to improve fitness; however, a novel training program focused on individual body type (BT) may provide additional benefits to body satisfaction. **Purpose:** To examine body image dissatisfaction (BID) responses after ~7 weeks of BT training or ATRT. **Methods:** Participants (age 19 $\pm$ 1y; BMI 23.2 $\pm$ 3.5) provided self-report measures of BID (Body Area Satisfaction Scale (BASS), Body Shape Questionnaire (BSQ), and Body Morph Assessment version 2.0 (BMA 2.0)) at baseline and after 15 exercise sessions, 2 d/wk. Participants were randomized to BT or ATRT intervention after classification to a Body Type (Cone®, Spoon®, Hourglass®, or Ruler®) according to circumference measures. BMA 2.0 assessed perceived current body size (CBS), selected ideal body size (IBS), selected acceptable body size (ABS), and BMA-BID (CBS-IBS). Given this was an efficacy trial, intent-to-treat (ITT;  $n=132$ ) and per protocol (PP; BASS, BSQ  $n=77$ ; BMA  $n=93$ ; completed  $\geq$  10 of 15 supervised sessions) data analyses were utilized. **Results:** Overall, body image scores decreased with a trend observed for the BMA-BID (baseline: 5.5 95%CI(4.5-6.5); follow-up: 4.8 (3.9-5.8);  $P=0.07$ ) after exercise training indicating improvements in BID. Results were similar among ITT and PP analyses. Increases in BID were seen in the ATRT group with significantly lower BASS scores compared to BT group at follow-up (ATRT = 2.61 vs. 2.45;  $P < 0.05$ ). Participants in the ATRT group saw themselves as smaller and set a smaller acceptable goals based on significant reductions in CBS and ABS relative to BT. Sum circumferences were different after both programs (BT = -6.2cm; 95% CI -1.9, -10.7cm; ATRT = -7.5cm; -3.3, -11.7cm); however, changes in body satisfaction were not related to changes in total body circumferences ( $P > 0.05$  for all). **Conclusion:** Baseline scores for BID suggest women in this study were generally unsatisfied with their overall body image (BASS  $< 3.0$ , BSQ  $> 80$ ). In general, BT and ATRT produced similar responses; exercise reduced CBS—thereby reducing the difference between CBS and IBS—improving overall body satisfaction regardless of changes in body composition. Supported by the Robert and Patricia Hines Endowment in Kinesiology.

- 2133 Board #285 June 2, 3:30 PM - 5:00 PM  
**Efficacy of High-intensity Interval Training on Exercise Enjoyment, Adherence and Cardiometabolic Health in Overweight Adults**  
 Chantal A. Vella, FACSM, Katrina Taylor, Devin Drummer, University of Idaho, Moscow, ID.  
 Email: cvella@uidaho.edu  
 (No relationships reported)

High-intensity interval training (HIIT) has been shown to improve cardiometabolic health during supervised lab-based studies but adherence, enjoyment and health benefits of HIIT performed independently are yet to be understood, specifically in an overweight and obese sample. **PURPOSE:** We compared adherence, enjoyment and cardiometabolic outcomes after 8-weeks of HIIT or traditional moderate-intensity continuous training (MICT), matched for energy expenditure, in overweight and obese young adults. **METHODS:** 17 overweight and obese adults (mean $\pm$ SE: age 26.2 $\pm$ 2.0 y; BMI 35.6 $\pm$ 1.3 kg/m<sup>2</sup>; body fat 35.2 $\pm$ 1.7%; VO<sub>2</sub>peak 34.6 $\pm$ 1.8 mL/kg/min) were randomized to HIIT ( $n=8$ ) or MICT ( $n=9$ ). After completing 12 sessions of supervised training over 3 weeks, participants were asked to independently perform HIIT or MICT for 30 minutes, 4 times/week for 5 weeks. Cardiometabolic outcomes, measured at baseline and post intervention, included measured cardiorespiratory fitness (VO<sub>2</sub>peak), fasting lipids, and inflammatory markers. Enjoyment of exercise was measured by the validated Physical Activity Enjoyment Scale. Data were analyzed using multivariate ANOVA and ANCOVA. **RESULTS:** Exercise adherence (93.4 $\pm$ 3.1% vs 93.1 $\pm$ 3.7%, respectively) and enjoyment (100.1 $\pm$ 4.3 vs 100.3 $\pm$ 4.4, respectively) were high and similar between HIIT and MICT ( $p > 0.05$ ). After controlling for baseline values, both HIIT and MICT decreased total cholesterol (-19.9 $\pm$ 6.6 vs -8.8 $\pm$ 6.1 mg/dL, respectively) and LDL cholesterol (-21.5 $\pm$ 4.5 vs -4.7 $\pm$ 4.2 mg/dL, respectively),

with HIIT showing a greater decrease in both lipids ( $p < 0.05$ ). HIIT significantly increased  $\dot{V}O_{2\max}$  by 10% with no change in MICT ( $p < 0.05$ ,  $0.30 \pm 0.1$  vs  $0.03 \pm 0.1$  L/min, respectively). Interleukin-6 and c-reactive protein showed a trend to increase in HIIT and decrease in MICT ( $p < 0.05$  for group). Our novel findings suggest that HIIT is enjoyable, has high unsupervised adherence rates, and may be effective for reducing cardiometabolic risk factors in overweight and obese adults. However, HIIT may be associated with an increase in inflammation with short-term exercise in this population. Funded by CTR-IN NIH NIGMS #1U54GM104944-01A1

2134 Board #286 June 2, 3:30 PM - 5:00 PM  
**Effects of High-Intensity Physical Training on Inflammatory Markers of Men with Metabolic Syndrome**

Daniela L. Santos, Liziane Silva Vargas, Chane Basso Benetti, Juliano Bouffeur Farinha. *Federal University of Santa Maria, Santa Maria, RS, Brazil.*  
 Email: lopesdossantosdaniela@gmail.com  
 (No relationships reported)

The risk factors for metabolic syndrome (MS) induce to a chronic inflammatory state, because of the increase in pro inflammatory markers. One of the causes is the hypertrophy of visceral adipose tissue that releases interleukins. Regular physical exercise is considered a non-pharmacological treatment, since it increases energy expenditure, decreasing visceral adipose tissue and consequently, the inflammatory markers secretion. But the aerobic exercises are the most studied when it comes to inflammatory profile.

**PURPOSE:**

The aim of this study was to analyze the effects of 15 weeks of anaerobic high-intensity physical exercise on inflammatory markers of men with MS. **METHODS:** The sample included 21 men aged between 40 and 66 years, diagnosed with MS according to NCEP/ATP-III (2001) parameters. They had anthropometric measures and blood sample collected before and after 15 weeks of physical training, that consisted in a high intensity physical exercise protocol, 3 times a week, lasting approximately 1 hour, where muscle resistance exercises were performed (60 to 80% of maximal load). For the statistical analyses, Student t test and Wilcoxon Rank Test were used.

**RESULTS:**

A decrease in body fat percentage ( $32.51 \pm 5.02$  vs.  $31.90 \pm 5.15$ ,  $p < 0.05$ ) and an increase in lean body mass percentage ( $64.12 \pm 4.73$  vs.  $64.68 \pm 4.87$ ,  $p < 0.05$ ) were observed, although no significant changes were observed in body weight or BMI. The physical training diminished the pro inflammatory markers IL-1 $\beta$  ( $162.9 \pm 7.27$  vs.  $141.71 \pm 8.39$  pg/mL,  $p < 0.001$ ), IL-6 ( $182.38 \pm 6.9$  vs.  $146.19 \pm 11.28$  pg/mL,  $p < 0.001$ ), IL-18 ( $79.33 \pm 6.65$  vs.  $56 \pm 7.9$  pg/ml,  $p < 0.001$ ), TNF- $\alpha$  ( $208.71 \pm 7.69$  vs.  $9.01 \pm 176.28$  pg/mL,  $p < 0.001$ ) and IFN- $\gamma$  ( $281.95 \pm 10.79$  vs.  $216.71 \pm 22.45$  mg/mL,  $p < 0.001$ ). On the other hand, a significant increase in the anti inflammatory interleukin IL-10 ( $78.52 \pm 9.49$  vs.  $95.23 \pm 9.99$  pg/mL,  $p < 0.001$ ) was observed. **CONCLUSIONS:**

It was concluded that, regardless of the fact that there were no significant changes in body weight and body mass index (BMI), 15 weeks of anaerobic high-intensity physical exercises had a positive effect on the inflammatory state of men with metabolic syndrome. These results suggest great importance of the muscle mass in inflammation regulation.

2135 Board #287 June 2, 3:30 PM - 5:00 PM  
**Effects of Exercise Training on Insulin Sensitivity and Lipid Adaptations With and Without Weight loss**

Damon L. Swift<sup>1</sup>, Joseph A. Houmard, FACSM<sup>1</sup>, William E. Kraus, FACSM<sup>2</sup>. <sup>1</sup>East Carolina University, Greenville, NC. <sup>2</sup>Duke University, Durham, NC.  
 Email: swift@ecu.edu  
 (No relationships reported)

Purpose: Achieving at least modest weight loss (MWL) ( $\geq 3.0\%$  from baseline) with exercise training is associated with improvements in cardiometabolic risk factors, however the independent contributions of exercise versus weight loss is unclear. The present study evaluated whether the achievement of at least MWL with aerobic training results in greater improvements in insulin sensitivity and lipid metabolism compared to those who do not achieve MWL.

Methods: In the Studies of Targeted Risk Reduction Interventions through Defined Exercise (STRRIDE) overweight and obese adults with dyslipidemia completed 8 months of aerobic training at low amount, moderate intensity (LAMI), low amount, high intensity (LAHI), and high amount, high intensity (HAHI). We analyzed data from participants (N=163) who were adherent to training ( $>70\%$ ). Participant data were categorized based on whether or not MWL was achieved. Insulin sensitivity (intravenous glucose tolerance test), lipid concentrations and lipoprotein particle size were assessed at baseline and follow-up.

Results: Response rates for MWL were 18.9%, 16.7% and 32.1% in the LAMI, LAHI and HAHl groups, respectively (22.7% overall). A greater increase in insulin sensitivity was observed in participants that achieved MWL compared to those that did not in the LAMI (MWL: 1.3, no MWL: 3.4,  $p=0.002$ ) and the HAHl (MWL: 0.7,

No MWL: 1.8,  $p=0.04$ ), but not the LAHI group (MWL: 0.6, No MWL: 1.4,  $p=0.37$ ). When exercise groups were collapsed together, similar effects were observed for changes in insulin sensitivity (MWL: 2.2, No MWL: 0.9), triglycerides (MWL: -44.2 mg/dL, No MWL: -20.1 mg/dL), low density lipoprotein (LDL) particle size (MWL: 0.30 nm, No MWL: 0.07 nm), and high density lipoprotein (HDL) particle size (MWL: 0.12 nm, No MWL: 0.02 nm) ( $p < 0.05$ ). No significant effects were observed for changes in LDL, HDL, or total cholesterol concentrations ( $p > 0.05$ ).

Conclusion: The results of the present study suggest that modest weight loss with aerobic exercise training enhances the changes in insulin sensitivity and elements of lipid metabolism compared to no weight loss. Although exercise has independent effects in improving health, clinicians should encourage weight loss with exercise training to maximize cardiometabolic health benefits in overweight and obese adults.

2136 Board #288 June 2, 3:30 PM - 5:00 PM  
**Effects Of Drinking Seawater During A Resistance Training Program On Kidney, Performance And Cardiovascular Health**

Nicole L. Rogers<sup>1</sup>, Alvaro Juesas<sup>2</sup>, Nicole Fritzz<sup>3</sup>, Pedro Gargallo<sup>2</sup>, Victor Munoz<sup>2</sup>, Guillermo Saez<sup>4</sup>, Amaya Hernando<sup>4</sup>, Juan C. Colado<sup>2</sup>, Michael E. Rogers, FACSM<sup>1</sup>. <sup>1</sup>Wichita State University, Wichita, KS. <sup>2</sup>University of Valencia, Valencia, Spain. <sup>3</sup>Universidad Austral, Valdivia, Chile. <sup>4</sup>Universitary Hospital Dr. Peset, Valencia, Spain. (Sponsor: Michael E. Rogers, FACSM)  
 (No relationships reported)

The oceans contain a vast amount of potential resources for pharmaceuticals and nutritional supplements. Recently, the most widely available component of the oceans, seawater (SW), has been incorporated into supplements designed to improve physical performance and overall health but the efficacy of this is currently unknown.

**PURPOSE:** To analyze the effects of consuming a SW-based electrolyte drink during a resistance-training (RT) program on kidney health, physical performance, and cardiovascular risk in older adults. **METHODS:** 56 sedentary older adults ( $71.3 \pm 6.2$  yr) were divided into three groups: control group (CG) (n=18) that continued normal activities without additional physical training or nutritional supplementation; placebo group (PG) (n=19) that drank a 20 ml sample of mineral water before and after each training session; and a SW group (SWG) (n=19) that consumed a 20 ml sample of electrolyte drink (Totum Sport) before and after each training session. A 12 wk RT program using elastic bands was performed on 2 d/wk with 6 exercises and 4 sets of 6 repetitions. Isometric strength for the upper (vertical row (VR)) and lower (horizontal leg press (HLP)) extremities, levels of creatinine and urea (kidney health indicators), and atherogenic index (AI) (cardiovascular health indicator) were assessed pre and post training. **RESULTS:** SWG significantly ( $p < 0.05$ ) improved VR (+44.6%) and HLP (+52.8%), significantly reduced urea levels (-6.6%) and AI (-4.9%), and showed a trend towards reducing creatinine levels (-5.4%). PG significantly improved VR (+29.3%) and HLP (+52.5%), and significantly reduced AI (-4.50%) with no changes in urea and creatinine values. There were no significant differences between the exercise groups. VR (+9.5%), urea (+5.4%), and creatinine (+1.3%) did not change in CG but there were significant changes in AI (+14.1%) and HLP (-24.7%). There was not an interaction between groups for VR, HLP, and AI, but there was for urea and creatinine levels with CG showing significant differences compared to the exercise groups. **CONCLUSIONS:** Drinking SW while involved with a RT program may improve kidney health, cardiovascular health, and IS in older adults.

2137 Board #289 June 2, 3:30 PM - 5:00 PM  
**Men's Experiences With The Hockey Fans In Training Physical Activity And Healthy Living Program**

Stephanie Muise, Shannon Sibbald, Dawn P. Gill, Ashleigh De Cruz, Brendan Riffin, Roseanne Pulford, Robert J. Petrella, FACSM. *Western University, London, ON, Canada.*  
 Email: smuise2017@meds.uwo.ca  
 (No relationships reported)

Increasing rates of chronic disease (CD) have led to an increased effort to implement lifestyle interventions aimed at healthy eating, healthy weight and physical activity. While male CD risk exceeds that of women, men are often highly underrepresented in lifestyle programs. This may in part be due to the fact that men consider programs inherently feminine, serving as a barrier for participation. Some studies have observed that men prefer lifestyle programs that incorporate an element of competition and occur in the company of other men. Additionally, programs situated in the context of sports may have lower drop-out rates and higher levels of satisfaction due to feelings of affiliation. **PURPOSE:** To review men's feedback regarding their motivation for joining and their experience in a 12-week lifestyle intervention in the context of professional hockey clubs, in London and Sarnia, Ontario, Canada. **METHODS:** Participants who completed at least 6 of the 12 weekly sessions (n=30) were asked to fill out an online questionnaire after their completion of the intervention. The questionnaire was designed to elicit why they joined the program, what changes they saw following their participation, as well as what program components they found

useful and not useful in helping them make those changes. **RESULTS:** A total of 27 men completed the questionnaire. Weight loss and a desire to increase physical activity were the two main reasons cited for joining the program. After the 12-week intervention, 100% of the men reported eating a healthier diet and 78% reported having increased their activity level. Satisfaction with the program elements was high with 96% of men believing both the classroom and exercise components were useful. Most suggestions for improvement involved decreasing the repetition of classroom material and increasing the proportion of physical activity during each session. **CONCLUSION:** Our results support previous research showing increased levels of satisfaction in men when lifestyle interventions are run in a sporting context and incorporate both an educational component (with a large focus on healthy eating and physical activity) and an exercise component. This information will be used to support the refinement of the Hockey FIT program prior to conducting future studies.

2138 Board #290 June 2, 3:30 PM - 5:00 PM  
**The Prognostic Value and Predictors of Responding to Exercise Training in Heart Failure Patients**

Esmée A. Bakker<sup>1</sup>, Johan A. Snoek<sup>2</sup>, Esther P. Meindersma<sup>1</sup>, Louise Bellersen<sup>1</sup>, Maria T.E. Hopman, FACSM<sup>1</sup>, Dick H. Thijssen<sup>1</sup>, André L.M. Verbeek<sup>1</sup>, Thijs M.H. Eijssvogels<sup>1</sup>.  
<sup>1</sup>Radboud university medical center, Nijmegen, Netherlands.  
<sup>2</sup>Isala Clinics, Zwolle, Netherlands. (Sponsor: Maria TE Hopman, FACSM)  
 Email: esmee.bakker@student.ru.nl  
 (No relationships reported)

Improvement of physical fitness by exercise training during cardiac rehabilitation (CR) is an important target for secondary prevention in heart failure (HF). However, not all HF patients improve physical fitness following CR, i.e. non-responders, which may impact the risk of future morbidity and mortality.

**PURPOSE:** We compared the risk of death and unplanned hospitalization in HF responders versus non-responders to CR. Secondly, we identified predictors of improvement in physical fitness following CR in HF patients.

**METHODS:** HF patients performed an incremental cycle exercise test combined with gas analysis to assess peak oxygen consumption (VO<sub>2</sub>peak), before and after completion of 8-, 12-, or 26-week CR. Responders showed ≥6% improvement in VO<sub>2</sub>peak, which is chosen to compensate for inter-test variability, whereas non-responders showed a decrease, no change, or improve in VO<sub>2</sub>peak <6%. Patient characteristics (age, sex, BMI, smoking), co-morbidities (hypertension, hypercholesterolemia, diabetes mellitus, COPD), and HF features (HF etiology, ejection fraction, NYHA class, use of medical devices and medication) were collected from electronic patient files. Main end point was all-cause mortality and secondary end point all-cause mortality or unplanned hospitalization.

**RESULTS:** 45% of our study population (n=155) responded to exercise training. After adjustment for age, sex, BMI, smoking and baseline VO<sub>2</sub>peak, responders had a hazard ratio (HR) for all-cause mortality of 0.41 (95% CI 0.12; 1.35) and a HR for all-cause mortality or unplanned hospitalization of 0.54 (95% CI 0.29; 0.98) compared to non-responders. The prediction model included lower age, BMI and baseline VO<sub>2</sub>peak as significant predictors for exercise response. The performance of the model, assessed by ROC analysis, had an AUC of 0.68 (95% CI 0.60; 0.77).

**CONCLUSIONS:** The finding that a minority of HF patients responded to CR is of clinical relevance since this group showed a 46% reduction of the risk for death and/or unplanned hospitalization compared with non-responders. HF patients who are older, have a higher BMI and a higher baseline VO<sub>2</sub>peak have a larger chance to become a non-responder. These observations emphasize the importance to improve CR based exercise interventions in HF patients to improve survival and prevent hospitalization.

2139 Board #291 June 2, 3:30 PM - 5:00 PM  
**Factors Associated With Inter-Individual Variability In The Fat-Free Mass Response To Resistance Training**

Erik A. Willis, Lauren T. Ptomey, Jeffery J. Honas, Joseph E. Donnelly, FACSM, Richard A. Washburn, FACSM. *University of Kansas Medical Center, Kansas City, KS.*  
 Email: ewillis@ku.edu  
 (No relationships reported)

**PURPOSE:** To assess baseline factors associated with the response of fat-free mass (FFM) to a 9 mo. resistance training (RT) protocol.

**METHODS:** Normal/overweight sedentary, previously untrained young adults (n = 78, age ~22 yrs. BMI ~ 25 kg/m<sup>2</sup>) completed a 9-mo., supervised efficacy trial (1 or 3- sets RT, 9 exercises, 3 d/wk.). Participants were asked to maintain ad-libitum diets. Body weight and composition (DXA), height, energy intake ([EI]/macronutrient; digital photography), bench and leg press strength (1-RM), total daily energy expenditure (TDEE) and non-exercise energy expenditure (NEEx; TDEE minus the energy expenditure of RT; doubly labelled water) were assessed at baseline and 9 mos. Participants who did, or did not increase FFM in response to RT were classified as responders (R) and non-responders (NR), respectively.

**RESULTS:** Participants completed 92 ± 6% of scheduled RT sessions. FFM increased significantly from baseline to 9 mos. (1.2 ± 1.7 kg, p < 0.0001) with high inter-individual variability (range = - 2.0 to 6.2 kg). Fifty-five (70%) and 23 (30%) participants were classified as R (FFM change = +2.1 ± 1.4 kg) and NR (FFM change = -0.7 ± 0.6 kg), respectively. There were no significant baseline differences (all p > 0.05) between R and NR in the proportion of females (R = 51%, NR = 52%), body weight (R = 75.5, NR = 72.9 kg), BMI (R = 25, NR = 25 kg/m<sup>2</sup>), fat mass (R = 72.1, NR = 69.6 kg), FFM (R = 48.1, NR = 48.6 kg), EI (R = 2407, R = 2484 kcal/d), protein intake (R = 88.4, NR = 90.4 g/d), bench press strength (R = 45, NR = 45 kg), leg press strength (R = 153, NR = 152 kg), TDEE (R = 2543, NR = 2559 kcal/d) or NEEx (R = 719, NR = 771 kcal/d). The proportion of R and NR differed significantly by intervention group (1 set, R = 43.6%, 3 sets, R = 56.4%; 1-set, NR = 69.6%, 3-sets, NR = 30.4%, p = 0.037).

**CONCLUSION:** None of the baseline characteristics evaluated were associated with the FFM response to a 9 supervised RT protocol. The observation that the proportion of R was higher in the 3-set compared with the 1-set group suggests RT volume is an important factor in the FFM response to RT. Thus, 3-set RT protocols are recommended for use by untrained young adults if the goal of RT is an increase in FFM.

Supported by NIH R01 DK49181

2140 Board #292 June 2, 3:30 PM - 5:00 PM  
**Can a Sports Team-based Lifestyle Program (Hockey Fans In Training) Improve Weight In Overweight Men?**

Robert J. Petrella, FACSM<sup>1</sup>, Dawn P. Gill<sup>1</sup>, Ashleigh De Cruz<sup>1</sup>, Brendan Riggan<sup>1</sup>, Stephanie Muise<sup>1</sup>, Roseanne Pulford<sup>1</sup>, Cassandra Bartol<sup>1</sup>, Kate Hunt<sup>2</sup>, Sally Wyke<sup>2</sup>, Cindy M. Gray<sup>2</sup>, Christopher Bunn<sup>2</sup>, Shaun Treweek<sup>3</sup>, Merrick Zwarenstein<sup>1</sup>, Guangyong Zou<sup>1</sup>, Karen Danylchuk<sup>1</sup>. <sup>1</sup>Western University, London, ON, Canada. <sup>2</sup>University of Glasgow, Glasgow, United Kingdom. <sup>3</sup>University of Aberdeen, Aberdeen, United Kingdom.  
 Email: petrella@uwo.ca  
 (No relationships reported)

The issue of gender is often neglected when planning and implementing chronic disease prevention and management strategies. Football Fans in Training (FFIT) — a gender-sensitized, weight loss and healthy living program for men delivered via professional football clubs — has been shown to be highly effective in helping overweight/obese men lose weight and improve their health risk. **PURPOSE:** To examine the potential for new male-friendly, physical activity and healthy living program — Hockey Fans in Training (Hockey FIT) — to help overweight/obese men decrease their weight, waist circumference (WC), and body mass index (BMI), after 12 weeks. **METHODS:** A pilot, pragmatic randomized controlled trial (RCT) whereby male fans (35-65 years; BMI ≥ 28 kg/m<sup>2</sup>) of 2 Junior A hockey clubs (Ontario, Canada) were randomized to either the intervention (Hockey FIT) or comparator (wait-list control). Hockey FIT involved 12 weekly, 90-minute group sessions delivered by trained coaches using club facilities. Each session combined classroom activities, including evidence-based behaviour change techniques (e.g., self-monitoring, goal setting) and healthy eating advice (e.g., reducing portions), with physical activity training. Lifestyle prescriptions, including incremental step count targets, were also prescribed each week. We examined between-group differences in mean weight loss, WC, and BMI using linear mixed effects regression models that accounted for club and age. **RESULTS:** Baseline characteristics were similar between groups [total N = 80, median (interquartile range) — i) age: 48.0 (17.0) years; ii) weight: 112.2 (23.2) kg; iii) WC: 119.3 (13.5) cm; iv) BMI: 35.1 (6.3) kg/m<sup>2</sup>]. Of the 40 men in the Hockey FIT group, 30 (75%) attended at least 6 sessions. At 12 weeks, the Hockey FIT group lost more weight than the control group [difference between groups in mean weight change (control is reference): -3.6 (95% confidence interval: -5.2 to -1.9) kg, p < 0.001]. The Hockey FIT group also saw greater reductions in WC and BMI, when compared to the control group [difference between groups in mean i) WC: -2.8 (-5.0 to -0.6) cm, p = 0.01; ii) BMI: -0.9 (-1.4 to -0.4) kg/m<sup>2</sup>, p < 0.001]. **CONCLUSION:** Hockey FIT has the potential to help overweight/obese men lose weight and improve health risk. A definite RCT is warranted with long-term follow-up.

2141 Board #293 June 2, 3:30 PM - 5:00 PM  
**Smartphone-app-delivered Interval Walking Training In Denmark: User Characteristics And Predictors Of Adherence.**

Mathias Ried-Larsen<sup>1</sup>, Reimar W. Thomsen<sup>2</sup>, Klara Berencsi<sup>2</sup>, Rasmus Ø. Nielsen<sup>1</sup>, Cecilie F. Brinkløv<sup>1</sup>, Charlotte Brønns<sup>1</sup>, Laura S. Valentiner<sup>3</sup>, Kristian Karstoft<sup>1</sup>, Henning Langberg<sup>3</sup>, Allan A. Vaag<sup>1</sup>, Bente K. Pedersen<sup>1</sup>, Jens S. Nielsen<sup>4</sup>.

<sup>1</sup>Copenhagen University Hospital, Copenhagen, Denmark.

<sup>2</sup>Aarhus University Hospital, Aarhus, Denmark. <sup>3</sup>University of Copenhagen, Copenhagen, Denmark. <sup>4</sup>Odense University Hospital, Odense, Denmark.

Email: mathias.ried-larsen@regionh.dk

(No relationships reported)

**PURPOSE:**

To describe user characteristics and adherence to interval walking training (IWT) in Denmark, using the smartphone app InterWalk.

**METHODS:**

The InterWalk app for smartphones was developed aiming at implementing IWT in type 2 diabetes patients in Denmark.

Interval walking training consists of repetitive 3-minutes cycles of slow and fast walking with individualized audio guided feedback. The intensities during walking are determined based on a short initial self-conducted audio guided fitness test. Training data (acceleration, GPS, exercise duration, height, weight, and the civil personal registration number) are uploaded by users and can be used for later data-linkage to Danish nationwide medical databases and administrative registries.

**RESULTS:**

The InterWalk app has been downloaded by >27,000 persons, including 9,466 persons providing personal user information. Of the latter users, 29% were men and 71% women, median age (quartiles) was 55.6 (46.4-63.6). Eighty percent of the men and 62% women were overweight or obese (BMI ≥ 25). The risk of overweight among InterWalk app downloaders was higher compared to the Danish population of similar age (ages 45-74 years) with prevalence odds ratio (95% confidence intervals) of 2.1 (1.9; 2.3) for men and 1.8 (1.7; 1.9) for women. A total of 14,333 valid training sessions (defined as >6 min training duration) were uploaded 86 weeks post release. At least one valid session was uploaded from 2,932 unique users. People downloading the InterWalk app were more likely to be characterized as adherent users, defined as uploading >10 sessions of > 6 minutes duration (N=320) if they performed the audio-guided fitness test; odds ratio (95% confidence intervals) 6.28 (4.82 to 8.18). Men were more likely to be adherent users compared to women; odds ratio (95% confidence intervals) 1.34 (1.03 to 1.72).

**CONCLUSIONS:**

The increased risk of overweight in the InterWalk cohort compared to the Danish reference population suggests that the app is in fact of interest for the at-risk (overweight) individuals. The nationwide implementation suffers from a general lack of adherence, and efforts should be made to increase usage of the app. Our data suggest that promoting completion of the audio guided fitness test might improve adherence to interval walking training.

2142 Board #294 June 2, 3:30 PM - 5:00 PM  
**Prescription Of Physical Training In Pacemaker Patients: Compatibility Between The Formulas And Cardiopulmonary Exercise Test**

Daniel D. Nishioka<sup>1</sup>, Silvana D. Nishioka<sup>2</sup>, Patricia A. Oliveira<sup>2</sup>, Martino M. Filho<sup>2</sup>, Denise M. Lobo<sup>2</sup>, Carlos E. Negrao<sup>2</sup>, Ivani C. Trombetta<sup>2</sup>, Nancy P. Aptekmann<sup>1</sup>, Nancy P. Aptekmann<sup>1</sup>. <sup>1</sup>FMU, Sao Paulo, Brazil. <sup>2</sup>INCOR-HCFMUSP, Sao Paulo, Brazil.

(Sponsor: none, FACSM)

Email: danielddorio90@gmail.com

(No relationships reported)

Heart Rate (HR) is one of the more physiological variables used to prescribe exercises and easy measurement. There are several formulas for predicting the Maximum Heart Rate (HR<sub>max</sub>).PURPOSE: Examine the compatibility of the formulas "reserve HR (Karvonen) = HR<sub>res</sub>" and "%HR<sub>max</sub>" predicted for age with the anaerobic threshold (AT) and respiratory compensation point (RCP) obtained from cardiopulmonary test (CPT) in patients with pacemaker (PM) and compare the training prescription FC at different ages groups and BMI > 30. METHODS: Were included 38 patients with PM, 57.7 mean age, 26 (68%) female. A maximum CPT was performed on a treadmill.

To study the reproducibility between HR measures we used the intraclass correlation coefficient (ICc). RESULTS: The reproducibility of HR was excellent (r=0.767) and significant (p<0.001) between AT and HRres60% test, and excellent (r=0.773) and significant (p30: a) none of the analyzed formulas had any degree of correlation to estimate the AT HR and HR in RCP for the age group between 40-50 years; b) the reproducibility of HR was moderate (r=0.574) and significant (p=0.043) between AT and HRres40% test and HRres40% predicted and it was excellent (r=0.880) and significant (p<0.001) between CPT and HRres80% test for the age group of 51-60anos; c) was excellent (r=0.827) and significant (p<0.001) for the age group of 61-70anos and excellent (0.772) and significant (p=0.001) for BMI > 30, between AT and HRres60% test and was moderate (r=0.744) and significant (p=0.002) for the age group of 61-70anos and moderate (r=0.733) and significant (p=0.002) for BMI > 30, both between CPT and HRres80% test. CONCLUSION: In patients with MP (overall study population), prescribing training is possible using the formula of HRres 60% and 80% obtained in the conventional stress test, when the CPT is not available; for the age group of 61-70anos and BMI > 30, the percentage correlation of HRres are the same as those observed for the overall study population; and in the lower age groups (40-50years and 51-60years) were not observed the same results, possibly due to the small sample size in each subgroup.

2143 Board #295 June 2, 3:30 PM - 5:00 PM  
**Effect of Aerobic Training on Neural Conduction in Type 2 Diabetes and Peripheral Neuropathy**

Saeid Nikoukheslat<sup>1</sup>, Yaghoob Salekzamani<sup>1</sup>, Farhad Golami<sup>1</sup>, Afshar Jafari<sup>1</sup>, Hamidollah Hassanlouei<sup>2</sup>, Arno Schmidt<sup>3</sup>, Normand G. Boule<sup>3</sup>. <sup>1</sup>Tabriz University, Tabriz, Iran, Islamic Republic of. <sup>2</sup>Marquette University, Milwaukee, WI. <sup>3</sup>University of Basel, Basel, Switzerland.

Email: hamidhasanlooie@gmail.com

(No relationships reported)

Diabetes is one of the main causes of neuropathy. No definite treatment for this complication has been established yet. Although it is established that diabetics can benefit from metabolic and cardiovascular effects of exercise, very few studies have investigated the role of regular exercise on diabetic peripheral neuropathy. Therefore, the present study was designed to examine the effect of 12 weeks aerobic training on neural conduction in men with type-2 diabetes and peripheral neuropathy. METHODS: Twenty-four diabetic male subjects diagnosed with peripheral neuropathy were randomly assigned into two groups (12 subjects each): 1- exercise (43±6.4 yrs, 86.5±15.3 kg) and 2- control (42±4.6 yrs, 89.3±11.9 kg). Aerobic training program consisted of 20 to 45 minutes walking or running at 50% to 70% of heart rate reserve, RPE<15, three sessions per week for 12 weeks. Before and 48h after the experimental period, nerve conduction studies (NCS) were performed and blood samples were taken to be analyzed for HbA1c, fasting and 2h postprandial glucose concentration. The data were analyzed using repeated-measures ANOVA and paired t-test and significant level was set at P<0.05. Covariates included baseline value, age and duration of diabetes. RESULTS: NCS analysis showed significant increase in sural sensory and peroneal motor nerves conduction velocity (NCV) in exercise group (P<0.05). We also observed significant time by group interaction regarding sural NCV (P0.05). Moreover, HbA1c, fasting and 2h postprandial glucose levels decreased in exercise group with significant time by group interaction observed for Hb1Ac (P<0.05). CONCLUSION: Based on the findings of the present study, it could be concluded that 12 weeks aerobic training could have favourable effects on peripheral nerves function in diabetic patients with peripheral neuropathy (DPN). Aerobic training may have the potential to hinder DPN development but given the short duration of the present study and very few evidence in this regard, findings need to be validated in future studies.

2144 Board #296 June 2, 3:30 PM - 5:00 PM  
**Endurance Training Improves Muscle Function And Metabolism In A Sickle Cell Disease Mouse Model**

Benjamin Chatel<sup>1</sup>, Laurent Messonnier<sup>2</sup>, Yann Le Fur<sup>1</sup>, Christophe Vilmen<sup>1</sup>, Monique Bernard<sup>1</sup>, David Bendahan<sup>1</sup>. <sup>1</sup>Aix-Marseille Université, CNRS, CRMBM UMR 7339, Marseille, France. <sup>2</sup>Savoie Mont Blanc University, Laboratoire de Physiologie de l'Exercice, Chambéry, France.

Email: benjamin.chatel@live.fr

(No relationships reported)

Sickle cell disease (SCD) is an inherited disorder resulting in the synthesis of an abnormal hemoglobin (HbS) and associated with the occurrence of painful vaso-occlusive crisis (VOC). While it has been recently suggested that oxygen supply and use might be impaired due to muscle remodeling, the corresponding metabolic effects in exercising muscle are still unknown. Considering that regular moderate-intensity exercise is known to be beneficial on muscle structure and energetics, endurance training could alleviate the muscle remodelling described in SCD and improve muscle function.

**PURPOSE:** The aim of this study was to characterize in a mouse model of SCD i) the potential abnormalities in muscle energetics and function, and ii) the potential beneficial effects of endurance training.

**METHODS:** Sedentary control (HbAA-SED, n=10), heterozygous (HbAS-SED, n=10) and sickle cell (HbSS-SED, n=10) mice and endurance-trained (8-weeks treadmill running) healthy (HbAA-END, n=10), heterozygous (HbAS-END, n=11) and sickle cell (HbSS-END, n=8) mice were placed in a home-built device designed for a strictly non-invasive study of posterior hindlimb muscles function and metabolism by NMR during a standardized rest - stimulation - recovery protocol.

**RESULTS:** During the stimulation period, HbSS mice developed less force as compared to HbAA mice ( $p < 0.01$ ) and HbAS mice displayed a reduced total force production as compared to HbAA mice ( $p < 0.05$ ). Whatever the genotype, training resulted in a significantly increased force production ( $p < 0.001$ ). Regarding muscle energetics, the exercise-induced phosphocreatine (PCr) depletion and pH decrease were significantly ( $p < 0.05$ ) larger in HbSS mice as compared to HbAA and HbAS mice. Interestingly, training resulted in a significant ( $p < 0.05$ ) reduction in PCr depletion and intracellular acidosis.

**CONCLUSIONS:** We demonstrated in the present study that SCD was associated with an impaired muscle force production and a larger exercise-induced metabolic consumption. The larger acidosis, which could trigger VOC, might be explained by both an increased non-oxidative glycolytic energy production and an altered protons handling. Interestingly, endurance training improved muscle function and reduced metabolic abnormalities, including acidosis.

2145 Board #297 June 2, 3:30 PM - 5:00 PM  
**Assessment of Muscle Fatigue during Prolonged, Moderate-Intensity Cycling Across Two Age Groups**  
 Kamyar Momeni<sup>1</sup>, Pouran Faghri, FACSM<sup>2</sup>. <sup>1</sup>Rutgers/Kessler Foundation, West Orange, NJ. <sup>2</sup>University of Connecticut, Storrs, CT. (Sponsor: Pouran D. Faghri, FACSM)  
 Email: KMomeni@KesslerFoundation.org  
 (No relationships reported)

**PURPOSE:** To examine the progression of muscle fatigue in lower limb muscles during a prolonged, moderate-intensity cycling protocol and compare adults of two age groups.

**METHODS:** Eighteen male, healthy, novice cyclists, with no history of joint problems, participated in this study and were divided into two groups of young (Y; n=12; age= 22±2 yrs.) and old (O; n=6; age=53±3 yrs.). All participants signed an informed consent, prior to the beginning of the study. After a 2-min warm up, participants engaged in continuous cycling for 30 minutes at a constant workload of 50 W and a cadence of 60 rpm. Cycling period was followed by a 5-min cool-down. During cycling, ten 30-sec epochs of EMG data were collected at 3-min intervals from rectus femoris (RF), biceps femoris (BF), tibialis anterior (TA), and gastrocnemius medialis (GT) of the right leg. Kinematics of the pedal were recorded and synchronized with the EMG data. Median frequency (MDF) of the power spectrum was utilized as an indicator of muscle fatigue. Linear regression was performed on all MDF values of each participant. T-tests were used to compare the regression slopes between the two groups and to determine the presence of sustained muscle fatigue. An ANOVA with repeated measures was used to compare the progression of transient fatigue between the two groups across all epochs.

**RESULTS:** Occurrence of sustained muscle fatigue was not statistically significant ( $p > 0.05$ ) in any of the muscles. The young group showed trends of sustained fatigue by exhibiting negative average slopes for the RF (-0.14±0.77), BF (-0.14±0.78), and GT (-0.28±1.16) muscles. Whereas the older group only showed a negative average slope for the RF muscle (-0.18±0.71). Average MDF of both groups exhibited non-monotonic changes across epochs in all muscles. The transient fatigue and recovery periods appeared more frequently in older adults, compared to young; however, no significant difference ( $p > 0.05$ ) was observed between the two groups in any of the muscles.

**CONCLUSIONS:** None of the groups exhibited significant emergence of transient or sustained muscle fatigue throughout the cycling session. The employed prolonged, moderate-intensity cycling exercise satisfies the ACSM guidelines for maintaining a daily dose of exercise, making it an ideal physical activity alternative for older populations.

2146 Board #298 June 2, 3:30 PM - 5:00 PM  
**The Effects of Yoga Exercise Intervention on Quality of Sleep and Quality of Life in Stroke Patients**  
 City C. Hsieh<sup>1</sup>, Chao-Ming Lin<sup>2</sup>, Yen-Ting Lai Lai<sup>3</sup>, Jung-Cheng Yang<sup>3</sup>, Hsiao-Ling Huang<sup>4</sup>. <sup>1</sup>Hsinchu university of education, Hsinchu, Taiwan. <sup>2</sup>Hsinchu Commercial & Vocational High School, Hsinchu, Taiwan. <sup>3</sup>Taiwan University Hospital Hsinchu Branch, Hsinchu, Taiwan. <sup>4</sup>Yuanpei University, Hsinchu, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM)  
 (No relationships reported)

**Purpose:** The purpose of this study was to investigate the effects of yoga exercise intervention on quality of sleep and quality of life in stroke patients.

**Method:** Thirty-five stroke patients were randomly assigned to the following two groups. sixteen patients were in the experimental group (age: 56.82±9.11 yr), another nineteen patients were in the control group (age: 60.89±10.74 yr). The experimental group had performed yoga exercise twice a week for eight weeks with each session lasting 60 minutes per day, including warm-up (15 minutes), main exercise (35 minutes) and moderate stretching (10 minutes), additionally except rehabilitation courses held by the hospital. The control group had not carried out any exercise intervention except rehabilitation courses. The quality of sleep, and quality of life were tested before and after yoga exercise intervention. Analysis of covariance (ANCOVA) was applied to examine the difference between experimental and control groups on quality of sleep and quality of life.

**Result:** The score of quality of sleep for stroke patients in the experimental group (↓33.2%) decreased significantly compared to that in the control group (↓8.3%) ( $p < .05$ ). In addition, the score of quality of life in the experimental group (↑7.5%) increased significantly compared to that in the control group (↓2.9%) ( $p < .05$ ).

**Conclusion:** The result indicated that the yoga exercise intervention could improve the quality of sleep, sleep efficiency, quality of life and physical health domain in stroke patients.

2147 Board #299 June 2, 3:30 PM - 5:00 PM  
**Contextual Interference Effect on Motor Skills: A Systematic Review with Meta-Analysis**  
 Judith Jimenez<sup>1</sup>, Walter Salazar<sup>1</sup>, Maria Morera<sup>2</sup>. <sup>1</sup>University of Costa Rica, San Jose, Costa Rica. <sup>2</sup>National University, Heredia, Costa Rica. (Sponsor: George A. Kelley, FACSM)  
 Email: judith.jimenez\_d@ucr.ac.cr  
 (No relationships reported)

Previous research has reached conflicting conclusions regarding the effects of random (R) versus block (B) practice in motor skill acquisition and retention, an important component of fitness. **PURPOSE:** Use the aggregate data meta-analytic approach to examine the effects of R versus B practice in motor skill acquisition and retention.

**METHODS:** Randomized trials of B versus R skill acquisition published up to 2014 were included by searching eleven databases, cross-referencing and expert review. Studies were selected and extracted by the first author, with 45% of those extracted checked by the third author. Risk of bias was assessed using a self-developed instrument (maximum points = 5). Random effects models using the standardized mean difference effect size (ES) were used to pooled results. Heterogeneity was examined using the Q statistic and inconsistency using I<sup>2</sup>. An alpha value < 0.05 was considered statistically significant.

**RESULTS:** Of 481 studies screened, 25 representing 1256 males and females and up to 43 ES were included. Risk of bias was M ± SD = 2.3 ± 0.48. For within-group analysis, the B group significantly improved performance during the acquisition phase (ES = 0.69, CI95% = 0.40 to 0.97; Q= 219,  $p < 0.001$ , I<sup>2</sup> = 82%) and significantly decreased performance during the retention phase (ES = -0.25, CI95% = -0.51 to -0.02; Q= 209.4,  $p < 0.001$ , I<sup>2</sup> = 79%). The R group also significantly improved performance during the acquisition phase (ES = 0.79, CI95% = 0.43 to 1.15; Q= 182.2,  $p < 0.001$ , I<sup>2</sup> = 83%) with no statistically significant changes during the retention phase (ES = 0.12, CI95% = -0.12 to 0.38; Q= 159.1,  $p < 0.001$ , I<sup>2</sup> = 74%). For between-group analysis, the B group outperformed the R group in the acquisition phase (ES = -0.15, CI95% = -0.30 to -0.01; Q= 41.8,  $p < 0.07$ , I<sup>2</sup> = 7%) with no statistically significant between-group differences during the retention phase (ES = 0.02, CI95% = -0.20 to 0.26; Q= 124.1,  $p < 0.001$ , I<sup>2</sup> = 71%).

**CONCLUSIONS:** The overall results suggest that (1) both B and R practice improve motor skills during the acquisition phase, with greater improvements observed for B practice, (2) B practice results in decreases in performance during the retention phase, with no differences for R practice, and (3) no differences exist between B and R practice during the retention phase.

THURSDAY, JUNE 2, 2016

2148 Board #300 June 2, 3:30 PM - 5:00 PM

**Exercise Reduces Depressive Symptoms in Adults with Arthritis: Evidential Value**

George A. Kelley, FACSM, Kristi S. Kelley. *West Virginia University, Morgantown, WV.*  
 Email: gkelley@hsc.wvu.edu  
 (No relationships reported)

There is a lack of evidential value regarding the effects of exercise on depressive symptoms in adults with arthritis and other rheumatic diseases.

**PURPOSE:** Determine whether evidential value exists that exercise reduces depressive symptoms in adults with arthritis and other rheumatic diseases.

**METHODS:** Using data from a previous meta-analysis of 29 published studies that included 2449 participants (1470 exercise, 979 control) with fibromyalgia, osteoarthritis, rheumatoid arthritis or systemic lupus erythematosus, a novel, recently developed method, p-curve, was used to assess for evidential value and rule out selective reporting of statistically significant findings regarding exercise and depressive symptoms in adults with arthritis and other rheumatic diseases. Using the method of Stouffer, z-scores were used to test for selective-reporting bias with alpha (p) values  $\leq 0.05$  considered statistically significant. In addition, average power of the tests included in p-curve, adjusted for publication bias, was calculated. **RESULTS:** Fifteen of 29 studies (51.7%) with exercise and depression results were statistically significant ( $p < 0.05$ ) while 73.3% had p-values  $< 0.025$ . None of the results were statistically significant with respect to exercise increasing depressive symptoms in adults with arthritis and other rheumatic diseases. Statistically significant right-skew to rule out selective reporting was found ( $z = -5.28, p = 0.99$ ). The relative frequencies of p-values were 66.7% at 0.01, 6.7% each at 0.02 and 0.03, 13.3% at 0.04 and 6.7% at 0.05. The average power of the tests included in p-curve, corrected for publication bias, was 69%. Diagnostic plot results revealed that the observed power estimate was a better fit than the alternatives. **CONCLUSION:** Evidential value results provide additional support that exercise improves depressive symptoms in adults with arthritis and other rheumatic diseases.

Supported by NIH Grants RO1AR061346 and U54GM104942.

2149 Board #301 June 2, 3:30 PM - 5:00 PM

**VO<sub>2</sub>/PO Relationship In Type 2 Diabetic Subjects.**

Giorgia Spigolon, Federico Y. Fontana, Elisabetta Bacchi, Paolo Moghetti, Silvia Pogliaghi, FACSM. *University of Verona, Verona, Italy.*  
 Email: spigolongiorgia@gmail.com  
 (No relationships reported)

The ability to perform physical activity of prolonged duration and adequate intensity (i.e. exercise tolerance) is instrumental to obtain the well-known health benefits that are associated with physical training in Type 2 diabetes (T2D). During whole-body physical activity exercise tolerance is compromised as the oxygen cost (VO<sub>2</sub>) of energy production becomes progressively higher (i.e. "excess" VO<sub>2</sub>) at power outputs (PO) above the lactate threshold (LT). This loss of muscle efficiency, of which type I fibers fatigue and/or increased type II fibers recruitment are putative causes, impairs exercise tolerance. **PURPOSE:** We tested the hypothesis that a strength training intervention (ST), by increasing maximal force (F<sub>max</sub>) and reducing the recruitment of high-threshold motor units at a given exercise intensity, will reduce the "excess" VO<sub>2</sub> during a cycling incremental exercise. **METHODS:** 11 male patients (mean±SD age 56±8 yrs, BMI 29±4 kg/m<sup>2</sup>), with uncomplicated T2D on oral hypoglycemic drugs were tested *Pre* and *Post* a 4-months ST intervention (3 times per week, 60 min). VO<sub>2</sub>/PO relationship during an incremental cycling test to exhaustion was modelled using a double-linear fit: the slopes of the VO<sub>2</sub>/PO relationship below (S<sub>1</sub>) and above (S<sub>2</sub>) the LT were calculated. Parameters were compared with Wilcoxon signed-rank tests. **RESULTS:** F<sub>max</sub>, VO<sub>2max</sub> and PO<sub>max</sub> significantly increased following ST (20±5, 7±7 and 10±10% respectively). No "excess" VO<sub>2</sub> was present before (S<sub>2</sub> not different from S<sub>1</sub>: 10.5±1.1 vs 9.9±1.7 mlmin<sup>-1</sup>W<sup>-1</sup>) yet it became evident following ST (S<sub>2</sub> significantly higher than S<sub>1</sub>: 14.1±3.1 vs 11.8±4.0 mlmin<sup>-1</sup>W<sup>-1</sup>). **CONCLUSIONS:** Contrarily to our hypothesis, the "excess" VO<sub>2</sub> typically displayed by healthy age-matched controls, was absent in our T2D patients. We speculate that this could be due to the acceleration of the age-related selective atrophy of type II muscle fibers that is known to occur in T2D. A 4-months ST that improved muscle F<sub>max</sub>, VO<sub>2max</sub> and PO<sub>max</sub> was associated with the appearance of an "excess" VO<sub>2</sub>. We speculate that this is the result of the recovered ability to recruit type II muscle fibers towards force production in the heavy-intensity domain of an incremental cycling exercise. The practical implications of the above findings for exercise prescription in T2D require further evaluation.

2150 Board #302 June 2, 3:30 PM - 5:00 PM

**About Exercise Recommendations to Relax Your Brain**

Vera Abeln<sup>1</sup>, Timo Klein<sup>2</sup>, Julia Peter-Krull<sup>1</sup>, Stefan Schneider<sup>1</sup>.  
<sup>1</sup>German Sport University Cologne, Cologne, Germany.  
<sup>2</sup>University of the Sunshine Coast, Maroochydore, Australia.  
 (No relationships reported)

In today's population stress and psychological diseases are on the rise. To support mental health, exercises should be recommended which reduce electrocortical arousal especially within the frontal cortex (executive functions). Because a decrease of frontal cortical activity was revealed following running exercise in runners but not bicycling, arm-cranking or isometric strength exercise (Brümmer et al. 2011), it was hypothesized that exercise preference, adaptation or running characteristics might play a role for the post-exercise effect on brain cortical activity.

**PURPOSE:** The present study aimed to check the preference/adaptation hypothesis by testing a group of triathletes, who are adapted to both running and bicycling, but who prefer one of the two exercises. A group of hockey players running but during a competitive match aimed to confine the effect of running sports.

**METHODS:** 10 professional triathletes were asked to perform two modes of triathlon (bicycling and running), each at their individual self-chosen intensity under field conditions. 24 professional hockey players (n=12 active, n=12 passive) were tested during a competitive match. Electroencephalography (EEG) was recorded under rest conditions before (PRE) and after (POST) exercise. Low-resolution brain electromagnetic tomography (LORETA) was applied to localize current density (μV/2mm<sup>4</sup>) of the frontal, parietal, occipital and temporal lobe.

**RESULTS:** In triathletes, brain cortical activity decreased following running exercise within the frontal lobe ( $p < .001$ ). No differences were found for bicycling exercise. Comparing the trials of the preferred with non-preferred mode revealed no difference for all regions of interest (frontal  $p = .943$ , occipital  $p = .438$ , parietal  $p = .987$ , temporal  $p = .664$ ). In hockey players, no significant differences between PRE and POST brain cortical activity and between active and passive players were found.

**CONCLUSIONS:** The triathlete study supports that the effect of exercise on brain cortical activity is not dependent on adaptation, whereas the hypothesized effect of exercise preference was disproven. The hockey data suggests that steady rather than interval running is making the difference. Steady running should be recommended to support mental health. Further studies are required for verification.

2151 Board #303 June 2, 3:30 PM - 5:00 PM

**Influence of Aerobic versus Anaerobic Exercise on Insulin Function in Recreationally Active Non-Diabetic Females**

Sarah Moede, Sophie L. Gottsman, Elaine Warner, Paul Mellick, Bridget A. Duos. *University of St. Thomas, St. Paul, MN.*  
 Email: moed9914@stthomas.edu  
 (No relationships reported)

Insulin sensitivity and related metabolic complications can be attributed to a lack of physical activity and poor eating habits resulting in improper endocrine function which can lead to type II diabetes (T2D). T2D is classified by the body's inability to adequately respond to insulin, and in turn results in dangerously high levels of glucose in the blood. **PURPOSE:** To determine the effect of a single bout of aerobic exercise versus a single bout of anaerobic exercise on insulin sensitivity.

**METHODS:** Non-diabetic collegiate females (N=14; ht=169.31±5.73 cm; wt=61.36±10.79 kg; age=21.35±0.81 yrs) classified as recreationally active (2-5 days/week of planned physical activity lasting no more than 45 minutes) participated in this study. Baseline venous blood was drawn following an 8-hour fast and 24-hour exercise restriction. Each subject participated in a single bout of aerobic and anaerobic exercise. The aerobic exercise session consisted of 30 minutes of cycling at 60% of the subject's HR max. The anaerobic exercise session consisted of 6x100-meter sprints with a 90 second rest following each sprint. Venous blood was drawn again 24±4 hours after each exercise condition. Blood glucose and insulin concentrations were determined using an ELISA Mercodia insulin test. Insulin sensitivity was calculated using the HOMA-IR index. Paired t-tests were run at the  $p < 0.05$  level using Minitab 16 to determine which exercise condition had a greater effect on increasing insulin sensitivity.

**RESULTS:** A significant difference was established between aerobic (1.36±0.79) and anaerobic (1.04±0.70) conditions ( $p=0.03$ ), but no significance was found between aerobic (1.36±0.79) and baseline (1.14±0.53) conditions ( $p=0.21$ ) or anaerobic (1.04±0.70) and baseline (1.14±0.53) conditions ( $p=0.66$ ).

**CONCLUSIONS:** Results indicated anaerobic exercise is more effective than aerobic exercise in improving insulin function.

2152 Board #304 June 2, 3:30 PM - 5:00 PM  
**Exercise Effect Upon Plasma Irisin And Its Association With Some Metabolic And Anthropometric Variables.**  
 Patricia Cortes-Salim<sup>1</sup>, Arturo Figueroa, FACSM<sup>2</sup>, Victoriano Pérez-Vazquez<sup>1</sup>, Carolina Archundia<sup>1</sup>, Rodolfo Guardado-Mendoza<sup>1</sup>, Carlos Kornhauer<sup>1</sup>, Maciste H. Macias<sup>1</sup>.  
<sup>1</sup>Universidad de Guanajuato, Leon, Mexico. <sup>2</sup>Florida State University, Tallahassee, FL. (Sponsor: Arturo Figueroa, FACSM)  
 Email: pato114@hotmail.com  
 (No relationships reported)

**Background:** Irisin, a recently identified myokine, is induced by muscular contraction and activates profound changes in the subcutaneous adipose tissue, promoting thermogenesis and energy expenditure. Plasma irisin level and its change after recreational physical activity (RPA) have not been clearly elucidated  
**Purpose:** To assess the change in plasma irisin after eight weeks of RPA and its association with metabolic and anthropometric variables.  
**Methods:** Thirty six sedentary obese children were included in this study. RPA training program consisted in 4 weekly sessions during 8 weeks. Each 60 minutes session was divided in 10 minutes warm-up, 40 minutes exercise, and 10 minutes cool-down. Anthropometric (weight, height, waist circumference, triceps and subscapularis skinfolds), blood pressure and metabolic (glucose, cholesterol, triglycerides, HDL, and irisin) measures were obtained in each participant before and after the intervention. Data are presented as medians with ranks. Analysis included paired student's t test, and Spearman's correlation.  
**Results:** From a total of 36 children included (age, 9.5 + 1.5 years; body mass index, 23.8 (19.1-36.2 Kg/m<sup>2</sup>), 19 boys (52.8%) and 17 girls (47.2%) were studied. An increment in muscle area of the arm was observed 2583(1677 - 4563 mm<sup>2</sup>) to 2742 ( 1592 - 4336 mm<sup>2</sup>, p<0.03). Triglycerides decreased from 111 (60-227 mg/dl) to 91 (56-238 mg/dl, p<0.01). Plasma irisin levels did not change after the RPA program 11.2 (6-22 ng/ml) to 11.1 (5-22 ng/ml, p=0.9) . Before the RPA, plasma irisin was correlated with systolic blood pressure (r=0.47, p<0.05) and diastolic blood pressure (r=0.36, p<0.05). There were no significant correlations between irisin and anthropometrics measurements before the RPA; while plasma irisin was positively correlated with the arm muscular area (r=0.45, p<0.05) after the RPA.  
**Conclusion:** Similar to other studies, no changes were observed in plasma irisin levels after an RPA program. Nevertheless, the increased arm muscle area after 8 weeks of RPA was related to plasma irisin. Further studies are needed to clarify the mechanisms of this correlation in obese children.

2153 Board #305 June 2, 3:30 PM - 5:00 PM  
**Comparing Distance-based Vs. Time-based Exercise Prescriptions Of Walking And Running For Improvement Of Blood Lipid Profile And Blood Glucose**  
 Cody E. Morris<sup>1</sup>, John C. Garner<sup>2</sup>, Scott G. Owens<sup>2</sup>, Melinda W. Valliant<sup>2</sup>, Mark Loftin, FACSM<sup>2</sup>. <sup>1</sup>Western Kentucky University, Bowling Green, KY. <sup>2</sup>University of Mississippi, University, MS.  
 (Sponsor: Mark Loftin, FACSM)  
 Email: cody.morris1@wku.edu  
 (No relationships reported)

**PURPOSE:** Some research has suggested that walking for distance as opposed to walking for time may be a stronger predictor of overall amount of accumulated exercise or physical activity and thereby overall energy expenditure (Williams, 2012). The primary purpose of this study was to compare walking/running for distance to walking/running for time as part of a 10-week exercise intervention.  
**METHODS:** Participants included 15 overweight but otherwise healthy adults. Fasting blood lipid profile [high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), triglycerides (TG), total cholesterol (TC)] and fasting blood glucose (BG) were measured using a Cholestech LDX system (Alere, Waltham, MA). A mixed-factor repeated-measures ANOVA was used to compare all dependent variables before and after exercise intervention for within-subjects and between-subjects differences.  
**RESULTS:** A significant interaction was shown for BG change between groups (p < 0.05). The DIST group lowered their BG an average of 10.5 mg/dL while the BG of the TIME group increased by an average of 4.7 mg/dL.  
**CONCLUSIONS:** The results of this study would support the suggestion by Williams (2012) that a distance-based exercise prescription of walking or running should provide a clinician or researcher with a closer estimation of overall energy expenditure and improved BG as a risk factor for cardiovascular disease.

2154 Board #306 June 2, 3:30 PM - 5:00 PM  
**The Impact Of Three Progressively Higher Step Recommendations On Weight And Body Composition Over The Freshmen Year**  
 Bruce W. Bailey, William Errico, Sharla Compton, Gabrielle LeCheminant. Brigham Young University, Provo, UT.  
 Email: bruce.bailey@byu.edu  
 (No relationships reported)

The transition from high school to college generally results in reduced physical activity and weight gain that is at a rate that is higher than the general population.  
**PURPOSE:** The purpose of this study was to examine the effects of three progressively higher step recommendations over 24 weeks on change in body weight and body composition. **METHODS:** Seventy-nine freshmen college women wore a multi-function pedometer for 24 weeks after being randomly assigned to a daily step level: 10,000; 12,500; or 15,000. Pedometer data were downloaded every two weeks and participants were counseled on meeting their step recommendation. Body weight and body composition was assessed at baseline and 24 weeks. Body composition was assessed by dual x-ray absorptiometry. **RESULTS:** On average women got 10,904 ± 927, 12,935 ± 1319 and 14077 ± 1276 steps per day for the 10,000, 12,500 and 15,000 step groups respectively (F = 15.48, P < 0.0001). Participants gained 1.4 ± 2.6, 1.8 ± 2.1 and 1.4 ± 2.1 kg for the 10,000, 12,500 and 15,000 step groups. Weight gain was not significantly different between groups (F = 0.18, P = 0.8385). There was also no difference in fat weight gain (F = 0.41, P = 0.7954). **CONCLUSION:** A step recommendation beyond 10,000 does not seem to prevent weight or fat gain over the first year of college. Future research should focus on either intensity of physical activity or the addition of dietary interventions to prevent weight gain during the first year of college.

2155 Board #307 June 2, 3:30 PM - 5:00 PM  
**The Effects of Cell Phone Use on Anterior and Posterior Postural Stability**  
 Cody A. Croall, Emily A. Cumberledge, Matthew Dirlam, Taylor Maldonado Maldonado, Deanna O'Donnell, Timothy Sheehan, Michael J. Rebold. Bloomsburg University, Bloomsburg, PA.  
 Email: cac49290@huskies.bloomu.edu  
 (No relationships reported)

In today's society cell phones have become a near-ubiquitous tool and is used in many common activities such as when standing in a line, walking from one location to another, in the classroom while learning, while watching sporting events, etc. **Purpose:** To assess the effects of various cell phone functions (talking, texting, and listening to music) on anterior and posterior postural stability compared to a control condition. **Methods:** Forty-five college students (n = 16 males) participated in four conditions in a randomized order. During the control condition no cell phone functions were utilized. For the texting and talking conditions participants followed a predetermined script. Finally, during the music condition participants selected the music of their choice. **Results:** The anterior and posterior postural stability index scores during the control (0.85) condition was significantly (p ≤ 0.005) lower than the texting (1.58) and talking (1.04) conditions. The control (0.85) condition was not significantly (p = 0.30) different than the music (0.81) condition. The talking (1.04) condition was significantly (p < 0.001) lower than the texting (1.58) condition. The music (0.81) condition was significantly (p ≤ 0.001) lower than both the talking (1.04) and texting (1.58) conditions. **Conclusion:** Based off of the current results, it is recommended that cell phone texting and talking be refrained from while either maintaining balance in a static position or while moving within the anterior and posterior plane.

2156 Board #308 June 2, 3:30 PM - 5:00 PM  
**The Anti Fatigue Effect Of Momordica Grosvenori And Its Influence On Blood Rheology Index**  
 Peng Feng-lin. Guangxi Normal University, Guilin, China.  
 (Sponsor: Weimo Zhu, FACSM)  
 Email: pengflin@mailbox.gxnu.edu.cn  
 (No relationships reported)

In recent years, how to eliminate and alleviate exercise fatigue has become a focus of sports medicine and physiological research. So far, no ideal method to eliminate exercise fatigue has been found. Very recently, researchers in China have found Mangosteen unique cucurbits has precious medical and edible values. Although studies have reported its effective component can delay the exercise fatigue and accelerate body function recovery \ its mechanism is still not clear.  
**PURPOSE:** To study the ability of Momordica grosvenori effective components anti fatigue and impact on blood rheological index. **Methods:** 32 male college students majored in physical education (21.04±0.88 yrs) from a Chinese university, were recruited and randomly divided into control group, low dose group (4ml/kg.d), medium dose group (8ml/kg.d), and high dose group (20ml/kg.d), n = 8 per group.

Momordica grosvenori effective components intervened for 20 days. Blood samples were collected before and after the experiment. Blood lactic acid (LD), blood urea nitrogen (BUN), malondialdehyde (MDA), glutamic pyruvic transaminase (GPT) activity, blood rheological index (high shear viscosity and reduction viscosity of whole blood) were measured. Exercise fatigue was induced by exhaustive exercise (riding, 230W, 60-70rpm). Results: The intervention of Momordica grosvenori effective components has a positive effects on exercise fatigue indexes. Compared with the control group, LD, ΔLD, ΔBUN, ΔMDA, GPT, ΔGPT in high dose group were significant lower ( $P < 0.05$ ), ΔLD, GPT, ΔGPT in medium dose group were significant lower ( $P < 0.05$ ), low dose group only ΔGPT was significant lower ( $P < 0.05$ ). MDA and GPT were significantly correlated with blood rheology index ( $P < 0.05$ ). MDA was very significantly correlated with high shear viscosity and reduction viscosity of whole blood ( $P < 0.01$ ). Conclusion: Intervention of high dose effective constituents of the grosvenor momordica can improve antioxidant ability, improve the index of blood rheology, improve the ability of anti fatigue, so as to eliminate and delay exercise fatigue.

2157 Board #309 June 2, 3:30 PM - 5:00 PM  
**Brief, Intense Intermittent Stair Climbing Is A Practical, Time-Efficient Method To Improve Cardiorespiratory Fitness**  
 Mary K. Allison<sup>1</sup>, Brian J. Martin<sup>1</sup>, Martin J. MacInnis<sup>1</sup>, Brendon Gurd<sup>2</sup>, Martin J. Gibala<sup>1</sup>. <sup>1</sup>McMaster University, Hamilton, ON, Canada. <sup>2</sup>Queens University, Kingston, ON, Canada. (Sponsor: Dr. Stuart Phillips, FACSM)  
 (No relationships reported)

Sprint Interval Training (SIT), involving brief intermittent bursts of very intense exercise, has been touted as a time-efficient alternative to traditional endurance training for improving cardiorespiratory fitness (CRF) and clinical markers of health. Most SIT protocols, such as Wingate-based cycling, have been studied in a laboratory setting and require specialized equipment, which is impractical for many individuals. Stair climbing may be a more suitable and accessible alternative to laboratory-based SIT. While established as an effective form of exercise to enhance CRF, the minimum effective "dose" of stair climbing remains unknown.

**PURPOSE:** To determine whether brief, intense intermittent stair climbing improves CRF. **METHODS:** Twelve sedentary but otherwise healthy women (age = 26±11 y; BMI = 23.6±3.0 kg/m<sup>2</sup>) trained 3 d/wk for 6 wk. Each 10-min training session involved a 2-min warm up, 3x20-s bouts of intense stair climbing interspersed with 2 min of recovery, and a 3-min cool-down. Training was performed using the stairwell of a 6-storey campus building. Subjects were instructed to climb stairs as fast as safely possible. Recovery periods involved descending the stairs slowly and walking on flat ground. **RESULTS:** Participants climbed 59±4 stairs (height climbed = 11.4±0.8 m) during each bout. Mean power output was 365±40, 354±38 and 337±35 W for the three bouts, with corresponding ratings of perceived exertion scores of 12±1, 14±2, and 16±2, respectively. Training elicited 81±4% of maximum heart rate (HR<sub>max</sub>) on average over the 10-min session, 86±3% HR<sub>max</sub> during the 3x20-s bouts, and peak HR was 94±3% of HR<sub>max</sub>. Peak oxygen uptake (VO<sub>2peak</sub>) increased by 13% from 28.9±3.7 to 32.4±3.6 mL O<sub>2</sub>·kg<sup>-1</sup>·min<sup>-1</sup> after training ( $p < 0.01$ ). Absolute VO<sub>2peak</sub> similarly increased from 1.8±0.2 to 2.0±0.3 mL O<sub>2</sub>·min<sup>-1</sup> ( $p < 0.01$ ) as body mass was unchanged after training (62.2±9.5 vs. 62.6±9.6 kg,  $p > 0.05$ ). **CONCLUSION:** Brief, intense intermittent bursts of stair climbing, involving only 3 min of "all-out" exercise within a 30-min time commitment per week increased CRF by ~1 metabolic equivalent over 6 wk. This change is similar to that previously reported after laboratory-based SIT protocols of similar duration, and traditional endurance training involving a much higher exercise volume and time commitment.

2158 Board #310 June 2, 3:30 PM - 5:00 PM  
**Influence of Exercise Time of Day on Salivary Melatonin Responses**  
 Kaylee M. Pobocik<sup>1</sup>, Michael Lawrence<sup>2</sup>, Daniel A. Brazeau<sup>2</sup>, Lara A. Carlson, FACSM<sup>1</sup>. <sup>1</sup>University of New England, Biddeford, ME. <sup>2</sup>University of New England, Portland, ME.  
 (Sponsor: Lara A Carlson, FACSM)  
 (No relationships reported)

Sleep deprivation may have changes in cognition, pain, mood, metabolism, and immunity, which can ultimately create negative consequences on athletic performance. Melatonin is thought to induce sleepiness due to its synchronization with the circadian rhythm. **PURPOSE:** The purpose of this study was to evaluate the influence of exercise time of day on salivary melatonin (s-Mel) responses. **METHODS:** Ten regularly exercising, males (age 20.7 ± 0.7 yr; height 1.74 ± 0.04 m, mass 73.6 ± 11.4 kg, maximal oxygen consumption [VO<sub>2max</sub>] 56.4 ± 4.4 ml/kg/min<sup>-1</sup>) completed a VO<sub>2max</sub> using an incremental protocol on a treadmill. In a randomized, crossover design, subjects completed three protocols: morning exercise (09:00 h), afternoon exercise (16:00 h), and no exercise (control) at least 5 days apart. For each exercise session, subjects performed 30 min of steady-state running at 75% of VO<sub>2max</sub>

following a 5 min warm-up. Saliva was collected via a passive drool into 2 ml polypropylene conical tubes at 20:00 h, 22:00 h, and 03:00 h following all sessions. **RESULTS:** No significant differences existed in the s-Mel levels for exercise time of day. A trend found morning exercise produced a higher concentration of s-Mel than afternoon exercise ( $p = 0.074$ ). The 20:00 h collection time was significantly higher than the 03:00 h collection ( $p = 0.001$ ). Additionally, s-Mel levels were significantly ( $p = 0.018$ ) greater for the 20:00 h collection time compared to the 22:00 h collection, and 22:00 h was greater than 03:00 h ( $p = 0.038$ ). **CONCLUSION:** It appears that exercise time of day did not affect s-Mel levels.

Table 1: s-Mel Levels, (pg/mL), Mean ± SD

|         | 20:00 h     | 22:00 h    | 03:00 h   |
|---------|-------------|------------|-----------|
| Control | 2.8 ± 0.8** | 1.7 ± 0.8* | 0.8 ± 0.8 |
| 9:00 h  | 2.5 ± 0.7** | 1.6 ± 0.9* | 0.8 ± 0.6 |
| 16:00 h | 2.5 ± 0.8** | 2.1 ± 0.5* | 1.0 ± 1.0 |

\*Significantly > 03:00 h ( $p < 0.05$ ) \*Significantly > 22:00 h ( $p < 0.05$ )

Supported by: NEACSM Undergraduate Research Grant

2159 Board #311 June 2, 3:30 PM - 5:00 PM  
**The Effects Of A 10-week Whole-body Vibration Program On Balance And Lower Body Muscular Strength In Adult Women.**  
 Andjelka Pavlovic, David L. Nichols, FACSM, Kyle Biggerstaff, Ron Davis. Texas Woman's University, Denton, TX.  
 (No relationships reported)

**The effects of a 10-week whole-body vibration program on balance and lower body muscular strength in adult women.**

**Abstract:**

The purpose of this study was to examine the effects of 10 weeks of whole-body vibration on balance, lower body muscular strength, and bone mineral density in women. The study was comprised of two groups: whole body vibration (WBV, n = 19) and control (CON, n = 16). Both groups completed a 10-week WBV program. The WBV group received a vibratory stimulus while performing lower extremity exercises. The CON group performed the same protocol without vibration. Data were collected on balance, muscular strength and bone mineral density. Two, factorial MANOVAs were used to analyze the data with a significance level of .05. Isometric strength of the quadriceps increased significantly for both groups. The improvement in strength was significantly greater in the WBV group (pre: 128.7 ± 50.8 ft•lb, post: 157.7 ± 51.9 ft•lb) compared to the control group (pre: 129.3 ± 33.9 ft•lb, post: 136.5 ± 33.8 ft•lb). No significant differences were observed between the groups for any other variables. Both groups showed significant improvements over time in the adaptation test (WBV pre: 61.53 ± 3.28 deg/s, post: 52.74 ± 3.37 deg/s; CON pre: 68.19 ± 3.6 deg/s, post: 65.44 ± 3.67 deg/s) and the rising index of the sit-to-stand test (WBV pre: 29.32 ± 9.2 %BW, post: 31.32 ± 10.5 %BW; CON pre: 29.81 ± 9.4 %BW, post: 33.3 ± 7.9 %BW). In conclusion, adding WBV to a lower extremity exercise program appears to improve lower body muscular strength.

2160 Board #312 June 2, 3:30 PM - 5:00 PM  
**Association between Physical Activity and Depression: The Exercise for Persons Who Are Immunocompromised (EPIC) Study**  
 Sanaz Nosrat, James W. Whitworth, Nicholas J. SantaBarbara, Jordan E. Labrec, Joseph T. Ciccolo. Teachers College, Columbia University, New York, 10027, NY. (Sponsor: Carol Ewing Garber, FACSM)  
 Email: sn2504@tc.columbia.edu  
 (No relationships reported)

**Background:** The prevalence of major depressive disorder and depressive symptoms is higher in people living with HIV (PLWH) than in their seronegative counterparts. Evidence suggests that depression may negatively affect the progression of HIV, and that it is associated with reduced medication adherence. Physical inactivity is hypothesized to be associated with poorer mental health in general population; however, this relationship is less examined among PLWH. **Purpose:** This study explored the cross-sectional relationship between self-reported physical activity levels and depressive symptoms in a community sample of PLWH. **Methods:** Baseline data collected from a trial testing the acute effects of resistance exercise in PLWH were used. Participants were 15 males and 6 females ages 32-61 (M=49.4, SD=9.2) who completed questionnaires relating to their physical activity and mental health. Physical activity was assessed with the interview version of the past-week Modifiable Activity Questionnaire (MAQ); depressive symptoms were measured with the Center for Epidemiologic Depression Scale (CES-D) and the Patient Health Questionnaire (PHQ-9). Height and weight were measured using standard procedures, and body mass index (BMI) was calculated. Participants were classified as completely sedentary: no physical activity reported in the past 7 days (n=9); or leisurely active: any leisure

activity reported in the past 7 days (n=12). Group differences were analyzed using t-tests with significance level set at p<.05. **Results:** The leisurely active group had significantly lower CES-D (t=-2.65, p=.02) and PHQ-9 (t=-2.46, p=.02) scores than the sedentary group. There were no significant differences for BMI between the two groups. **Conclusion:** The results of this study suggest a significant inverse association between physical activity and depressive symptoms among PLWH. Future studies will be required to examine the direction of the effects, and the mechanisms that may be involved in the relationship between physical activity and depressive symptoms in PLWH.

2161 Board #313 June 2, 3:30 PM - 5:00 PM  
**Commuting with Electric Assist Bicycles as a Means to Improve Cardiometabolic Risk Factors**  
 James E. Peterman, Kalee L. Morris, Rodger Kram, William C. Byrnes, FACSM. *University of Colorado Boulder, Boulder, CO.* (Sponsor: William C Byrnes, FACSM)  
*(No relationships reported)*

This study used a type of electric assist bicycle known as a pedelec. A pedelec is a bicycle equipped with a modest electric motor that provides assistance only when the rider is actively pedaling thus helping to overcome the common hurdles associated with active transportation (e.g. difficult hills and longer distances). **PURPOSE:** Our primary purpose was to quantify improvements in cardiometabolic risk factors associated with pedelec commuting for 4 weeks. Our secondary purpose was to quantify pedelec usage patterns (duration and intensity). **METHODS:** Twenty physically inactive participants (6 males, 14 females) visited the lab three times for baseline physiological measurements (body composition, VO2max test, mean arterial pressure (MAP) blood pressure, lipid profile, and 2-hour oral glucose tolerance test (OGTT)). During the following 4 weeks, participants commuted using a pedelec a minimum of 3 day/week for 40 min/day. While riding the pedelec, participants wore a heart rate monitor and used a GPS device. Heart rate data was used in conjunction with a regression equation developed from the VO2max test to estimate METS. After 4 weeks, participants repeated the physiological measurements. **RESULTS:** Commuting with a pedelec significantly improved 2-hr post OGTT glucose (5.45±1.18 to 5.02±0.91 mmol/L, p<.05), VO2max (2.19±0.48 to 2.37±0.52 L/min, p<.05), and power output at the end of the VO2max test (165.6±39.4 to 185.6±38.2 Watts, p<.05). There was a trend for improvements in MAP (84.1±10.5 to 82.7±9.4 mmHg, p=0.15) and fat mass (28.3±11.3 to 27.8±11.4 kg, p=0.07). The average ride distance was 11.2±6.8 km with ride time averaging 0:32:56±0:14:41 (hr:min:sec). Average 4 week total distance and time were 317.9±113.7 km and 16:16:41±3:19:05, respectively. Estimated METS while riding were in the moderate intensity range (4.6±1.2 METS). **CONCLUSIONS:** Commuting with a pedelec for 4 weeks resulted in significant improvements in 2-hr post OGTT glucose, VO2max, and peak power output. Despite the electric assistance, riders self-selected an intensity that helped them meet the ACSM guidelines for physical activity. Pedelecs are an effective form of active transportation that can improve some cardiometabolic risk factors. Supported by NIH Grant UL1 TROOO154, the City of Boulder, and Skratich Labs

2162 Board #314 June 2, 3:30 PM - 5:00 PM  
**Kinesio Taping does not Alter Muscular Performance of Lower Extremity in Obese Adults**  
 Nan Hee Lee, Hyun Chul Jung, Gina Ok, Sukho Lee. *Texas A&M University-San Antonio, San Antonio, TX.* (Sponsor: Minsoo Kang, FACSM)  
 Email: nanhee84@hanmail.net  
*(No relationships reported)*

Obese adults often experience a weight burden imposed on the joints during physical activities. Taping is known as an effective therapy that can lessen the stress on joints during physical activity. Specially, Kinesio taping has gained recognition to improve exercise performance. However, the acute effects of Kinesio taping using obese population have not been well established. **PURPOSE:** The purpose of this study was to examine the acute effects of Kinesio taping on the muscular strength, power, and endurance of lower extremity in obese adults. **METHODS:** This study was conducted in randomized crossover design with 7 days washout periods. Fourteen obese adults (male: 5, female: 9), mean age of 24.0 ± 3.04 years and percent body fat of 37.44 ± 7.64 % (male: 33.25 ± 8.12, female: 38.16 ± 6.91) took part in the study. All subjects underwent three different trials which were no taping, placebo taping (3M tape), and Kinesio taping. The tape was applied to the rectus femoris, tibialis anterior, and patella ligament based on the Kinesio taping techniques. Subjects wore an eye mask and the taped leg was covered by clothes for preventing subjects and researchers from identifying different tapings (double-blind). Muscular power, isometric muscle strength, and muscle endurance of lower extremity were assessed. The percentage change from base-line values were used for dependent variable. Repeated measures ANOVA was used to determine differences among three trials. **RESULTS:** There were no statistical differences in peak power (F= 0.978, p=.402), mean power (F=1.386, p=.285), muscular strength (extension: F= 1.138, p=

.350; flexion: F= 3.326, p=.068, and endurance (F= 3.675, p=.060) among three trials. Although, this study did not show any significant differences, Kinesio taping showed a slight improvement in peak power and mean power 0.22 % and 0.89 % respectively to compared with the placebo taping. Also, leg strength showed relatively higher augmentation in Kinesio taping 4.28 % in flexion and 1.37 % in extension than the placebo taping respectively. **CONCLUSIONS:** The Kinesio tape did not improve lower limb performance in obese adults. Short application period may affect to the non-significance result. Further studies are needed to investigate the effective period of taping on lower limb exercise performance in obese adults.

2163 Board #315 June 2, 3:30 PM - 5:00 PM  
**An Economic Evaluation of a 12 Week Workplace Primary Prevention Program**  
 Holly Wollmann. *UBC, Vancouver, BC, Canada.*  
 Email: holly\_wollmann11@hotmail.com  
*(No relationships reported)*

Introduction: Healthy lifestyle behaviors (such as routine physical activity, proper nutrition, absence of smoking, and reduced alcohol consumption) play a critical role in workplace wellness and overall wellbeing. However, it is unclear what effects a healthy lifestyle intervention will have on absenteeism and presenteeism. **Purpose:** To examine the effectiveness of a healthy lifestyle workplace intervention on absenteeism and presenteeism. **Methods:** A total of 50 participants (35 Females (43.4 ± 11.5 yr) and 15 males (44.9 ± 10.5 yr) completed a 12 wk comprehensive healthy lifestyle intervention (ACCELERATION) in the workplace. Workers received weekly 1 hr education and exercise sessions related to evidence-based best practice in proper nutrition, physical activity, smoking cessation, alcohol reduction, mental health, and stress management. Participants completed questionnaires related to employee absenteeism and presenteeism at baseline and after a 3-month follow up. **Results:** Due to the non-normal distribution, a Wilcoxon matched pairs signed rank test was conducted to determine differences in baseline and follow up absenteeism costs. Results of the analysis indicated that there was no significant difference in baseline absenteeism costs (m = 272.6 ±399.4) and follow up costs (m = 289.3 ±774.3). The monetary results from the evaluation reported a reduction in absence days by 54.0% from 1.40±2.93 to 0.64±2.01 per employee A paired samples t-test was conducted to determine the difference in employee presenteeism costs at baseline and at the three month follow up. There was no significant difference in the scores for presenteeism costs at baseline (m = 3798.5 ± 3441.9) and follow up (m = 3496.6 ±3627.3) time points; t(49)=5.37, p=0.594. Presenteeism was reduced by 17.0% from 29.0% to 12.0% equating to an average cost savings of \$420.12±290.30 per employee. **Conclusion:** These results indicate that the comprehensive healthy lifestyle behaviour intervention (ACCELERATION) had a positive effect on employee health costs. Future larger scale studies are warranted.

2164 Board #316 June 2, 3:30 PM - 5:00 PM  
**Objectively Measured Aerobic and Resistance Exercise and Cardiovascular Disease Risk Factor Response**  
 Elizabeth C. Schroeder, Duck-chul Lee. *Iowa State University, Ames, IA.*  
*(No relationships reported)*

**PURPOSE:** To examine the effects of objectively measured weekly exercise weight (EW) lifted and exercise heart beats (EHB) during exercise training on changes in cardiovascular disease (CVD) risk factors. **METHODS:** We randomized 31 pre-to-stage 1 hypertensive (not on medication), overweight/obese, and sedentary non-smokers (58±8 years) into an aerobic training (AT) only (n=16) or a resistance training (RT) only (n=15) 8 week exercise intervention. Participants exercised 3 days/week for 60 min/session. An innovative exercise training system and software (TechnoGym) captured EW lifted and EHB automatically each session. Total weekly EW lifted was calculated as the sum of weight x repetitions x sets for each exercise, averaged over 8 weeks, then divided by body weight (lbs). Total weekly EHB were calculated by the sum of exercise heart rate x min/session/week, with resting heart rate x minutes of exercise subtracted. We measured peripheral and central blood pressure (BP), % body fat, cardiorespiratory fitness, bench and leg press 1 repetition maximum (1RM), and blood lipids at baseline and 8-weeks. Individual CVD risk factors were standardized as sex specific z-scores for each participant and the mean was used to establish an overall clustered CVD risk score. Data was analyzed using Pearson correlation and linear mixed models adjusting for age, sex, and average daily steps. **RESULTS:** The average weekly EW and EHB were 220±68 lbs and 7004±1419 beats, respectively. Regression analysis showed a reduction in overall CVD risk score by -0.25 (p = 0.06) per 100 lbs lifted relative to body weight with RT and -0.1 (p=0.16) per 1000 beats with AT. With RT, we found strong correlations between total EW and changes in peripheral systolic (r=-0.45, p=0.09) and diastolic BP (r=-0.59, p=0.02), central systolic (r=-0.47, p=0.08) and diastolic BP (r=-0.53, p=0.04), and leg press 1RM (r=0.62, p=0.01). With AT, strong correlations with total EHB were noted with change in triglyceride levels (r=-0.50, p=0.049).

**CONCLUSIONS:** In individuals at high risk of developing CVD, increased total EW lifted and EHB are associated with improved overall CVD risk, especially peripheral and central BP with greater EW lifted, and triglyceride levels for additional EHB. Supported by Iowa State University College of Human Sciences seed grant.

2165 Board #317 June 2, 3:30 PM - 5:00 PM  
**The Physiology and Health Impact of Squat: A Review**

Zezhao Chen. *University of Illinois at Urbana-Champaign, Champaign, IL.*

Email: zezhao.chen86@gmail.com

(No relationships reported)

Squat as a lower body training is known its positive impact in both fitness training and strength training for athletic performance, as well as a mean for rehabilitation. However, the physiological impact and application to health intervention have not been systematically reviewed.

**PURPOSE:** To provide a systematic review on squat as an exercise intervention and examine its physiological impact in fitness training, health promotion and rehabilitation.

**METHOD:** Key words, such as "Squat", "Physiology" combined with "Rehabilitation", "Training", "Fitness" and etc., were researched in the databases of "Web of Science", "Google", and "PubMed". Criterion search was defined in "written in English" paper only, back to year of 2005. **RESULT:** 321 papers were found, but only 150 were qualified. Four categories were summarized including fitness performance, body physiology impact, chronic disease and anatomy morphology. Clinical trial (50%) design was mostly conducted. Most of the qualified studies (50%) adapted squats to improve fitness performance, in particular countermovement jump, acceleration, and running speed, showing a moderate intensity of squat intervention could greatly improve the athletic performance. Physiology impacts (30%) such as muscle activation were also examined in some of the studies, reporting that muscle activation of the lower limb resulting from several of squat depth; several studies noted that common various such as stance width, hip rotation, and front squat had no impact to muscle activation. About 10% of the quailed studies discussed the important role of squats in chronic disease intervention, showing a positive impact. For example, a 3-time weekly, moderate intensity squat intervention could help reduce disease symptoms, especially in older adults (aged 60-85 yr.). **CONCLUSION:** While squat has been widely used in fitness and athletic training, its application to health and chronic diseases are still limited. Combined with other physical activity intervention, such as aerobics and resistant training, squat could bring some positive impact on lower extremity, balance, and even mobility. Meanwhile, there is still a gap in the information on detailed dose-response of squat in exercise and its interaction with age, gender, etc.

2166 Board #318 June 2, 3:30 PM - 5:00 PM  
**The Effects of Cell Phone Use on Medial and Lateral Postural Stability**

Emily A. Cumberledge, Cody A. Croall, Matthew Dirlam, Taylor Maldonado, Timothy Sheehan, Deanna O'Donnell, Michael J. Rebold. *Bloomsburg University of Pennsylvania, Bloomsburg, PA.*

Email: eac70235@huskies.bloomu.edu

(No relationships reported)

The ability to pay adequate attention to two tasks at the same time has become more important with the advancement of today's technology. While dual-tasking neither source receives the proper attention needed to be properly performed. The effects of cell phone use during common activities is just beginning to be understood. **Purpose:** To assess the effects of various cell phone functions (talking, texting, and listening to music) on medial and lateral postural stability compared to a control condition. **Methods:** Forty-five college students ( $n = 29$  females) participated in four conditions in a randomized order. During the *control* condition no cell phone functions were utilized. For the *texting* and *talking* conditions participants followed a predetermined script. Finally, during the *music* condition participants selected the music of their choice. **Results:** The medial and lateral postural stability index scores during the *control* (0.66) and *music* (0.66) conditions were significantly ( $p < 0.001$ ) lower than the *texting* (1.21) and *talking* (0.86) conditions. The *control* (0.66) condition was not significantly ( $p = 0.83$ ) different than the *music* (0.66) condition. The *talking* (0.86) condition was significantly ( $p < 0.001$ ) lower than *texting* (1.21) condition. **Conclusion:** Based off of the current results, it is recommended that cell phone texting and talking be refrained from while either maintaining balance in a static position or while moving within the medial and lateral plane, such as side to side movement or shuffling. Failure to do so can possibly lead to orthopedic injuries.

2167 Board #319 June 2, 3:30 PM - 5:00 PM

**The Effect of Walking Exercise on Fitness and Metabolic Abnormal Factors in Patients with Schizophrenia**

Yu-Huei Chen<sup>1</sup>, Tsui-Mei Hung<sup>2</sup>, Mei-Wun Tsai<sup>1</sup>. <sup>1</sup>National Yang-Ming University, Taipei, Taiwan. <sup>2</sup>Taipei City Hospital Songde Branch, Taipei, Taiwan.

Email: ilovebobo52336@gmail.com

(No relationships reported)

The increase in developing obesity and metabolic syndrome becomes another burden in patients with schizophrenia who took antipsychotics. Exercise and lifestyle modification are suggested as effective and primary management for the chronic diseases. Walking is a feasible lifestyle activity but ceiling effect due to a relative low intensity is challenged. **PURPOSE:** To compare the effect of different walking exercises on fitness and metabolic abnormal factors in patients with schizophrenia.

**METHODS:** Fifty-six admitted patients, meeting DSM-IV criteria for schizophrenia and having antipsychotic-treated under stable medical condition, were recruited and divided into three groups: walking prescription group (Wp, set target speed and distance based on individual fitness level,  $n=22$ ), free walking group (Wf, encouraged to walk 30 minutes per day,  $n=20$ ) and control group (C,  $n=14$ ). Physical fitness (e.g. step physical fitness index and leg strength) and metabolic factors (e.g. waist girth, blood pressure, fasting plasma glucose and lipids) were assessed before and after 6-month intervention. Basic data and clinical features were also investigated.

**RESULTS:** After adjusting for age, sex and baseline values, Wp got significantly improvement on muscular fitness of abdominal muscle endurance and leg strength after 6-month intervention. While subjects in both Wf and C got little improvement or regressed on muscular fitness. Metabolic factors were not significantly different among three groups on pre- and post 6-month intervention. The change of step physical fitness index, however, significantly correlated to the change of triglycerides after 6-month intervention (Pearson's  $r = -0.57$ ,  $p < 0.001$ ). A negative correlation was also found between the change of abdominal muscle endurance and the change of systolic blood pressure (Pearson's  $r = -0.32$ ,  $p = 0.039$ ).

**CONCLUSIONS:** Walking exercise by setting a route with prescribed distance and slope individually for 5 days a week is feasible and more effective for patients with schizophrenia.

2168 Board #320 June 2, 3:30 PM - 5:00 PM

**The Effectiveness Ratio: Refining Exercise Prescription for Optimal Health Benefit**

Beth A. Taylor<sup>1</sup>, Amanda L. Zaleski<sup>1</sup>, Gregory A. Panza<sup>1</sup>, Paul D. Thompson, FACSM<sup>2</sup>. <sup>1</sup>University of Connecticut, Storrs, CT. <sup>2</sup>Hartford Hospital, Hartford, CT.

Email: beth.taylor@uconn.edu

(No relationships reported)

**PURPOSE:** The practice of exercise prescription calculates the benefits of exercise on specific health outcomes according to the frequency, intensity, time, type, volume and progression of exercise. However, exercise prescription does not typically account for differences in injury risk associated with exercise training programs. The purpose of the present study was to calculate a novel effectiveness ratio (ER) to compare differences in cardiometabolic risk reduction alone and relative to injury risk between exercise interventions.

**METHODS:** Data from two exercise studies (JAMA Pediatr. 2014;168:1006-14 and Br J Sports Med. 2009;43:825-31) were used to calculate the absolute value of the average percent (%) change in measured cardiometabolic risk factors (RF) alone and as an ER (% change in RF relative to the % of participants injured during training).

**RESULTS:** In Study 1, 6 months of aerobic exercise (AE), resistance exercise (RE) and combined exercise (CE) training evoked similar ( $p = 0.45$ ) average reductions in RF (systolic and diastolic blood pressure, body mass index, and waist circumference) of  $3.3 \pm 1.0$ ,  $2.3 \pm 1.0$ , and  $2.8 \pm 1.3\%$ , respectively. However, when normalized to injury rates, the ER of AE was significantly higher ( $0.8 \pm 0.2$ ) than the ER of RE ( $0.3 \pm 0.1$ ;  $p < 0.01$ ) and CE ( $0.3 \pm 0.1$ ;  $p < 0.01$ ). In Study 2, 12 weeks of soccer (S) and running (R) training evoked similar ( $p = 0.14$ ) improvements in RF (systolic blood pressure, heart rate, low-density lipoprotein cholesterol and maximal oxygen uptake) of  $11.0 \pm 3.9$  and  $7.0 \pm 2.6\%$ , respectively. When normalized to injury rates, the ER of S was significantly higher than the ER of R ( $1.4 \pm 0.5$  vs.  $0.4 \pm 0.2$ ;  $p < 0.01$ ).

**CONCLUSIONS:** Examining the effectiveness of an exercise intervention by creating an ER (change in health outcome relative to the number of participants who were injured during training) demonstrates that certain modalities of exercise may be more beneficial for cardiovascular and metabolic health due not to their absolute impact on health alone but their favorable effect in relation to low likelihood of injury. Future research is needed to rigorously test use of the ER, but examining outcomes in exercise interventions with respect to both health improvement and injury rates may ultimately result in a more personalized, effective outcome for the patient.

2169 Board #321 June 2, 3:30 PM - 5:00 PM  
**Associations Between Dietary Behaviors And Objectively Measured Physical Activity Behaviors**  
 Graceson C. Kerr, Meghan Baruth, Rebecca A. Schlaff. *Saginaw Valley State University, University Center, MI.*  
*(No relationships reported)*

Despite the known health benefits of a healthy diet and physical activity (PA), many older adults do not meet guidelines. Evidence suggests that health behaviors cluster. **PURPOSE:** To examine the associations between various dietary and PA behaviors. **METHODS:** Inactive older adults (50+ years) were recruited to take part in a PA or dietary intervention. Participants completed a baseline questionnaire assessing demographic variables, self-reported fruit and vegetable (FV) consumption, and fat- and fiber-related behaviors (lower scores indicate more favorable fat- and fiber-behaviors). Objectively measured height and weight were also obtained. Participants wore an accelerometer for seven days, during all waking hours. Time spent sedentary, and in light and moderate to vigorous PA was calculated. Pearson correlation coefficients examined relationships between dietary and PA behaviors. **RESULTS:** Participants (n=71) averaged 64.0±8.5 years of age and had a BMI of 33.3±7.1. Most were women (75%), married (61%), white (80%), and had at least some college education (82%). On average, participants spent 62% of the day sedentary, 37% in light PA, and 1% in moderate to vigorous PA. Percent time sedentary was not related to FV consumption (r=.04, p=.74), fat-r=.11, p=.35) or fiber-related (r=.08, p=.50) behaviors. Percent time in light PA was not related to FV consumption (r=.04, p=.75), fat- (r=-.12, p=.31) or fiber-related (r=-.09, p=.44) behaviors. Percent time in moderate to vigorous PA was not related to FV consumption (r=-.03, p=.78), fat- (r=-.08, p=.52) or fiber-related (r=-.11, p=.36) behaviors. There was a significant relationship between FV consumption and fat- (r=-.33, p=.004) and fiber-related behaviors (r=-.47, p<.0001), and between fat- and fiber-related behaviors (r=.74, p<.0001). **CONCLUSIONS:** Our findings suggest that dietary behaviors among older adults may cluster; however there is no evidence that dietary and PA behaviors cluster. Interventions aiming to improve the health of older adults via PA and healthy diets may not lead to changes in the other. A better understand of the extent to which health behaviors, beyond PA and diet, cluster among older adults may help to inform interventions aimed at improving health.

2170 Board #322 June 2, 3:30 PM - 5:00 PM  
**Reduced Postprandial Insulin Resistance by Exercise One Hour After Meal But Not by Pre-meal Exercise**  
 Po-Ju Lin, Katarina T. Borer. *University of Michigan School of Kinesiology, Ann Arbor, MI.*  
 Email: pjlin@umich.edu  
*(No relationships reported)*

Interaction between meals and exercise is of interest because it may affect insulin resistance through both an insulin-dependent and non-insulin mediated muscle glucose uptake. We hypothesized an equal involvement of both mechanisms regardless of whether exercise precedes or follows the meal. **PURPOSE:** To examine postprandial (PP) insulin resistance to moderate-intensity exercise completed 1 h before, or initiated 1 h after, the meals. **METHODS:** Twenty-four healthy postmenopausal women, matched by weight and BMI, were assigned, eight each, to either sedentary (SED), exercise before meals (EBM), or exercise after meals (EAM). Two 800-Kcal meals containing 60% carbohydrate, 25% fat, and 15% protein were provided at 10 and 17 h. EBM group completed 2-h treadmill exercise at 45%VO<sub>2</sub>max 1 h before each meal, while exercise in EAM group started 1 h after the onset of the meals. Homeostasis-model assessment of insulin resistance (HOMA-IR) was calculated from glucose and insulin areas under the curves (AUCs) and were compared between SED and EBM or EAM and between EBM and EAM groups. AUCs also were calculated for insulin and glucose during early (10-14 h and 17-21 h) and late PPs (14-17 h). **RESULTS:** HOMA-IR insulin resistance scores were 56% lower (t=3.22, p=0.0061) when exercise was performed during early PP after the first meal than before the first meal. The corresponding 60% reduction of HOMA-IR occurred with exercise after, compared to exercise prior, to the second meal (t=3.95, p=0.0015). While PP HOMA-IR did not differ between SED and EBM trials after either meal, it was 43% (t=2.11, p=0.054) and 52% lower (t=3.74, p=0.0022) after EAM compared to SED groups after the two respective meals. In contrast to the changes in PP HOMA-IR related to the timing of exercise and meals, a significant reduction in plasma glucose during exercise in late PP in the EBM compared to EAM group (t=2.99, p=.0054) was not associated with changes in late PP HOMA-IR. **CONCLUSION:** Insulin resistance is acutely reduced during the early postprandial period by concurrent exercise but not by exercise completed 1 h before the meal. Timing of exercise during late postprandial period lowers plasma glucose concentration without affecting insulin resistance. Supported by NIDDK grant R15 DK082800 and Blue Cross Blue Shield student award.

2171 Board #323 June 2, 3:30 PM - 5:00 PM  
**Acute Organ Transplantation Rehabilitation: High versus Low Reinforcement of Wirelessly Monitored Effect of Bedside Exercise**  
 Ssu-Yuan Chen<sup>1</sup>, Shoen-Shen Wang<sup>1</sup>, Ray-Heng Hu<sup>1</sup>, Ching Lan<sup>1</sup>, Yih-Shang Chen<sup>1</sup>, Andrew K. Dorsch<sup>2</sup>, Jin-Shin Lai<sup>1</sup>, Bruce H. Dobkin<sup>2</sup>. <sup>1</sup>National Taiwan University Hospital and National Taiwan University College of Medicine, Taipei, Taiwan. <sup>2</sup>University of California, Los Angeles, Los Angeles, CA.  
 Email: ssuyuan@ntu.edu.tw  
*(No relationships reported)*

**PURPOSE:** Few studies have examined the benefits of exercise immediately after heart or liver transplantation. This prospective, randomized, and assessor-blinded study compared the effect of high feedback (HF) versus low feedback (LF) about performance on an instrumented bedside exercise ergometer in organ transplantation recipients.

**METHODS:** Adult patients who received a heart or liver transplantation were randomized to either HF or LF about daily leg cycling. Data were transmitted via a wireless internet connection to the investigators from the intensive care unit or ward. HF subjects were encouraged to look at the summary of daily data about pedaling and to progress more activities for the legs. LF subjects were only encouraged to increase their total cycling time. The outcome measure was level of independence for walking, walking speed, 6-minute walking distance, Short-Form 36 health-related quality of life, and cardiorespiratory fitness.

**RESULTS:** Eighty-five patients who received a heart (n=29) or liver (n=56) transplantation participated at a median of 8 days after surgery. No adverse events were reported during the median study period of 17 days. The HF group (n=44) achieved greater energy expenditure (p<0.05), with a trend toward greater 6-minute walking distance at discharge compared to the LF group (n=41). No significant between-group differences were detected in outcomes of interest. Of note, participants who performed cycling exercise for 24 minutes or more per day (n=41) had significantly greater independence for walking, walking speed, 6-min walking distance, health-related quality of life scores in physical functioning and vitality, and cardiorespiratory fitness compared with patients using the bedside device for less than 24 minutes per day (n=44).

**CONCLUSIONS:** In this first trial of bedside exercise with remote monitoring for inpatient organ transplantation rehabilitation, augmented feedback alone did not improve outcomes of interest. Exercise for 24 minutes or more per day, however, appeared to be efficacious and warrants further investigation, since the procedures were safe in the early postoperative period. Supported by Grant NSC 101-2314-B-002-006-MY3 from Ministry of Science and Technology, Taiwan (ClinicalTrials.gov Identifier: NCT01705015)

2172 Board #324 June 2, 3:30 PM - 5:00 PM  
**Improving Postoperative Recovery Of Patients Waiting For A Lumbar Spine Surgery: A Feasibility Study**  
 Margaux Suitner<sup>1</sup>, Andrée-Anne Marchand<sup>1</sup>, Julie O'Shaughnessy<sup>1</sup>, Claude-Édouard Châtillon<sup>2</sup>, Vincent Cantin<sup>1</sup>, Martin Descarreaux<sup>1</sup>. <sup>1</sup>Université du Québec à Trois-Rivières, Trois-Rivières, QC, Canada. <sup>2</sup>Centre de Santé et des Services Sociaux de Trois-Rivières, Trois-Rivières, QC, Canada.  
 Email: margaux.suitner@uqtr.ca  
*(No relationships reported)*

Lumbar spine stenosis (LSS) is a prevalent specific low back pain (LBP), characterized by neurogenic claudication and important loss of function, such as a decrease in lower limb and trunk muscle strength and endurance and in walking ability. Among the conservative treatments, physical exercises have been used to improve functional physical capacities in the case of LBP; this is also valid for LSS. Several studies have investigated preoperative exercise programs for patients awaiting knee or hip surgery, but not for LSS.

**PURPOSE** The aim of this study was to assess the feasibility and the efficacy of a preoperative exercise program that was conducted to improve postoperative recovery. **METHODS** Thirteen patients (63.2±12.6 yrs) with LSS awaiting surgery were recruited and participated to a 6-week (3 times a week, 30 min/session) supervised exercise program prior to surgery. Physical and functional evaluations were conducted prior and at the end of the 6-week exercise program. The intervention program aimed at improving muscular strength and endurance, spinal stabilization and cardiovascular capacities. Primary physical outcomes were trunk flexor and extensor maximal strength, trunk extensor endurance and lower limb maximal strength. The main feasibility variables were dropout rate, compliance to program and program satisfaction. Comparisons for physical outcomes were made using one-way ANOVA with repeated measures.

**RESULTS** Dropout rate was 7.7% and the compliance to program was 85.9%. Nine of 10 participants showed a program satisfaction over 85%. Lower limb maximal strength was improved, but not significantly (pre=72.9±38.0 N, post=76.02±37.2 N,

p=0.555). Trunk extensor endurance was not significantly improved (pre=41.5±57.2 s, post=53.4±69.2 s, p=0.318). Extensor maximal strength was also not significantly improved (pre=0.48±0.28 V, post=0.84±0.98 V, p=0.298), but flexor maximal strength was significantly improved (pre=0.42±0.20 V, post=0.52±0.23 V, p≤0.05).

**CONCLUSION** A preoperative exercise program conducted to improve postoperative recovery is feasible. There seems to be a trend of improvement, however due to the poor physical condition of patients with LSS, participants are difficult to train and to evaluate within a specific time frame.

2173 Board #325 June 2, 3:30 PM - 5:00 PM

**Educational Program Promoting Regular Physical Exercise Does Not Improve Muscular Capacity In Osteoarthritis Knee Patients**

José M. Rodrigues da Silva<sup>1</sup>, Márcia U. de Resende<sup>2</sup>, Tânia C. Spada<sup>2</sup>, Júlia M. D'Andréa Greve<sup>2</sup>, Emmanuel G. Ciolac<sup>1</sup>. <sup>1</sup>São Paulo State University – UNESP, School of Sciences, Bauru-SP, Brazil. <sup>2</sup>Institute of Orthopedics and Traumatology, School of Medicine, University of São Paulo, Sao Paulo, Brazil., São Paulo, Brazil.

Email: capoeiragafa@hotmail.com

(No relationships reported)

<sup>1</sup> São Paulo State University – UNESP, School of Sciences, Physical Education Department, Bauru, Brazil; <sup>2</sup> Institute of Orthopedics and Traumatology, School of Medicine, University of São Paulo, SP, Brazil.

**Abstract:**

**PURPOSE:** To analyze the effects of an educational program promoting regular physical exercise on knee extension–flexion isokinetic performance in osteoarthritis knee patients. **METHODS:** One hundred and thirty six sedentary patients (111 women; age = 67.6 ± 9.6, BMI = 30.6 ± 4.4 kg/m<sup>2</sup>), diagnosed with primary osteoarthritis (OA) of the knee and under conventional therapy, had their knee extension–flexion (5 reps at 60°/sec and 15 reps at 180°/sec at a Biodex™ Multi-Joint System 3 dynamometer) assessed before and after 12 month of an educational program of 8-hour intervention with a multidisciplinary team. To reinforce the educational program learning, each patient received a teaching support material (1 booklet and 1 DVD) to proceed with the recommendations at home. Statistical analysis was performed with ANOVA with repeated measurements and the Bonferroni's *t* test. **RESULTS:** No significant differences between legs were observed in any variable analyzed, and only the data of right leg are displayed. No significant difference between pre and post-intervention with the educational was found in any variable assessed (Table.1). **CONCLUSIONS:** An educational program with emphasis in promoting the regular practice of physical activity did not change the muscular capacity of knee OA patients, and the present results suggest that other interventions are necessary to improve this variable in the present population.

**Table 1.** Knee extension-flexion isokinetic performance before and after 12 month of an educational program.

| Variable                        | Right Leg       |                 |
|---------------------------------|-----------------|-----------------|
|                                 | Pre             | Post            |
| Knee Extension                  |                 |                 |
| Peak torque 60°/sec (Nm)        | 80,62 ± 38,92   | 83,76 ± 32,68   |
| Total work 180°/sec (J)         | 528,28 ± 291,69 | 562,11 ± 249,03 |
| Work fatigue 180°/sec (%)       | 17,02 ± 23,35   | 16,92 ± 21,17   |
| Agon. / Antag ratio 60°/sec (%) | 56,82 ± 26,61   | 56,95 ± 16,86   |
| Knee Flexion                    |                 |                 |
| Peak torque 60°/sec (Nm)        | 44,96 ± 28,66   | 43,53 ± 19,92   |
| Total work 180°/sec (J)         | 321,79 ± 216,71 | 319,98 ± 177,94 |
| Work fatigue 180°/sec (%)       | -19,88 ± 386,75 | 20,93 ± 25,12   |

2174 Board #326 June 2, 3:30 PM - 5:00 PM

**Lumbar Strength, Back Pain And Work Ability After Low-dose, Non-supervised Exercise In Employees.**

Sven Haufe<sup>1</sup>, Klaus Wiechmann<sup>1</sup>, Lothar Stein<sup>1</sup>, Momme Kück<sup>1</sup>, Andrea Smith<sup>1</sup>, Stefan Meineke<sup>2</sup>, Yvonne Zirkelbach<sup>2</sup>, Samuel Rodriguez-Duarte<sup>2</sup>, Michael Drupp<sup>2</sup>, Uwe Tegtbur<sup>1</sup>. <sup>1</sup>Hannover Medical School, Hannover; Germany. <sup>2</sup>AOK lower saxony, Hannover; Germany.

(No relationships reported)

**PURPOSE:**

Back pain is a major medical and social problem that causes physical and psychological distress and great expense to society in most industrialized countries. Feasible interventions, low in costs and personnel requirements are needed to implement action to a large number of persons concerned.

**METHODS:**

Two hundred twenty six employees from three mid-size companies (age: 42.7 ± 10.2 years) were randomized to 5-month training or wait-list-control (continuing current lifestyle). Exercises for the trunk were instructed by personnel of a health insurance firm to be performed at home 3 times per week for 20 minutes. We assessed trunk strength, perceived low back pain, back pain related disability, and work ability before and after the intervention.

**RESULTS**

Changes in body weight and daily physical activity were not different between groups over time. Isometric muscle strength for back extension increased with exercise (delta 93.1 ± 125.4 Newton, p<0.01) and control (delta 65.7 ± 120.6 Newton, p<0.01) with a significant difference between groups (p=0.035). Low back pain was lower in participants after exercise training (2.8 ± 2.7 to 1.9 ± 2.2 cm, p<0.01) but not in controls (2.7 ± 2.5 to 2.5 ± 2.5 cm) (p=0.002 between groups). Positive changes after the program were also observed for the work ability index (exercise group: delta 1.08 ± 3.13 points; control group: delta 0.71 ± 3.53 points, both p<0.05) and back pain related disability (exercise group: delta -1.32 ± 4.72 %, p<0.01; control group: delta -0.58 ± 4.49 %, p=n.s.) but without difference between groups over time. After stratified analysis only subjects with chronic low back pain at baseline showed significant improvements after exercise compared controls in muscular strength for back extension, self-perceived pain, and work ability after the training program.

**CONCLUSIONS**

A low-dose and non-supervised exercise program at home over 20 weeks was sufficient to improve trunk muscle strength and self-perceived low back pain in middle-aged employees. The intervention seems most suitable for those already suffering from chronic low back pain.

**D-41 Free Communication/Poster - Renal**

Thursday, June 2, 2016, 1:00 PM - 6:00 PM

Room: Exhibit Hall A/B

2175 Board #327 June 2, 3:30 PM - 5:00 PM

**Association of Serum β2-microglobulin Levels with Prevalent and Incident Physical Frailty in Community-Dwelling Older Women**

Miji Kim<sup>1</sup>, Takao Suzuki<sup>2</sup>, Narumi Kojima<sup>1</sup>, Hideyo Yoshida<sup>1</sup>, Yuko Yoshida<sup>1</sup>, Hirohiko Hirano<sup>1</sup>, Hunkyung Kim<sup>1</sup>. <sup>1</sup>Tokyo Metropolitan Geriatric Hospital and Institute of Gerontology, Tokyo, Japan. <sup>2</sup>National Center for Geriatrics and Gerontology, Obu-shi, Japan.

Email: mijiak@tmig.or.jp

(No relationships reported)

Physical frailty is common among older adults and is associated with adverse outcomes. Reduced kidney function may predispose to frailty. The relationship between serum β2-microglobulin (B2M), a novel marker of kidney function, and frailty has been studied very little.

**PURPOSE:** This study aimed to investigate whether higher serum B2M levels were associated with prevalent and incident frailty in community-dwelling older women.

**METHODS:** To examine prevalent frailty, we included 1,191 participants with adequate data for assessing frailty status (based on the Fried criteria) and B2M in a baseline survey of community-dwelling women aged ≥75 years. To examine incident frailty, we analyzed a subset of 456 participants without baseline frailty and with a repeated frailty assessment at a 4-year on-site clinical follow-up. Adjusted odds ratios (ORs) for the main confounders were obtained using logistic regression.

**RESULTS:** There were 241 (20.2%) women with prevalent frailty at baseline and 67 (14.7%) with incident frailty at the 4-year follow-up. In a multivariable analysis adjusted for multiple potential confounders, B2M categories of 1.6-1.8 and 1.9-2.1 mg/L were associated with 2.24- and 2.05-fold greater odds of frailty, respectively, compared with prevalent frailty of B2M <1.6 mg/L. When modeled as continuous variables after adjusting for potential confounders and baseline status, higher B2M levels continued to be associated with incident frailty (odds ratio: 1.36, 95% CI: 1.03-1.80). After further adjustment for potential biochemical mediators, there was no evidence of an association between higher B2M levels at baseline and greater odds of frailty at follow-up.

**CONCLUSIONS:** Higher B2M levels were independently associated with greater frailty at baseline in older adults but only slightly associated with increased risk of incident frailty at the 4-year follow-up. Higher B2M might be a consequence of frailty, rather than a cause.

2176 Board #328 June 2, 3:30 PM - 5:00 PM

**Renal Responses to Endurance Cycling in the Heat**Cody R. Smith<sup>1</sup>, Cory L. Butts<sup>1</sup>, Aaron C. Caldwell<sup>1</sup>, Elaine C. Lee<sup>2</sup>, Colleen X. Munoz<sup>2</sup>, Matthew A. Tucker<sup>1</sup>, Jakob L. Vingren, FACSM<sup>3</sup>, Keith H. Williamson<sup>4</sup>, Lawrence A. Armstrong, FACSM<sup>2</sup>, Matthew S. Ganio<sup>1</sup>, Brendon P. McDermott<sup>1</sup>. <sup>1</sup>University of Arkansas, Fayetteville, AR.<sup>2</sup>University of Connecticut, Storrs, CT. <sup>3</sup>University of North Texas, Denton, TX. <sup>4</sup>Midwestern State University, Wichita Falls, TX.

Email: crs01@uark.edu

(No relationships reported)

Strenuous running and cycling have been reported to alter normal kidney function. Although running protocols have been performed in both hot and cold settings, cycling protocols have been performed primarily in cool environments, thus leaving a need for a cycling protocol in the heat. **PURPOSE:** Observe the effect of a long distance cycling event in a hot environment on renal function and identify potential factors related to renal stress. **METHODS:** 45 cyclists (38 male, 7 female, 51 ± 10 y, 84.7 ± 15.6 kg) completed either a 164 km or 100 km outdoor ride in the heat (max 36.6°C, 51% RH). Pre- and post-ride: body mass was measured to determine net fluid loss, a urine sample was collected to analyze urine specific gravity (USG) and urine color ( $U_c$ ), and a blood sample (50 mL) was drawn. A muscle soreness questionnaire was also completed as a surrogate for muscle damage in the legs. Serum and urine  $Na^+$ ,  $K^+$  and  $Cl^-$  concentrations were analyzed by ion-sensitive electrodes. Serum creatinine (SCr) was measured via colorimetric assay. Paired-samples T-tests were run to analyze differences in pre- and post-ride measures. **RESULTS:** A net fluid loss of 1.4 ± 1.1 kg (1.6 ± 1.4% body mass loss) was observed. USG was greater post- (1.021 ± 0.007) vs pre-ride (1.015 ± 0.007;  $P < 0.001$ ).  $U_c$  was greater post- (3.5 ± 1.5) vs pre-ride (2.1 ± 0.9;  $P < 0.001$ ). Leg muscle soreness increased post- (1.47 ± 1.67) vs pre-ride (0.18 ± 0.58;  $P < 0.001$ ). Serum  $Na^+$  (pre- 141.1 ± 2.3, post- 142.8 ± 2.9 mmol/L;  $P = 0.001$ ), serum  $K^+$  (pre- 4.4 ± 0.5, post- 4.7 ± 0.6 mmol/L;  $P = 0.002$ ), and urine  $K^+$  (pre- 36.6 ± 22.7, post- 95.8 ± 42.7 mmol/L;  $P < 0.001$ ) increased, whereas urine  $Na^+$  (pre- 96.0 ± 49.9, post- 52.1 ± 33.3 mmol/L;  $P < 0.001$ ) decreased post-ride. SCr was greater post- (0.88 ± 0.21 mg/dl) vs pre-ride (0.52 ± 0.14 mg/dl;  $P < 0.001$ ). **CONCLUSION:** Changes in electrolyte concentrations and SCr suggest kidney stress after endurance cycling in a hot environment. This impairment may be a result of dehydration and/or increased muscle damage (as indicated by increased soreness). Dehydration reduces blood volume and subsequent renal blood flow required for sufficient renal filtration. Muscle damage increases creatinine production, overloading the kidneys with waste to filter.

2177 Board #329 June 2, 3:30 PM - 5:00 PM

**Criterion Values for Urine Specific Gravity and Color to Detect Urine Osmolality > 500**

Erica T. Perrier, Jeanne H. Bottin, Guillaume Lemetais. Danone Research, Palaiseau, France. (Sponsor: Lawrence E. Armstrong, FACSM)

Email: erica.perrier@danone.com

(No relationships reported)

Urine osmolality ( $U_{osm}$ ) represents the net sum of water gains, losses, and neuroendocrine responses that act to maintain body water homeostasis. Recently, we proposed a 24h  $U_{osm}$  of ≤ 500 mOsm·kg<sup>-1</sup> as a desirable target for urine concentration, reflecting sufficient total water intake to compensate daily losses, reduce circulating vasopressin, and ensure sufficient urinary output to reduce the risk of some renal and metabolic health consequences. However, measuring  $U_{osm}$  is more time-consuming and less convenient than specific gravity ( $U_{SG}$ ) and color ( $U_c$ ), both of which are more practical to measure during daily activities. **PURPOSE:** To establish the criterion values for  $U_{SG}$  and subject-assessed  $U_c$ , which would have the best diagnostic accuracy for identifying  $U_{osm} > 500$  mOsm·kg<sup>-1</sup>. **METHODS:** A total of 817 individual urine samples were obtained from 82 healthy French adults (23.6 ± 2.9 years; 22.2 ± 1.5 kg·m<sup>-2</sup>; 41 women). Each urine sample represented a complete void.  $U_{osm}$  and  $U_{SG}$  were measured in the laboratory, and  $U_c$  was assessed by each participant under consistent lighting conditions against an 8-point color scale. The optimal cut-offs for  $U_{SG}$  and  $U_c$  for identifying  $U_{osm} > 500$  mOsm·kg<sup>-1</sup> were determined by logistic regression with receiver operating characteristic (ROC) analysis, favoring neither sensitivity nor specificity. **RESULTS:** The mean (5<sup>th</sup>, 95<sup>th</sup> percentile) for  $U_{osm}$ ,  $U_{SG}$ , and  $U_c$ , respectively, were 436 (192; 938) mOsm·kg<sup>-1</sup>, 1.012 (1.003; 1.025), and 4 (1; 7). ROC analysis revealed the optimal  $U_{SG}$  cut-off for identifying  $U_{osm} > 500$  mOsm·kg<sup>-1</sup> was 1.013 (AUC 0.984), while the cut-off for  $U_c$  was 4 (AUC .831). A  $U_{SG}$  of 1.013 or higher offered excellent sensitivity and specificity. A  $U_c$  of 4 or higher was highly sensitive but less specific. **CONCLUSION:** In this analysis, we demonstrate that both  $U_c$  and  $U_{SG}$  can be used with good-to-excellent accuracy to identify individuals above or below the 500 mOsm·kg<sup>-1</sup> target.  $U_{SG}$  is both highly sensitive and highly specific, suggesting its utility for health care professionals and clinicians, with faster results and

lower cost than  $U_{osm}$ . Subject-assessed  $U_c$  demonstrated excellent sensitivity and good specificity, confirming  $U_c$  as a practical field measure. A self-assessed  $U_c$  of 3 or lower suggests a very high probability of  $U_{osm}$  being less than 500 mOsm·kg<sup>-1</sup>.

2178 Board #330 June 2, 3:30 PM - 5:00 PM

**The Effect Of An Active Versus Inactive Lifestyle On Renal Response To Exercise-induced Dehydration**

Coen C.W.G. Bongers, Thijs M.H. Eijssvogels, Mohammad Alsady, Peter M.T.E. Deen, Sponsor: Maria T.E. Hopman, FACSM. Radboud university medical center, Nijmegen, Netherlands.

Email: coen.bongers@radboudumc.nl

(No relationships reported)

**Purpose.** Exercise by itself as well as exercise-induced dehydration cause a decrease in renal blood flow and an increase in glomerular permeability, leading to a decrement in renal function and temporarily renal damage. An active lifestyle may precondition the kidneys, resulting in attenuated decrease in kidney function and a reduction in kidney damage in response to exercise and dehydration determined as body weight loss. Therefore, we examined the differences in renal responses to exercise-induced dehydration between healthy young men with a physically active *versus* inactive lifestyle.

**Methods.** A total of 12 active and 6 inactive healthy male participants (23±3 years, 23.9±3.6 kg/m<sup>2</sup>, eGFR: 111.0±12.5 mL/min) were included, based on a physical activity questionnaire. Participants performed an incremental exercise test to determine physical fitness and maximum heart rate (HRmax). On a separate day, a submaximal exercise test was performed on 80% of the individual HRmax, until 3% dehydration. Blood and urine samples were taken pre- and post-exercise to assess renal function (estimated glomerular filtration ratio; eGFR) and renal damage (urinary albumin).

**Results.** Maximum oxygen uptake ( $VO_{2max}$ ) was higher in the active (59.7±8.6 mL/min/kg) compared to the inactive group (49.1±7.3 mL/min/kg;  $p=0.018$ ). All subjects cycled on a comparable exercise intensity (79±2% HRmax), resulting in a body mass loss of 3.2±0.7% and 2.5±0.4% for the active and inactive group, respectively ( $p=0.013$ ). After exercise, a significant decrease in eGFR was found for the active (17.4±10.2 mL/min;  $p=0.007$ ) and inactive group (21.7±17.8 mL/min;  $p=0.05$ ), which did not differ between groups ( $p=0.60$ ). Moreover, 33.3% of the active subjects and 50% of the inactive subjects had a post-exercise eGFR < 90 mL/min, which indicates a decrease in renal function. Furthermore, we found a significant increase in urinary albumin concentration in the active (24.6±30.9 mg/L;  $p=0.011$ ) and inactive group (33.6±27.5 mg/L;  $p=0.016$ ), which did not differ between groups ( $p=0.55$ ).

**Conclusion.** In short, exercise induces a decrease in renal function and an increase in urinary albumin concentration, suggesting temporary renal damage of the glomerulus or proximal tubulus. However, these changes do not differ between physically active and inactive subjects.

2179 Board #331 June 2, 3:30 PM - 5:00 PM

**Metaboreflex Dysregulation In Type 2 Diabetes Mellitus**

antonio crisafulli, silvana roberto, girolamo palazzolo, irene sanna, gianmarco saines, matteo pusceddu, gabriele mulliri, raffaele milia. university of Cagliari, Cagliari, Italy.

Email: crisafulli@tiscali.it

(No relationships reported)

In healthy subjects, when the muscle metaboreflex (MM) is activated, mean blood pressure (MBP) increases because of a sympathetic-induced increase in both systemic vascular resistance (SVR) and cardiac output (CO). It has been reported that this reflex is dys-regulated in patients suffering some metabolic diseases. In detail, patients with type 1 diabetes mellitus (DM) have a blunted MBP response during the MM due to sympathetic deficit; moreover, patients suffering from metabolic syndrome show an exaggerated SVR during the MM because of their sympathetic hyperactivation. **Purpose:** to discover whether the MM is dys-regulated in patients with type 2 DM. **Methods:** 14 MS patients with type 2 DM obesity (4 females, 62.7±8.3 yrs) together with 13 control subjects (CTL, 5 females 61.2±10.5 yrs) participated in this study. They underwent randomly assigned the following protocol: 1) post-exercise muscle ischemia (PEMI) session, to study the MM, and 2) control exercise recovery (CER) session. Response to the metaboreflex for each cardiovascular parameter was assessed as PEMI minus CER level. Hemodynamic parameters were evaluated by impedance cardiography. **Results:** patients with type 2 DM showed an exaggerated SVR response as compared to the CTL group (392.5±549.6, vs -68±248.5 dynes·s·1·cm<sup>-5</sup> respectively,  $p < 0.05$ ), whereas MBP response was not different between groups (8.9±5.7 vs. 6.8±8.7 mmHg respectively,  $p > 0.05$ ). **Conclusions:** This investigation indicates that patients with type 2 DM have an exaggerated vasoconstriction in response to the MM activation. This phenomenon is different to what observed in type 1 DM2 and similar to what reported for metabolic syndrome3.

1 Crisafulli A et al. Muscle metaboreflex-induced increases in stroke volume. Med Sci Sports Exerc 2003; 35: 221-228.

2 Roberto S et al. Altered hemodynamics during muscle metaboreflex in young, type 1 diabetes patients. *J Appl Physiol* 2012; 113: 1323-1331.

3 Milia R et al. Differences in hemodynamic response to metaboreflex activation between obese patients with metabolic syndrome and healthy subjects with obese phenotype. *Am J Physiol (Heart Circ Physiol)* 2015; 309: H779-789.

## D-42 Free Communication/Poster - Running Stride Mechanics

Thursday, June 2, 2016, 1:00 PM - 6:00 PM

Room: Exhibit Hall A/B

### 2180 Board #332 June 2, 2:00 PM - 3:30 PM Kinetic Differences Associated with Minimalist Shoe and Reduced Stride Length Running

Colin Firminger, W. Brent Edwards. *University of Calgary, Calgary, AB, Canada.* (Sponsor: Joe Hamill, FACSM)  
Email: cfirring@ucalgary.ca

(No relationships reported)

Running is a popular activity with over 2 million half-marathon finishers in the US each year. Unfortunately, running is associated with a high incidence of injury ranging from 24% to 77% per annum. Minimalist shoes have been developed to mimic barefoot running while protecting the foot. Common injuries in minimalist runners include plantar fasciitis, Achilles tendinopathy, and metatarsal stress fractures. It is known that changing a runner's preferred stride length (PSL) can alter joint kinetics, however these effects have not been studied in minimalist runners.

**PURPOSE:** To examine changes in metatarsophalangeal (MTP), ankle, and knee joint kinetics when running in minimalist shoes and at reduced stride length.

**METHODS:** Fourteen male recreational runners ( $26.2 \pm 4.2$  yr;  $178.4 \pm 5.4$  cm;  $75.6 \pm 5.6$  kg) ran 10 trials overground at preferred running speed during four conditions: control shoe at PSL and 90% PSL; minimalist shoe at PSL and 90% PSL. Markers were placed on the pelvis and right lower extremity, and motion capture and force platform data were recorded at 240 and 2400 Hz, respectively. A 2 x 2 factor repeated measures ANOVA was used to compare trial-averaged peak moments, angular impulse, and eccentric and concentric work among the four conditions ( $\alpha = 0.05$ ). A cumulative impulse was also calculated by multiplying impulse with the number of steps associated with a 5 km run.

**RESULTS:** Increased eccentric work at the MTP ( $12.8 \pm 4.9$  vs.  $8.9 \pm 3.2$  J/kg) and ankle joint ( $30.0 \pm 6.7$  vs.  $26.4 \pm 7.7$  J/kg) was observed when running in minimalist shoes. Minimalist shoe running was also associated with reduced knee impulse ( $17.1 \pm 3.7$  vs.  $18.7 \pm 4.8$  Nm·s/kg), while 90% PSL was associated with reduced knee impulse ( $15.0 \pm 5.2$  vs.  $18.7 \pm 4.8$  Nm·s/kg), eccentric work ( $30.8 \pm 10.8$  vs.  $39.8 \pm 13.6$  J/kg), and cumulative impulse ( $33.3 \pm 5.6$  vs.  $29.3 \pm 7.9$  x103 Ns/kg). 90% PSL also illustrated a lower ankle impulse ( $37.1 \pm 4.9$  vs.  $38.6 \pm 4.8$  Nm·s/kg).

**CONCLUSIONS:** Running in minimalist footwear was beneficial for knee joint loading, however increased loads were observed at the MTP and ankle joints, which may help to explain the running injuries seen in minimalist shoe users. Running at 90% PSL lowered ankle and knee joint impulse and eccentric work, suggesting that a combination of the control shoe and 90% PSL may provide a good compromise for minimizing injury.

### 2181 Board #333 June 2, 2:00 PM - 3:30 PM Stride Length, Frequency, And Velocity Relationships During Treadmill And Overground Running.

John A. Mercer, FACSM, Tiffany Mata, Michael Soucy, Leland Barker, Josh Bailey, FACSM. *UNLV, Las Vegas, NV.*  
Email: john.mercer@unlv.edu

(No relationships reported)

Mathematically, running velocity is the product of stride length (SL) and stride frequency (SF), with the relationship between these parameters well documented.

With the increase in availability and accuracy of wearable technology, parameters such as SL, SF, and velocity can be easily measured while running outdoors as well as on a treadmill. However, there are no data directly comparing the relationship between these parameters during treadmill running and overground running.

**PURPOSE:** To compare the relationship between SL, SF, and velocity using wearable Global Positioning System (GPS) technology while running at different velocities on the treadmill and overground.

**METHODS:** Subjects ( $n=10$ ;  $22.3 \pm 2.6$  yrs;  $1.71 \pm 0.08$  m;  $71.4 \pm 15.5$  kg) completed a total of 14 runs (7 treadmill, 7 overground) with each run at a different velocity. SL, SF, and velocity data were recorded using a GPS watch with footpod (Garmin, Fenix2). Overground runs (approximately 1 min per velocity) were completed first, with treadmill run velocities matching the range of overground velocities. Raw data were exported to excel via a combination of proprietary software (Garmin Connect)

and custom software to convert data to excel format. A global 2nd order polynomial lines were fit to the SL vs. velocity as well as to the SF vs. velocity plots for treadmill and overground. Additionally, for each individual subject, SL vs. velocity data sets were fit with a 2nd order polynomial with coefficients averaged across subjects and compared overground vs. treadmill (paired t-tests).

**RESULTS:** The global SL vs. velocity relationship during treadmill running was described as  $SL = -0.046v^2 + 0.86v + 0.01$  (where 'v' represents velocity) ( $R^2=0.94$ ) and during overground running  $SL = -0.11v^2 + 1.04v - 0.18$  ( $R^2=0.95$ ). The global SF vs. velocity relationship during treadmill running was  $SF = 0.38v^2 + 3.18v + 69.8$  ( $R^2=0.38$ ) and during overground was  $SF = 3.03v^2 - 5.7v + 81.4$  ( $R^2=0.68$ ). For the SL vs. velocity relationship, the squared coefficient was greater during overground vs. treadmill ( $p=0.031$ ) while the linear coefficient ( $p=0.136$ ) and constant ( $p=0.260$ ) were not.

**CONCLUSIONS:** The larger SL vs. velocity  $v^2$  coefficient for overground running is an indication that subjects used different strategies to achieve faster velocities running overground and on a treadmill.

### 2182 Board #334 June 2, 2:00 PM - 3:30 PM Effects of Intrinsic Foot Strength and Step Rate Manipulation on In-Shoe Maximum Force in Recreational Runners

Lacey M. Gould, Michelle Aube, Anh-Dung Nguyen, Jeffrey B. Taylor, James M. Smoliga, Kevin R. Ford, FACSM. *High Point University, High Point, NC.* (Sponsor: Kevin R Ford, FACSM)  
Email: gouldl13@highpoint.edu

(No relationships reported)

Due to the high prevalence of recreational running related injuries, step rate manipulation and foot strike modifications are often utilized to reduce lower extremity loading. Likewise, intrinsic foot strength (IFS) may also influence loading by modulating the arch's ability to absorb impacts. Runners with greater IFS may adapt differently to step rate modifications compared to runners with lower IFS. **PURPOSE:** To determine the effects of IFS and changes in step rate on in-shoe maximum force in recreational runners.

**METHODS:** Fifteen recreational runners ( $\geq 10$  miles/week, age  $20.7 \pm 0.8$  years, mass  $68.2 \pm 11.8$  kg, height  $168.3 \pm 9.3$  cm) volunteered to participate in this study. IFS was calculated from maximum isometric toe flexor strength trials performed while seated adjacent to a pressure platform. The subjects were divided into high and low IFS groups based on the median distribution. The subjects were then fitted with pressure distribution measurement insoles and ran on a treadmill at a self-selected speed ( $3.2 \pm 0.4$  m/s) matching an audible metronome, a preferred step rate ( $164 \pm 12$  steps/min), and a ten percent increased step rate ( $180 \pm 13$  steps/min) in randomized order. Maximum in-shoe force within nine separate regional areas of the foot were calculated over ten consecutive steps during each condition. A 2x2 repeated measures ANOVA determined the difference between cadence and IFS group ( $p < 0.05$ ).

**RESULTS:** Total in-shoe maximum force was greater in the low IFS group ( $2.5 \pm 0.2$  BW) compared to high IFS ( $2.2 \pm 0.2$  BW,  $p = 0.001$ ). Both medial ( $p = 0.03$ ) and lateral ( $p = 0.04$ ) heel regions exhibited a main effect for cadence condition, with lower maximum in-shoe forces at increased cadence. There was not an interaction between IFS group and cadence condition.

**CONCLUSIONS:** Recreational runners with greater IFS had lower overall maximum in-shoe force while running at a self-selected speed. Increasing IFS through targeted training interventions should be investigated further. Increased cadence resulted in lower maximum forces at the heel. However, in our small sample, cadence-induced changes in maximum in-shoe regional forces were not influenced by IFS.

### 2183 Board #335 June 2, 2:00 PM - 3:30 PM Stride Frequency And Injury Rates In Recreational Runners Training For A Half-marathon

Jacqueline Morgan, Robert L. Franco, Kate Harrison, Anson M. Blanks, Heather L. Caslin, D. S. Blaise Williams, III. *Virginia Commonwealth University, Richmond, VA.*  
Email: morganj3@mymail.vcu.edu

(No relationships reported)

Injuries are common among runners training for distance events with annual incidence rates ranging from 19.4 to 79.3%. Recently, lower stride frequencies (SF) have been hypothesized as a potential factor contributing to these high injury rates. It has been suggested that  $SF \leq 162$  steps per minutes (spm) may increase the likelihood of injury, whereas,  $SF \geq 169$  spm may be protective. **PURPOSE:** To compare SF in injured and non-injured runners before and after training for a half-marathon.

**METHODS:** Twenty-eight recreational runners (males:  $n=9$ ,  $47.8 \pm 7.8$  yrs; females:  $n=19$ ,  $46.6 \pm 7.7$  yrs) training for a half-marathon volunteered to participate. Prior to beginning training (PRE), a 30-second 3-dimensional gait analysis was performed at a self-selected pace. The pace was used again for analysis at the conclusion of training (POST). Throughout training, participants submitted an online daily questionnaire regarding training and injury. Paired t-tests compared participants PRE to POST and a chi-square analysis examined the difference in injury rates between groups.

**RESULTS:** Overall, SF significantly increased,  $165.3 \pm 8.3$  spm PRE to  $173.2 \pm 11.6$  spm POST ( $p < 0.01$ ). 15 of the 28 runners sustained an injury and their SF significantly increased,  $162.1 \pm 6.6$  spm PRE to  $171.6 \pm 10.5$  spm POST,  $p < 0.01$ . During PRE analysis, 12 runners had  $SF \leq 162$  spm (Low SF) and 9 had  $SF \geq 169$  spm (High SF). Difference in injury rates between SF groups was found to be significantly different (8/12, Low SF vs. 2/9, High SF;  $p = 0.04$ ). Of the Low SF group, 8 reported an injury and of the High SF group, only 2 reported an injury. Compared to PRE, the Low SF group significantly improved their cadence,  $157.8 \pm 3.0$  spm PRE to  $166.3 \pm 8.8$  spm POST ( $p = 0.02$ ). As well, 8 of the 12 Low SF runners improved their rates above 162 spm; 7 were runners reporting an injury (87.5%), and only 1 was a non-injured runner (25%).

**CONCLUSIONS:** Prior to beginning training, 42.9% of participants had SF below 163 spm, and this group had injury rates of 66.7%. Comparatively, 32.1% of participants had SF above 168 spm, and their injury rates were 22.2%. This suggests SF  $\geq 169$  spm may have been protective. Future research is needed to examine if altering SF for those with cadences  $\leq 162$  spm prior to training would decrease injury rates for runners training for half-marathons.

2184 Board #336 June 2, 2:00 PM - 3:30 PM

**Effects of Increasing or Decreasing Cadence on Metabolic, Cardiopulmonary and Biomechanical Responses During Downhill Running**

Trevor Leavitt, Laura Ann Zdziarski, Cong Chen, Daniel C. Herman, JoAnna I. McClelland, Joseph G. Wasser, Kevin R. Vincent, FACSM, Marybeth Horodyski, Jason L. Zaremski, Heather K. Vincent, FACSM. *University of Florida, Gainesville, FL.* (Sponsor: Kevin R Vincent, FACSM)  
(No relationships reported)

**PURPOSE:** Running races are becoming popular in geographic areas with hilly terrain. This study compared the collective metabolic, cardiopulmonary and biomechanical responses during acute downhill and level running.

**METHODS:** This study used a repeated-measures, crossover design in healthy runners ( $N = 30$ ;  $28.6 \pm 8.6$  yrs,  $21.6 \pm 1.9$  kg/m<sup>2</sup>). Each runner completed six conditions including level running at self-selected cadence, and downhill running (-6% grade) at five cadences (self-selected,  $\pm 5\%$  and  $\pm 10\%$ ). A portable gas analyzer and heart rate monitor collected energy cost, minute ventilation (Ve), rate of oxygen use (VO<sub>2</sub>), heart rate (HR). 3D motion analysis and an instrumented treadmill were used to determine temporalspatial parameters, peak ground reaction forces (GRF) and lower extremity joint powers.

**RESULTS:** During the downhill conditions, Ve increased ( $61.1$  to  $65.6$  L/min;  $p = 0.017$ ) and HR increased ( $141$  to  $151$  bpm;  $p = 0.010$ ) from fastest cadence to slowest cadence, with no difference in energy cost or VO<sub>2</sub> among the conditions (both  $p > .05$ ). As cadence increased among the downhill conditions, step length decreased and step width increased (both  $p < .05$ ). GRF values progressively increased in the downhill conditions from fastest to slowest cadence ( $16.7$  to  $17.5$  Nm;  $p = 0.029$ ). Among ankle, knee and hip powers, knee power values increased from fastest to slowest cadence ( $9.5$  to  $12.2$  Watts;  $p = 0.023$ ).

**CONCLUSIONS:** When compared to the control condition, running downhill with a progressively faster cadence increases cardiopulmonary and biomechanical responses, but not metabolic responses. The findings suggest that runners maintain energetic cost among different cadence conditions by making adjustments to muscle activation patterns when running downhill. This muscle recruitment concept could be tested using similar cadence conditions described here during flat, uphill and downhill running.

2185 Board #337 June 2, 2:00 PM - 3:30 PM

**Kinetic Response to Stride Frequency Perturbations During Treadmill Running**

Joshua P. Bailey, Leland Barker, Kendell Galor, Michael Soucy, John A. Mercer, FACSM. *University of Nevada, Las Vegas, Las Vegas, NV.*  
Email: bailey69@unlv.nevada.edu  
(No relationships reported)

As a runner changes stride frequency, ground reaction forces likely change. There is a large body of research on ground reaction forces during running overground; however, there is very little research of ground reaction forces while running on a treadmill.

**PURPOSE:** To investigate the effect of stride frequency perturbations on kinetic events during treadmill running.

**METHODS:** Participants ( $n = 8$ ;  $24.9 \pm 4.2$  yrs;  $1.73 \pm 0.09$  m;  $73.3 \pm 13.4$  kg) determined preferred treadmill running speed while running on an instrumented force treadmill (Bertec, OH). Preferred stride frequency (PSF) was measured and participants ran a total of 7 conditions, each representing a different stride frequency perturbation (PSF, PSF  $\pm 5\%$ ,  $\pm 10\%$ ,  $\pm 15\%$ ). Run conditions were 5 minutes with 4 - 30 second data collection occurring every other 30 seconds after 1 minute. Data were processed via custom Matlab code identifying 15 right foot stance periods for analysis. Kinetic variables (active peak (FZ2), percent of stance phase of FZ2 (FZ2%)

and peak loading rate), braking impulse (BIM), propulsive impulse (PIM) and stance period were analyzed using repeated measure ANOVAs across perturbation conditions ( $\alpha = 0.05$ ). Due to the reduced frequency of occurrence of impact peak (FZ1) during the higher stride frequency perturbations ( $+5\%$ ,  $+10\%$  &  $+15\%$ ), FZ1s were analyzed comparing PSF to reduced SF perturbations ( $-10\%$  &  $-15\%$ ) with multiple paired sample t - tests.

**RESULTS:** Peak loading rate, FZ2 and BIM were not significantly different across SF perturbations ( $p > 0.05$ ). Stance time was significantly different across perturbations ( $p < 0.001$ ). Stance time during PSF was longer (0.260s) than both PSF+10% (0.235s) and PSF+15% (0.228s) ( $p < 0.05$ ). PIM was significantly different ( $p < 0.001$ ). Increased SF perturbations were significantly lower than decreased SF perturbations ( $p < 0.05$ ).

**CONCLUSIONS:** During treadmill running, SF perturbations affected running kinetics by reducing the occurrence of FZ1 during increased SF perturbations and increases in FZ1 magnitude at reduced SF.

2186 Board #338 June 2, 2:00 PM - 3:30 PM

**Effective Force Application Between Various Stride Frequencies While Running at Constant Velocity**

Leland Barker, Josh Bailey, Michael Soucy, Kendall Galor, John Mercer, FACSM. *UNLV, Las Vegas, NV.* (Sponsor: Dr. John Mercer, FACSM)  
Email: barkel1@unlv.nevada.edu  
(No relationships reported)

**Application Between Various Stride Frequencies While Running at Constant Velocity**

Barker, LA, Bailey, J., Galor, KS, Soucy, M., Mercer, JA FACSM  
Effective force application (EFA) is calculated as a ratio of horizontal force to resultant force ( $EFA = F_{Ht} / F_{Res} \times 100\%$ ), where EFA is the effectiveness of force application. EFA has been measured in sprinting, but not running at submaximal constant velocities using different stride frequencies. **Purpose** To examine EFA while running a constant velocity using different stride frequencies.

**Methods** Participants ( $n = 6$ ,  $69.7 \pm 14.8$  kg) ran at their preferred running speed at  $\pm 5\%$ ,  $\pm 10\%$ , and  $\pm 15\%$  of their preferred stride frequency on a force instrumented treadmill (Bertec, Columbus, OH). Participants ran for 5 minutes at each stride frequency (intermittently directed by metronome), where 4-30s trials were collected with the metronome off for each trial collection. EFA was calculated for 20 consecutive strides with the average EFA over stance, during braking, and during propulsive phases. A repeated measures ANOVA was performed to analyze the differences in EFA, EFA Brake, and EFA Propulsive ( $\alpha = 0.05$ ).

**Results** EFA, EFA Brake, and EFA Propulsive were not different ( $p > 0.05$ ) between stride frequencies. Mean EFA of 0%, +5%, +10%, +5%, -5%, -10%, -15% EFA values were  $6.81 \pm 2.20$ ,  $6.32 \pm 1.21$ ,  $5.77 \pm 1.47$ ,  $5.56 \pm 1.47$ ,  $6.23 \pm 1.41$ ,  $6.44 \pm 1.73$ ,  $5.95 \pm 1.79$ , respectively. Mean EFA Brake of 0%, +5%, +10%, +5%, -5%, -10%, -15% EFA values were  $-8.3 \pm 1.4$ ,  $-8.67 \pm 1.5$ ,  $-8.87 \pm 1.79$ ,  $-8.61 \pm 1.89$ ,  $-8.63 \pm 1.36$ ,  $-8.72 \pm 1.27$ ,  $-8.65 \pm 1.06$ , respectively. Mean EFA Propulsive of 0%, +5%, +10%, +5%, -5%, -10%, -15% EFA values were  $19.8 \pm 1.50$ ,  $20.63 \pm 1.51$ ,  $19.83 \pm 1.25$ ,  $19.45 \pm 1.12$ ,  $20.15 \pm 0.84$ ,  $20.33 \pm 0.59$ ,  $20.01 \pm 0.77$ , respectively

**Conclusion** EFA was not influenced by stride frequency changes during constant velocity, even when braking and propulsive EFA phases were analyzed separately. Since EFA calculation is analogous to angle of force application, despite variations in stride frequency and stride length, the angle of force is maintained when running velocity is constant. More studies are required to determine if EFA can be intentionally manipulated to optimize performance.

2187 Board #339 June 2, 2:00 PM - 3:30 PM

**Relationships Between Natural Cadence And Vertical Load Rates In Injured And Healthy Runners.**

Erin Futrell<sup>1</sup>, Adam Tenforde<sup>2</sup>, Steve T. Jamison<sup>2</sup>, Irene S. Davis, FACSM<sup>2</sup>. <sup>1</sup>MGH Institute of Health Professions, Boston, MA. <sup>2</sup>Spaulding National Running Center, Cambridge, MA. (Sponsor: Irene Davis, FACSM)  
Email: efutrell@mghihp.edu  
(No relationships reported)

Vertical ground reaction force load rates have been linked with running injuries. Increasing cadence has been shown to reduce load rates. However the relationship between natural cadence and load rates has not been examined. **PURPOSE:** To examine the relationship between natural running cadence and vertical load rates in both healthy and injured runners. It was expected that as cadence increases, load rates would decrease.

**METHODS:** Two groups of runners were examined. One group included healthy runners ( $n = 32$ , 25M, ages 18-54yrs) and the other included injured runners ( $n = 93$ , 45M, ages 15-65yrs) being seen in a running clinic. Vertical ground reaction force (VGRF) and cadence (CAD) were recorded as participants ran on an instrumented treadmill at a self-selected speed ( $x = 2.6$  m/s  $\pm 0.12$ ). The vertical average and instantaneous load rates (VALR, VILR) of the VGRF were calculated and correlated

with CAD. This was done for the healthy and injured groups separately and then combined. Additionally, CAD, VALR and VILR were compared between the healthy and injured groups. Significance set at  $p < 0.05$ .

**RESULTS:** CAD was not significantly correlated with either VALR or VILR for either group (Table). Furthermore, there were no differences in CAD between the healthy and injured groups. VALR and VILR were significantly higher in the injured group by 28% and 16% respectively.

**CONCLUSIONS:** While others have found that increasing cadence can reduce load rates, our results suggest that there is no relationship between these variables under habitual conditions. Future studies of gait retraining to increase cadence and reduce load rates should examine this relationship once the cadence has become habituated.

| Pearson correlations of CAD and load rates; Mean values for CAD, VALR, and VILR |             |             |            |               |               |
|---|-------------|-------------|------------|---------------|---------------|
|   | CAD/ALR (r) | CAD/ILR (r) | CAD (spm)  | VALR (BW/s)   | VILR (BW/s)   |
| Injured n=93  | 0.02        | -0.001      | 164 ±9.62  | 51.19 ±20.93* | 61.82 ±21.48* |
| Healthy n=32  | -0.13       | -0.29       | 161 ±11.63 | 38.69±15.51   | 52.78 ±16.35  |

2188 Board #340 June 2, 2:00 PM - 3:30 PM  
**Differences in Kinematic Correlates of Impact Loading Between Rearfoot and Non-Rearfoot Strikers in Running**

Christopher Napier<sup>1</sup>, Christopher L. MacLean<sup>2</sup>, Jack E. Taunton, FACSM<sup>1</sup>, Jessica Maurer<sup>2</sup>, Michael A. Hunt<sup>1</sup>. <sup>1</sup>University of British Columbia, Vancouver, BC, Canada. <sup>2</sup>Fortius Sport & Health, Burnaby, BC, Canada.  
 Email: c.napier@alumni.ubc.ca  
 (No relationships reported)

Impact loading (in particular, average vertical loading rate (AVLR)) has been implicated in the development of several running-related injuries (RRIs). Some researchers have also suggested that overstriding (landing with the foot too far in front of the centre of mass (COM)) may be linked to increased loading rates and RRI. There is no clear method for measuring overstriding. **PURPOSE:** To establish the relationship between kinetic outcomes (vertical impact peak (VIP), instantaneous vertical loading rate (IVLR), and AVLR) and five kinematic measures of overstriding (angle of shank at initial contact (IC); horizontal distance from heel to COM at IC; horizontal distance from centre of pressure (COP) to COM at IC; angle between COP, COM, and vertical projection of the COM; percent of step length anterior to COM). **METHODS:** 18 healthy female recreational runners (12 rearfoot strikers (RFS), 6 non-rearfoot strikers (NRFS)) ran at their preferred speed on an instrumented treadmill (Treadmetrix) while ground reaction force data and 3D joint kinematics were collected using a motion capture system (Qualisys). Data were analyzed using Visual3D software (C-Motion). Pearson's correlation coefficients were used to assess the relationship between the kinetic and kinematic variables. **RESULTS:** RFS and NRFS displayed opposing relationships between the kinematic measures of overstriding and kinetic outcomes. RFS showed a moderate positive correlation between AVLR and horizontal distance from heel to COM at IC ( $r=0.62$ ,  $p=0.037$ ). Conversely, NRFS displayed moderate to strong negative correlations between kinetic outcomes and several kinematic measures, with percent of step length anterior to COM showing the strongest association (AVLR  $r=-0.56$ ,  $p=0.031$ ; IVLR  $r=-0.65$ ,  $p=0.009$ ; VIP  $r=-0.80$ ,  $p=0.016$ ). **CONCLUSIONS:** Findings from this study suggest RFS and NRFS demonstrate moderate to strong, but opposing relationships between kinematic measures of overstriding and kinetic outcomes associated with RRI. Two potential measures of overstriding are associated with increased loading rates, but are dependent on classification of foot strike. Prospective studies are warranted to determine whether these overstriding measures also result in increased injury incidence. Supported by a Mitacs Accelerate Graduate Research Award.

2189 Board #341 June 2, 2:00 PM - 3:30 PM  
**Forefoot Loading With Step Rate Changes in Recreational Runners**

Scott D. Morin, Anh-Dung Nguyen, Jeffrey B. Taylor, James M. Smoliga, Kevin R. Ford, FACSM. High Point, High Point, NC. (Sponsor: Kevin R. Ford, FACSM)  
 Email: morins13@highpoint.edu  
 (No relationships reported)

Recreational runners benefit from increased physical activity but often sustain overuse lower extremity injuries. To reduce risk of injury, gait retraining to increase step rates have been developed that decrease peak vertical force and knee loading. However, runners at risk of overuse injuries in the metatarsals may not experience reduced forefoot loading with increased cadence. Purpose:

To determine if an alteration in cadence would affect forefoot loading during treadmill running in recreational runners. **Methods:**

Fifteen recreational runners (height 168.32±9.25 cm, 68.16±11.8 kg, age 20.69±0.83 years) who run ≥10 miles a week were selected. Individuals ran at a self-selected running speed while their preferred step rate was calculated. Three cadence levels were randomly assigned to each subject (+10% -10%, and normal cadence). Subjects were then instructed to match their foot strikes with the sound of a metronome. In-shoe pressure distribution insoles were used to determine force time integral (FTI) within the medial, central and lateral forefoot. Repeated measures ANOVA were used to determine step rate differences in loading ( $p < 0.05$ ). **Results:**

A main effect of step rate was found for FTI in the medial ( $p=0.009$ ) and central ( $p=0.003$ ) forefoot regions. Specifically, FTI was less in the -10% compared to +10% condition in the medial (-10%: 4.7±1.2%BW·s, +10%: 4.3±1.3%BW·s;  $p=0.008$ ) and central (-10%: 5.4±0.8%BW·s, +10%: 5.1±0.8%BW·s;  $p=0.007$ ) forefoot. **Conclusion :**

: Our data, with a larger 10% step rate modification compared to 5% change, support previous work indicating reduced medial and central forefoot loading (Wellenkotter 2014). Similarly, the lateral forefoot did not result in significant changes in loading. Interventions to reduce lateral forefoot loading should be investigated in patients returning from or prone to lateral forefoot injuries. :

2190 Board #342 June 2, 2:00 PM - 3:30 PM  
**Comparison of Running Mechanics in Healthy Runners versus Runners with Bilateral Compartment Syndrome**

Anna N. Brilliant<sup>1</sup>, Dai Sugimoto<sup>1</sup>, Charles A. d'Hemecourt<sup>2</sup>, Duncan A. d'Hemecourt<sup>1</sup>, Jen Morse<sup>3</sup>, Pierre A. d'Hemecourt, FACSM<sup>1</sup>. <sup>1</sup>Boston Children's Hospital, Waltham, MA. <sup>2</sup>Boston Children's Hospital, Boston, MA. <sup>3</sup>The Micheli Center for Sports Injury Prevention, Waltham, MA. (Sponsor: Pierre A. d'Hemecourt, FACSM)  
 Email: anna.brilliant@childrens.harvard.edu  
 (No relationships reported)

Bilateral compartment syndrome is often observed in athletes, particularly female runners. The running mechanics of these runners are understudied, especially biomechanical patterns that may lead to symptoms of compartment syndrome.

**Purpose:** To identify running mechanical differences between healthy runners and runners with bilateral compartment syndrome. **Methods:** Running videos of runners who were diagnosed with bilateral compartment syndrome were compared with videos of sex, age, and BMI matched healthy control runners. The main outcome variables were foot strike angle, overstep angle, knee joint angle, trunk angle and hip angle, at initial contact, midstance, take off and swing phases. The video image sequences were randomized and reviewed by a single examiner using ImageJ software. The examiner was blinded from the randomization process and statistical analysis. An independent t-test with an alpha level of 0.05 was performed. **Results:** A total of 31 healthy females runners (Age: 20.4±5.4 years old; BMI: 20.6±1.9) were compared to 7 female runners with bilateral compartment syndrome (Age: 17.9±2.1 years old; BMI: 21.9±2.3). The runners with bilateral compartment syndrome demonstrated significantly greater bilateral overstep angles on initial contact (Right leg: 11.2±3.7°; Left leg: 10.6±3.7°) compared to healthy controls (Right leg: 8.4±2.9°,  $p=0.016$ ; Left leg: 7.4±2.5°,  $p=0.008$ ). Injured runners demonstrated significantly greater right foot strike angles (17.7±3.9°) on initial contact compared to healthy runners (12.9±4.7°,  $p=0.022$ ). However, the left foot strike angle did not reach statistical significance. No other variables reached significance between the two groups. **Conclusions:** Female runners with bilateral compartment syndrome showed a propensity of landing with their foot further in front of their knee and with their foot more dorsiflexed at initial contact phase of running compared with healthy female runners.

D-43 Free Communication/Poster - Sports II: Upper Extremity

Thursday, June 2, 2016, 1:00 PM - 6:00 PM  
 Room: Exhibit Hall A/B

2191 Board #343 June 2, 2:00 PM - 3:30 PM  
**Changing Where Force is Applied Influences Force Parameters During Ergometer Rowing**

James Becker, Renae Jackson, Mimi Nakajima, Will Wu. California State University, Long Beach, Long Beach, CA.  
 (No relationships reported)

While the forces produced at the foot stretcher during ergometer rowing have been previously documented, there is little literature examining where under the foot these

forces are being concentrated. Changing where the force is applied changes both how muscles are working during the stroke and the internal loading of tissues, which may influence performance or injury.

**PURPOSE:** Examine how force parameters change during ergometer rowing when instructed to apply force to the foot stretcher in two different ways.  
**METHODS:** 10 collegiate rowers (5 male, 5 female; height:  $1.69 \pm 0.16$  m; mass:  $71.2 \pm 9.9$  kg; rowing experience:  $2.2 \pm 1.3$  years) participated in the study. After a self-determined warm up, participants rowed a "power 10" on the ergometer under two different instructional conditions: "push through the balls of your feet (BoF)" or "push through your heels (HL)". The order of conditions was randomized and 3 minutes of rest was provided between sets. Forces under the foot were recorded using an in-shoe plantar pressure system sampling at 500 Hz. For each trial forces under the whole foot, heel, and forefoot were determined using a 3-box analysis. From this data peak forces, timing of peak force, rate of force development (RFD), and impulses in each region were calculated. Paired t-tests were used to compare differences between conditions.  
**RESULTS:** Compared to HL, the BoF condition resulted in higher peak forces (BoF:  $483.1 \pm 102.1$  N, HL:  $425.1 \pm 104.1$  N,  $p = .002$ ), a later time to peak force (BoF:  $49.9 \pm 15.1$  % stroke, HL:  $41.9 \pm 10.6$  % stroke,  $p = .036$ ), and higher RFD (BoF:  $1553.1 \pm 391.4$  Ns-1, HL:  $1360.6 \pm 493.1$  Ns-1,  $p = .049$ ). Impulses were not different between conditions (BoF:  $329.0 \pm 65.5$  N\*s, HL:  $313.0 \pm 65.7$ ,  $p = .107$ ).  
**CONCLUSIONS:** For most rowers it appears pushing through the balls of feet yields better force curves during ergometer rowing. However, this is likely to vary on an athlete by athlete basis. While there were no differences in impulse as a whole, single subject analysis indicated 3 of the 10 participants generated higher impulses in the HL condition than the BoF condition while the remainder demonstrated the opposite pattern. Why these participants responded differently, whether this is a positive or negative response, and how it influences other aspects of the stroke such as timing, remains to be investigated.

2192 Board #344 June 2, 2:00 PM - 3:30 PM  
**Differences In Kinematic Sequencing Of Overhand Throwing Between Youth Pitchers, Catchers, And Position Players**

Allison L. Brambeck, Jessica K. Washington, Gretchen D. Oliver, FACSM. *Auburn University, Auburn, AL.* (Sponsor: Gretchen D. Oliver, FACSM)  
 Email: [alb0111@auburn.edu](mailto:alb0111@auburn.edu)  
 (No relationships reported)

**PURPOSE:** The purpose of the study was to examine the relationships between segmental velocities and ball speed of youth baseball catchers, pitchers and position players.  
**METHODS:** Twenty-three catchers (10.7 + 1.7 years; 148.2 + 10.7 cm; 44.0 + 7.6 kg), 44 pitchers (11.2 + 1.3 years; 152.8 + 12.6 cm; 49.5 + 11.9 kg), and 39 position players (11.7 + 1.2 years; 154.2 + 16.1 cm; 53.1 + 13.3 kg) participated. Kinematic data were collected using an electromagnetic tracking system at a frequency of 100Hz. Participants were instructed to perform positional throws for the positions of catcher (25.06m), pitcher (14.02m), and position player (18.29 m).  
**RESULTS:** See Table 1. Pearson product moment correlation coefficients were calculated. Catchers displayed significant relationships between velocities of pelvis ( $r=0.49$ ;  $p=0.02$ ), torso ( $r=0.49$ ;  $p=0.02$ ), humerus ( $r=0.46$ ;  $p=0.03$ ), and forearm ( $r=0.51$ ;  $p=0.01$ ) with ball speed. Pitchers had only one significant relationship, torso velocity ( $r=0.48$ ;  $p=0.00$ ) and ball speed, while position players had significant velocity relationships between pelvis ( $r=0.46$ ;  $p=0.00$ ) and torso ( $r=0.35$ ;  $p= 0.03$ ).  
**CONCLUSIONS:** The overhand throwing motion is a sequence of segmental rotations initiated upon the peak angular velocity of the proximally adjacent segment. Thus when trying to maximize ball speed and throwing efficiency, effective segmental velocity contributions are needed. The lack of a segmental contribution relationship with ball speed in the pitchers and position players could be indicative of variability in throwing mechanics. The fact that both the pitchers and position players threw faster than the catchers raises concern for developing appropriate mechanics in effort to avoid injury.

Table 1: Segmental Velocities and Ball Speeds

|                  | Catchers       | Pitchers       | Positions      |
|------------------|----------------|----------------|----------------|
| Pelvic Velocity  | 639.9 ± 108.0  | 653.3 ± 99.9   | 630.7 ± 106.1  |
| Torso Velocity   | 908.3 ± 109.2  | 929.6 ± 121.6  | 922.8 ± 156.1  |
| Humerus Velocity | 1859.0 ± 337.0 | 1967.1 ± 250.7 | 1935.3 ± 279.2 |
| Forearm Velocity | 2992.4 ± 254.8 | 2982.7 ± 202.4 | 3024.8 ± 253.9 |
| Total Velocity   | 6399.7         | 6532.7         | 6513.6         |
| Ball Speed       | 41.7 ± 8.3     | 49.3 ± 6.6     | 47.3 ± 6.7     |

2193 Board #345 June 2, 2:00 PM - 3:30 PM  
**Effect of Verbal Instructions on EMG During the Bench Press in Trained and Untrained Males**

Rebecca J. Daniels, Thomas D. Edmonds, Jesse C. Schwartz, Summer B. Cook, FACSM. *University of New Hampshire, Durham, NH.*  
 Email: [rjv73@wildcats.unh.edu](mailto:rjv73@wildcats.unh.edu)  
 (No relationships reported)

It is important to strength and rehabilitation professionals to emphasize the usage of correct muscles during exercise. Research indicates that it may be possible to alter muscle activity during certain exercises without changing the form of the exercise.  
**PURPOSE:** To determine if trained and untrained males were capable of selectively activating the pectoralis major or triceps brachii muscles according to instructions provided during the bench press exercise. **METHODS:** Participants included 13 trained males (21.5±2.9 years old, 178.7±7.0 cm, 85.7±10.7 kg, 9.5±4.6% body fat) and 12 untrained males (20.3±1.6 years old, 178.8±9.4 cm, 74.6±17.3 kg, 15.7±9.8% body fat). Participants were prepared for electromyography (EMG) for the pectoralis major (PM), anterior deltoid (AD), and the longhead (LT) and shorthead (ST) of the triceps brachii and then performed a bench press one repetition maximum (1-RM) test. Within 2-14 days of the 1-RM, participants returned and underwent EMG preparation for the same sites. While EMG data was collected, the participants performed one uninstructed set of 3 repetitions at 80% 1-RM. Two more sets of 3 repetitions at 80% 1-RM were randomly performed with instructions to isolate the chest muscles or to isolate the arm muscles. The EMG data was rectified and integrated and the maximum activity for each muscle during the concentric range of motion was averaged over the three repetitions for each set. A 2x3 repeated measures analysis of variance was used to compare the differences in EMG activity for each muscle between the uninstructed, chest-instructed and arm-instructed conditions among the groups. **RESULTS:** The 1-RM of the trained participants was  $126.2 \pm 30.6$  kg, which was significantly greater than the 1-RM of the untrained participants ( $61.6 \pm 14.8$  kg) ( $p < 0.05$ ). There were no differences in EMG between the two groups. Both groups had 5.6% significantly higher ST activity during the arm-instructed set than the chest instructed set ( $p = 0.012$ ). **CONCLUSION:** Verbal instructions are effective for increasing activity in the triceps brachii but not the pectoralis major during the bench press. Future studies should investigate whether or not these effects are able to be increased through training with instruction.  
 Supported by: Summer Undergraduate Research Fellowship University of New Hampshire

2194 Board #346 June 2, 2:00 PM - 3:30 PM  
**Effects of Barbell Bouncing on Joint Kinematics in Deadlifts**

Kellen Krajewski, Robert G. LeFavi, Bryan L. Riemann. *Armstrong State University, Savannah, GA.*  
 (No relationships reported)

Different lifting strategies are utilized to complete higher repetition sets of deadlift. Some coaches emphasize pausing on the floor between repetitions while others allow the athlete to bounce the bar off the floor. To date, little is known about biomechanical differences between these techniques. **PURPOSE:** To determine the effect of bouncing the barbell between repetitions on joint angles compared to pausing between repetitions while deadlifting. **METHODS:** Healthy, physically active men ( $n=11$ ) aged 18-30yrs with a minimum of one-year deadlifting experience completed two sessions. During the first session, participant's one repetition maximum (1RM) for the conventional deadlift were determined. The second session consisted of 4 sets of 5 repetitions using 75% of their 1RM for each technique (bounce and pause) performed in a randomized order. Ground reaction force and kinematic data of the feet, shanks, thighs, pelvis and trunk were collected. Additionally, marker sets placed on the bar determined bounce height and bar height when positive acceleration was restored (PAR) following the bounce. Center of Pressure (CP) to ankle joint distance and ankle, knee, hip and trunk angular positions were determined at PAR. **RESULTS:** The bar reached an average bounce height of .057m and was not significantly related to barbell load ( $r = .365$ ,  $P = .27$ ). The CP was significantly anterior during the bounce condition compared to pause condition ( $P = .031$ , 95% CI: .002 to .037m). A technique by joint analysis of variance failed to reveal significant differences in joint angles between the techniques ( $P = .19$ ). **CONCLUSION:** Although joint angles did not differ between techniques, significant change in CP location indicates a more anterior body position. Cumulative effects may result in participants using the musculature in the lower back instead of the musculature in the pelvis. Further research should be conducted to test this hypothesis by considering joint kinetics and heavier load intensities.

2195 Board #347 June 2, 2:00 PM - 3:30 PM  
**Effect of An Unstable Load On Primary And Stabilizing Muscles During The Bench Press**

Stephanie Ostrowski<sup>1</sup>, Lara Carlson, FACSM<sup>1</sup>, Michael Lawrence<sup>2</sup>. <sup>1</sup>University of New England, Biddeford, ME. <sup>2</sup>University of New England, Portland, ME.  
 (No relationships reported)

Unstable resistance exercises are performed to increase activity of stabilizing muscles. The premise is that this increase in activity will yield greater strength gains than traditional resistance exercises. **PURPOSE:** To determine if an unstable load increases muscle activity of stabilizing muscles during a bench press as compared to a standard bench press with a typical load.

**METHODS:** Fourteen resistance-trained males (age 24.2 ± 2.7 yr, mass 84.8 ± 12.0 kg, height 1.77 ± 0.05 m, weight lifting experience 9.9 ± 3.4 yr, and bench press one repetition maximum (1-RM) 107.5 ± 25.9 kg) volunteered for this study. Subjects pressed two sets of 5 repetitions in both stable (75% 1-RM) and unstable (60% 1-RM) conditions using a standard barbell and a flexible Earthquake bar™, respectively. Due to the increase in difficulty when using the Earthquake bar™, 1-RM percentages were standardized. The 75% load was used with the standard barbell as this is a typical load used for 5 repetitions. Surface electromyography was used to detect muscle activity of primary movers (pectoralis major, anterior deltoid, triceps) and stabilizing musculature (latissimus dorsi, middle and posterior deltoid, biceps brachii, and upper trapezius).

**RESULTS:** Muscle activity was compared using a multivariate analysis of variance to determine significant ( $p \leq .05$ ) condition differences (Table 1). The right and left biceps and the left middle deltoid were significantly more active in the unstable condition.

**CONCLUSIONS:** Only some of the stabilizing muscles were significantly more active in the unstable condition. Therefore, it is unclear whether unstable load training is more beneficial than training with a standard barbell and typical load.

Table 1. Muscle activity ( $\mu$ V), Mean ± SD, N = 14

|          | Left Bicep |            | Right Bicep |            | Left Middle Deltoid |           |
|----------|------------|------------|-------------|------------|---------------------|-----------|
|          | Concentric | Eccentric  | Concentric  | Eccentric  | Concentric          | Eccentric |
| Stable   | 53 ± 32    | 139 ± 119  | 65 ± 59     | 138 ± 108  | 105 ± 54            | 96 ± 36   |
| Unstable | 116 ± 46*  | 169 ± 121* | 136 ± 101*  | 188 ± 137* | 137 ± 54*           | 132 ± 58* |

\*Unstable significantly greater than stable ( $p < 0.05$ )

2196 Board #348 June 2, 2:00 PM - 3:30 PM  
**Predicting Jump Performance Using Biomechanics Of Various Versions Of The Kettlebell Swings**

Maggie M. Selzer<sup>1</sup>, Garrett S. Bullock<sup>1</sup>, Abigail C. Schmitt<sup>1</sup>, Jason M. Shutt<sup>1</sup>, Gray Cook<sup>2</sup>, Robert J. Butler<sup>1</sup>. <sup>1</sup>Duke University, Durham, NC. <sup>2</sup>Functional Movement Systems, llc, Chatham, VA.  
 (Sponsor: Dr. William Garrett Jr, FACSM)  
 (No relationships reported)

Research on kettlebell (KB) and indian club (IC) training is limited, particularly related to its transferability to power development. Initial research suggests KB training may be as effective for the development of vertical jump performance as more traditional strength training. However, to date there are no studies examining the relationship between KB or IC swing performance and vertical jump performance. **PURPOSE:** To determine how different styles of KB and IC swings predict vertical and broad jump flight time.

**METHODS:** Fifteen active and healthy adults with KB swing experience participated in a 3D biomechanical evaluation of their overhead KB swing (OKS), shoulder height KB swing (SKS), indian club swings (IC), vertical jumps (VJ) and broad jumps (BJ). Kinematic and kinetic data were collected during three consecutive 10 repetition trials of each of the swing movements. Peak sagittal plane joint angles and joint moments as well as vertical and anterior-posterior ground reaction forces were extracted for the down and up portions of the swing movement. Extracted variables for the right side were entered into a stepwise regression to identify which variables predicted vertical jump flight time and broad jump flight time. Variables were retained if the model was statistically significant at  $p < .05$ , and each variable was extracted if the variable caused the model to exceed  $p = .10$ .

**RESULTS:** Biomechanical variables extracted from the OKS significantly explained VJ flight time ( $r$ -squared = .56+/- .06) and BJ flight time ( $r$ -squared = .30+/- .05). Similarly, kinematic and kinetic variables during the SKS significantly explained the VJ flight time ( $r$ -squared = .93+/- .02) and BJ flight time ( $r$ -squared = .57+/- .04). Finally, biomechanical variables during the IC performance significantly explained the VJ flight time ( $r$ -squared = .72+/- .04) and the BJ flight time ( $r$ -squared = .34+/- .05).

**CONCLUSIONS:** The results of this study demonstrate that biomechanics during kettlebell and indian club swings explain a large percentage of vertical and broad jump performance. Surprisingly, the greatest amount of variability in jumping performance

was explained by variables present in the IC pattern. Therefore, power development from the indian club swing pattern may have the greatest potential to transfer into jumping performance.

2197 Board #349 June 2, 2:00 PM - 3:30 PM  
**Kinematic Factors Associated With Shoulder Pain in Youth Archers**

Joseph Wasser<sup>1</sup>, Cong Chen<sup>1</sup>, Carl Greene<sup>2</sup>, Heather Vincent, FACSM<sup>1</sup>. <sup>1</sup>University of Florida, Gainesville, FL. <sup>2</sup>Easton Newberry Sports Complex, Newberry, FL. (Sponsor: Heather Vincent, FACSM)  
 Email: wassejg@ortho.ufl.edu  
 (No relationships reported)

**Purpose:** Archery requires dynamic shoulder muscle loading for arming the bow (pushing bow and pulling string) and isometric loading for sighting (stretching the bow and targeting). Repetitive stresses of shooting arrows may contribute to the onset of shoulder pain syndromes, particularly in young archers with suboptimal motion. The purpose of this study was to determine the prevalence identify potential motion differences in youth archers with and without shoulder pain.

**Methods:** This was a cross-sectional study of youth archers (N=17; 14.7±1.9 yr; 165cm±8 cm; 65.5k±19.1 kg). Demographics, archery experience and current training practice, history of joint pain(s) and bow type were collected. A 12 optical camera 3-dimensional motion capture system was used to collect shooting motions of archers. Key motion variables included pelvis and draw foot orientation toward target (transverse plane).

**Results:** Archers practiced 4.7±1.9 days/week (2.4±1.2 hrs/session) and shot, on average, 76-100 arrows per practice. A total of 59% and 41% of archers used recurve and compound bows, respectively, and 76.5% of archers used a counter-weight to their bow. Shoulder pain was reported by 41% of archers. IN archers with shoulder pain, pelvis orientation and draw foot orientation was 5.8±0.7° and 11.8±1.2° more open toward the target than archers with no pain (both  $p < 0.05$ ).

**Conclusion:** Emphasis on proper foot and pelvis positioning relative to the target is important to control loading on the shoulder musculature in archery. Proper technique coupled with strengthening of the core and stabilizing muscles may reduce muscular demands of the shoulder during repetitive shooting. These are particularly important to keep developing youth archers progressing safely in the sport.

2198 Board #350 June 2, 2:00 PM - 3:30 PM  
**Variability in Forearm Biomechanics in the Fastball Pitch in Pitchers With and Without a History of Elbow Injury**

Eric M. Berkson, Luke S. Oh, Robert C. McCunney, Donna M. Scarborough. Massachusetts General Hospital, Boston, MA.  
 Email: dscarborough@mgh.harvard.edu  
 (No relationships reported)

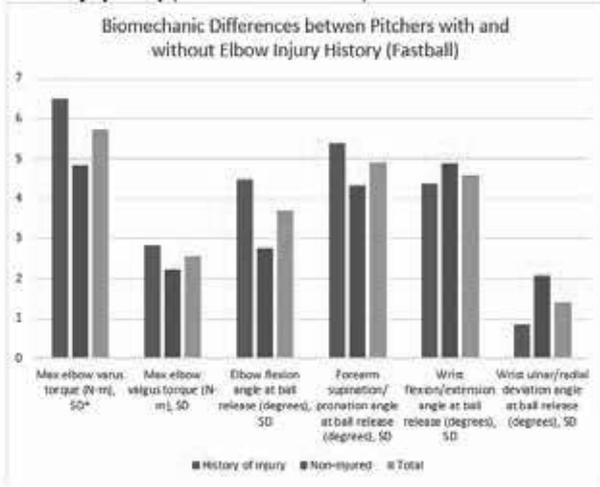
**PURPOSE:** Variability of mechanics has been linked to injury susceptibility. The purpose of this study was to compare within-pitcher variability of forearm biomechanics of a fastball across three levels of baseball pitchers and among those with and without history of elbow injury.

**METHODS:** 26 pitchers (10 high school, 10 collegiate, 6 minor league), mean age 19.65 ± 3.19 years, underwent 3D biomechanical analyses using high-speed motion capture cameras (360Hz). Forearm, elbow and wrist kinetics and kinematics were calculated for a sample of 3 - 6 trials per pitcher of the fastest, on-target fastballs. Variability was defined using standard deviation (SD) and single and multiple analyses of variance compared variability across pitchers level of play and history of elbow injury.

**RESULTS:** There was no statistical difference in elbow, forearm and wrist mechanics between those with and without history of elbow injury, and across 3 levels of play ( $p > 0.05$ ) (Figure 1). 2-way MANOVA found no statistically significant interaction effect between level of play and history of injury  $F(1,17) = 0.248, P = 0.907$ ; Wilk's Lambda = 0.945.

**CONCLUSIONS:** Past studies on the variability of lower body, shoulder and elbow mechanics in pitchers have found minimal variation (Fleisig G, 2009). Similarly, we found no significant within-subject variability in forearm mechanics for fastballs. The variability of forearm mechanics in other pitch types and in younger ages remains unknown.

**Figure 1: Comparison of variability in forearm biomechanics among pitchers with and without injury history (standard deviation values)**



2199 Board #351 June 2, 2:00 PM - 3:30 PM  
**The Relationship Between Bat Velocity And Measures Of Strength And Power In Ncaa Division Ii Baseball Players**  
 Brandon Snyder, Jason Kelmer, Gavin Moir, Shala Davis, FACSM, Matt Miltenberger, Shawn Munford. *East Stroudsburg University, East Stroudsburg, PA.* (Sponsor: Shala Davis, FACSM)  
*(No relationships reported)*

**PURPOSE:** This study was designed to examine the relationship between measures of upper and lower-body strength and power components and instantaneous bat velocity in NCAA Division II Collegiate baseball players. **METHODS:** Ten Division II collegiate baseball players (age:  $20.3 \pm 1.3$  years; mass:  $89.6 \pm 12.1$  kg; average years of experience:  $14.9 \pm 1.6$ ; 7 right-handed batters) volunteered to participate in this study. Each subject completed two days of testing with a week between test days. Day 1 consisted of 5 repetition maximum bench press, 5 repetition squat, and grip strength. Day 2 consisted of lower body power (vertical jump performed on a contact mat), upper-body power (plyometric pushup performed on a force plate) and instantaneous bat velocity testing. A 3D motion analysis system sampling at 200 Hz was used to record the instantaneous bat velocity with the players hitting a ball from a tee. Spearman rank correlations were performed to establish the magnitude of the relationships between the variables. **RESULTS:** The magnitude of the relationships between the measures of strength and power and bat velocity ranged from small to large (-0.103 to 0.583) and none were significant ( $p > 0.05$ ). The largest correlation was found between left-hand grip strength and instantaneous bat velocity (0.583). **CONCLUSION:** Findings from this study suggest the importance of possibly implementing hand grip training to aid in an increase in instantaneous bat velocity. Since the upper-body and lower-body strength components demonstrated only small correlations with bat velocity, training should consist of working on mechanical efficiency of the players swing once muscular strength and power have been developed.

2200 Board #352 June 2, 2:00 PM - 3:30 PM  
**Kinematic Predictors of Peak Elbow Varus Moments in Adolescent Baseball Pitchers**  
 Amy Whited<sup>1</sup>, Dai Sugimoto<sup>1</sup>, Corey Dawkins<sup>2</sup>, Donald Bae<sup>1</sup>. <sup>1</sup>*Boston Children's Hospital, Boston, MA.* <sup>2</sup>*The Micheli Center for Sports Injury Prevention, Waltham, MA.*  
 Email: amy.whited@childrens.harvard.edu  
*(No relationships reported)*

High-magnitude elbow joint moments during overhead throwing may lead to acute or overuse injuries, especially to the medial epicondyle physis and ulnar collateral ligament (UCL). During the pitching motion, the UCL is responsible for 54% of the elbow varus moment that is required to resist valgus motion. The identification of kinematic variables that predict high-magnitude elbow varus moments in adolescent baseball pitchers is needed.

**PURPOSE:** To develop a predictive model for peak elbow varus moments in adolescent male pitchers based on overhead throwing kinematic variables.

**METHODS:** Ten male baseball pitchers ( $14.9 \pm 1.1$  years;  $175.7 \pm 6.7$  cm;  $80.5 \pm 17.9$  kg) threw three fastball windup pitches while three-dimensional motion data were recorded using a 10 camera, digital motion analysis system (480 Hz). A total of 24 kinematic variables were analyzed at three temporal events occurring during the pitching motion: 1) Lead footstrike (FS), 2) Peak glenohumeral external rotation (GHER), and 3) Ball release (BR). Elbow varus joint moments were normalized to body weight and height. A multiple linear regression (MLR) using the stepwise procedure was employed to identify a predictive model for peak elbow varus moments.

**RESULTS:** The MLR model identified five significant kinematic variables predictive of peak elbow varus moments (adj.  $R^2 = 0.90$ ,  $p < 0.001$ ). The model revealed that significant predictors of peak elbow varus moments included contralateral trunk lean (CTL) at FS ( $\beta = 0.007$ ,  $p < 0.001$ ), sagittal lead knee angle (LKA) at FS ( $\beta = -0.030$ ,  $p < 0.001$ ), trunk rotation (TR) at FS ( $\beta = -0.011$ ,  $p < 0.001$ ), longitudinal glove distance (LGD) at GHER ( $\beta = 0.002$ ,  $p = 0.001$ ) and release point distance (RPD) ( $\beta = 0.011$ ,  $p = 0.04$ ). Standardized  $\beta$  values revealed CTL at FS ( $\beta = 0.699$ ) as the strongest predictor of peak elbow varus moments, followed by LKA ( $\beta = -0.289$ ), TR ( $\beta = -0.271$ ), LGD ( $\beta = 0.232$ ) and RPD ( $\beta = 0.139$ ).

**CONCLUSIONS:** Greater CTL, less flexed LKA and counter-clockwise TR at FS, greater LGD at GHER and greater RPD at BR are tendencies associated with greater elbow varus moments in adolescent male baseball pitchers. Modifying pitching mechanics may reduce excessive elbow varus moments and decrease risk of elbow injury in adolescent pitchers.

2201 Board #353 June 2, 2:00 PM - 3:30 PM  
**Pitch Mechanics and Pitch Velocity Changes during a Simulated Game in High School Baseball Pitchers**  
 Michelle A. Sandrey, Javan A. Ring. *West Virginia University, Morgantown, WV.*  
 Email: msandrey@mail.wvu.edu  
*(No relationships reported)*

While studies on the biomechanics of the throwing shoulder in youth and the professional baseball pitcher are abundant, few studies have evaluated changes in the pitching motion and pitch velocity during a game in high school baseball pitchers. **PURPOSE:** To describe changes in pitching mechanics including angle measurements and pitch velocity in high school pitchers during a seven-inning simulated game. **METHODS:** Five high school baseball pitchers ( $16.20 \pm 1.31$  yrs) pitched a seven-inning simulated baseball game consisting of 12 fastballs per inning (84 pitches) from an indoor pitching mound. During the seven 12-pitch innings, two video cameras recorded each subject's 12 pitches per inning. Reflective markers were placed on 8 bony landmarks of the upper and lower extremity. The 1st, 7th, and 12th pitch of each inning was evaluated for angle measurements (abduction, internal rotation, external rotation, elbow flexion, trunk tilt). Pitch velocity was recorded using a radar gun for every 84 pitches. A pitching evaluation checklist was also used to identify normal and/or abnormal pitching mechanics.

**RESULTS:** A significance within subjects ( $P = 0.036$ ) was found for shoulder abduction at the 4th inning between pitches #1 ( $103.92^\circ \pm 5.28^\circ$ ) and #7 ( $106.08^\circ \pm 3.98^\circ$ ) with ranges from  $99.82^\circ \pm 5.43^\circ$  to  $106.08^\circ \pm 3.98^\circ$ . Results were not significant with shoulder internal rotation ( $21.78^\circ \pm 2.95^\circ$  to  $26.16^\circ \pm 4.37^\circ$ ), external rotation ( $124.88^\circ \pm 2.77^\circ$  to  $135.22^\circ \pm 6.00^\circ$ ), elbow flexion ( $74.20^\circ \pm 7.91^\circ$  to  $83.26^\circ \pm 6.24^\circ$ ), or trunk tilt ( $46.88^\circ \pm 8.61^\circ$  to  $50.04^\circ \pm 10.29^\circ$ ) for any of the 7 innings for pitches #1, #7, or #12. Pitch velocity was not significant at pitch #1, #7, or #12 for any inning. Pitch velocity peaked in the second inning ( $68.0 \pm 4.42$  mph) and showed a steady decrease between the 2nd and 5th innings ( $66.0 \pm 2.12$  mph to  $64.20 \pm 2.17$  mph) with small increases in the last two innings ( $66.80 \pm 2.95$  mph). Using the Biomechanical Evaluation Checklist, consistent anomalies were seen with the arm cocking phase at step 6, arm deceleration phase step 6, and follow-through phase 3.

**CONCLUSIONS:** Changes in biomechanics, joint angle measurements and pitch velocity were evident as pitch count increased throughout the course of a game. Future studies should be conducted to examine whether this is a consistent pattern in high school baseball pitchers.

2202 Board #354 June 2, 2:00 PM - 3:30 PM  
**Symmetry of Strength Between the Arms in Open Water Swimmers**  
 Rodrigo Pereira<sup>1</sup>, Fabricio Madureira<sup>1</sup>, Claudio Scorcine<sup>1</sup>, Agatha Matheus<sup>2</sup>, Bruna Freitas<sup>1</sup>, Dilmar Guedes Jr.<sup>1</sup>, Victor Zuniga Dourado<sup>2</sup>. <sup>1</sup>*UNIMES, Santos, Brazil.* <sup>2</sup>*UNIFESP, Santos, Brazil.*  
 Email: r.pereirads@hotmail.com  
*(No relationships reported)*

**PURPOSE:** To investigate the bilateral force of open water swimmers in different angular speeds. **METHODS:** The isokinetic dynamometer equipment (Biodex), was used to analyze the performance of 16 swimmers in three angular speeds, these being:  $60^\circ$ ,  $180^\circ$  and  $300^\circ$  for three variables which were: (1) average of peak torque during the extension of the elbows to the right side (R) and left side (L); (2) strength deficits

produced between the arms and; (3) the angle which was produced more strength on both sides. After confirming the non-normality of the data, it was opted for the Wilcoxon test, the comparison between the average of peak torque and angle of the peak torque between the arms to the different accelerations. To the analysis of the moments of acceleration for both arms, it was opted for the Anova test to repeated measures. **RESULTS:** In the variable 1, differences were detected in the average peak of strength, measured in Newton Meter (Nm), being  $53.1 \pm 18.3$  Nm (L) and  $53.8 \pm 16.9$  Nm (R) at the angle of  $60^\circ$ ;  $41.1 \pm 15.8$  Nm (L) and  $43.2 \pm 14.9$  Nm (R) at the angle of  $180^\circ$  and;  $34.7 \pm 12.7$  Nm (L) and  $37.4 \pm 13.5$  Nm (R) at the angle of  $300^\circ$ . In the second variable, no differences were found over the produced strength deficit, being  $10.6 \pm 10.2$  Nm to  $60^\circ$ ;  $11.6 \pm 12.1$  Nm to  $180^\circ$  and;  $14.9 \pm 16.8$  Nm to  $300^\circ$ . To the variable 3, differences were detected in the moments of acceleration at angles of  $60^\circ$  and  $300^\circ$ , it also may be observed that the angle of the peak torque was on  $60^\circ$ , being the produced force of  $48.9 \pm 7.3$  the right side. **CONCLUSION:** Despite being detected differences in the average strength peak produced in the three types of acceleration forces ( $60^\circ$ ,  $180^\circ$  and  $300^\circ$ ), no differences were detected for any of the variables when comparing the right arm with his left arm.

| Table 01. Magnitude of strength produced by the open water swimmers for the average peak torque in Newton Meter on both sides of the body in the elbows extension action at three different accelerations. |                             |                             |                             |                             |                             |                             |
|--|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|  | 60° Left                    | 60° Right                   | 180° Left                   | 180° Right                  | 300° Left                   | 300° Right                  |
| AVERAGE (SD)   | 53,1 <sup>#</sup><br>(18,3) | 53,8 <sup>#</sup><br>(16,9) | 41,1 <sup>#</sup><br>(15,8) | 43,2 <sup>#</sup><br>(14,9) | 34,7 <sup>#</sup><br>(12,7) | 37,4 <sup>#</sup><br>(13,5) |

\*Indicates statistical difference between the arms. #Indicates difference between the moments of acceleration. The data are in the form of average and standard deviation ().

2203 Board #355 June 2, 2:00 PM - 3:30 PM  
**Immediate Effect Of Forearm Kinesio Taping On Handgrip Strength And Muscle Tone, Stiffness And Elasticity**

Mario Rodrigues<sup>1</sup>, Rui Costa<sup>1</sup>, Dalila Romão<sup>1</sup>, Maria Dias<sup>1</sup>, Sara Valério<sup>1</sup>, Luis Espejo-Antunes<sup>2</sup>, Fernando Ribeiro<sup>1</sup>. <sup>1</sup>University of Aveiro, School of Health, Aveiro, Portugal. <sup>2</sup>Extremadura University, Badajoz, Spain.  
 Email: mmpr@ua.pt  
 (No relationships reported)

Despite a widely used tool, there is still little quality evidence to support the use of kinesio tape. It was postulated that depending on the direction of the application, the effect on muscle function is different; the application from insertion to origin inhibits muscle function whereas from origin to insertion facilitates muscle function. The claim that the effects are different depending on the direction of tape application needs to be clearly ascertained. **PURPOSE:** To determine the immediate effects of two forearm kinesio taping applications on muscle tone, stiffness and elasticity and maximal grip strength of healthy young individuals.

**METHODS:** Thirty-nine participants (age range 18 and 33 years), 15 male and 24 female, were equally randomized into three groups, two experimental groups receiving kinesio tape (KT1, from origin to insertion; KT2, from insertion to origin) and a control group (CG). Before and 30-min after the intervention, maximal handgrip strength was assessed by a digital hand dynamometer; and the mechanical properties - tone, elasticity and stiffness - of the forearm muscles were measured using a handheld mechanical impulse-based myotonometric device.

**RESULTS:** No significant differences for age (KT1:  $21.4 \pm 3.8$  yrs, KT2:  $20.2 \pm 1.4$  yrs, CG:  $20.2 \pm 1.9$ ,  $p=0.429$ ), height, weight and body mass index were found between the three groups. Regarding maximal handgrip strength, a significant decrease was observed in the KT2 group after applying the kinesio tape (insertion to origin) [ $31.6$  (13.9) to  $30.4$  (12.7) kg,  $p=0.043$ ]. Only the application of kinesiology tape from origin to insertion (group experimental 1) increased significantly muscle tone [ $16.6$  (2.5) to  $17.4$  (3.5) Hz,  $p=0.036$ ], stiffness [ $318.3$  (52) to  $355.0$  (87) N/m,  $p=0.004$ ] and elasticity [ $0.98$  (0.1) to  $1.10$  (0.1),  $p=0.023$ ].

**CONCLUSIONS:** The results of the present study show that kinesio tape application has different effects depending on the direction of taping application. The application of the kinesio tape aiming to facilitate muscle function (application from origin to insertion) increased muscle tone, elasticity and stiffness, while the application aiming to inhibit muscle function (application from insertion to origin) decreased muscle strength.

2204 Board #356 June 2, 2:00 PM - 3:30 PM  
**Tremor Amplitude is Greater in the Mediolateral Direction than Vertical During Handgun Aiming Tasks.**  
 Kyle J. Kelleran, Steven Morrison, Daniel M. Russell. Old Dominion University, Norfolk, VA.  
 (No relationships reported)

**PURPOSE:** In aiming at a target, humans produce small involuntary fluctuations in the aiming limb which may hamper performance. While often studied in the vertical axis, these fluctuations occur in all axes. The current study compared vertical and mediolateral tremor amplitude during different handgun aiming postures. **METHODS:** Thirty volunteers stood 21 feet from a target and aimed a weighted mock handgun for 10 sec with an accelerometer affixed to each wrist and the gun barrel. Participants performed five trials per condition. Amplitude (RMS) of the acceleration signals were computed. Two hand grip (bilateral, unilateral), two arm positions (bent, straight), and two segments (forearm, gun) were analyzed in conjunction with the two directions (VT, ML). **RESULTS:** Across all conditions tremor amplitude in the mediolateral tremor was significantly greater than the vertical direction (VT:  $.017 \pm .006$  vs. ML:  $0.021 \pm .005$ g,  $p < .001$ ). Additionally significant interaction effects were seen for direction by hand grip ( $p < .001$ ) as well as direction by arm position ( $p = .002$ ). For hand grip, vertical tremor was significantly lower than mediolateral and bilateral tremor was significantly lower than unilateral. For arm position, vertical tremor was significantly lower than mediolateral and bent arm tremor was significantly lower than straight arm. There were no significant interaction effects for direction by segment ( $p = .173$ ). **CONCLUSION:** Across numerous hand gun aiming postures mediolateral tremor amplitude was consistently higher than the vertical tremor amplitude. This may be due to the neurological and mechanical factors of the limb, the limbs resistance to gravity, or the effort of control. Further research is needed to examine the interaction of mediolateral and vertical tremor.

2205 Board #357 June 2, 2:00 PM - 3:30 PM  
**Cross-education Effects After High Versus Low Frequency, Volume-matched Grip Strength Training.**  
 Natasha G. Boyes, Peter Yee, Joel L. Lanovaz, Jonathan P. Farthing. University of Saskatchewan, Saskatoon, SK, Canada.  
 (No relationships reported)

Unilateral strength training can attenuate muscle mass and strength losses in an opposite immobilized limb. Traditional unilateral training programs that yield these cross-education effects cause inter-limb asymmetry by inducing hypertrophy and strength increases in the trained limb. A higher frequency training program with lower per session volume may attenuate trained limb hypertrophy but still yield cross-education effects, lowering inter-limb asymmetry. Purpose: To determine the effects of a high frequency (HF) vs. low frequency (LF) volume-matched 4-week isometric grip strength training program on cross-education of strength. Methods: Nineteen healthy right-handed participants (age  $24 \pm 5$  years) were randomly assigned to one of two groups: HF ( $n=10$ ) and LF ( $n=9$ ). Participants were tested twice before and once after a 4-week, unilateral (right) grip strength training program totaling 120 maximal repetitions per week. HF trained twice per day, 5 days per week, 2 sets of 6 repetitions per session. LF trained 3 days per week, 5 sets of 8 repetitions per session. Measures included maximal isometric grip strength (grip dynamometer) and wrist flexion (NORM dynamometer), muscle thickness (ultrasound), muscle activation (EMG) and voluntary activation (twitch-interpolation). Results: A significant time main effect ( $p < 0.001$ ) was observed for isometric grip strength where both limbs increased from pre to post with no differences between groups (LF right:  $42.4 \pm 12.2$  to  $46.6 \pm 11.1$  kg; LF left:  $38.6 \pm 10.5$  to  $42.0 \pm 10.4$  kg; HF right:  $47.6 \pm 13.6$  to  $50.5 \pm 13.5$  kg; HF left:  $43.9 \pm 11.9$  to  $47.6 \pm 13.3$  kg). Muscle thickness significantly increased in both groups in the right limb only (R:  $3.93 \pm 0.44$  to  $4.04 \pm 0.45$  cm,  $p < 0.05$ ; L:  $3.88 \pm 0.51$  to  $3.88 \pm 0.49$  cm,  $p = 0.897$ ). EMG burst activity (normalized to the maximal M wave), maximal isometric wrist flexion torque, and voluntary activation of the forearm muscles did not change significantly from pre to post training in either arm ( $p = 0.256$  to  $0.831$ ). Conclusion: As predicted, both LF and HF training programs were effective for inducing cross-education of grip strength to the untrained limb; however, contrary to our hypothesis, both programs induced similar hypertrophy in the trained limb. These findings have implications for rehabilitation strategies after unilateral injury.

2206 Board #358 June 2, 2:00 PM - 3:30 PM  
**The Effect of Shoulder Position on Internal Elbow Flexion Torque**  
 Robert Presta, Justin A. Fiore, Richard S. Feinn, David A. Wallace. Quinnipiac University, Hamden, CT.  
 (No relationships reported)

**PURPOSE:** The purpose of this study was to determine the optimal exercises for strengthening the biceps brachii through the production of torque curves given different shoulder positions.

**METHODS:** Fourteen subjects were tested, using a dynamometer, for maximum voluntary contraction (MVC) of the elbow flexors. Each subject was strapped into a chair for four different elbow positions for two different shoulder positions, a total of eight test positions. The dynamometer was stabilized by a custom built apparatus. Each subject performed 3 trials per position with least 1 minute rest intervals between each trial. The average force exerted for each position was calculated. The data collected was used to generate internal torque curves, which were compared to the external torque curves of the two different shoulder positions. Calculations determined if modifying each exercise with cables would better match the external torque curve than the original exercises against gravity.

**RESULTS:** The percentage of the maximum elbow flexion torque for the shoulder at 0 degrees was 60.8% for the elbow at 0 degrees, 80.9% for the elbow at 35 degrees, 97.4% for the elbow at 80 degrees, and 83% for the elbow at 125 degrees. The percentage of the maximum elbow flexion torque for the shoulder at 90 degrees was 50.0% for the elbow at 0 degrees, 65.7% for the elbow at 35 degrees, 98.1% for the elbow at 80 degrees, and 81.9% for the elbow at 125 degrees. When comparing the original exercise and the cable modified exercise at shoulder 0 degrees, the difference in errors between methods is about 5.1 and this difference is not statistically different from 0 (p=.197). When comparing the original exercise and the cable modified exercise at shoulder 90 degrees, the difference in errors between methods is about 3.8 and this difference is not statistically different from 0 (p=.214). When comparing the two original exercises, the exercise at shoulder 0 degrees resembles the internal torque curve more than the exercise at shoulder 90 degrees and its respective internal torque curve.

**CONCLUSIONS:** The closer resemblance of the internal and external torque curves at shoulder 0 degrees than shoulder 90 degrees should indicate a more efficient strengthening exercise. However, modification of both exercises resulted in no statistically significant differences.

2207 Board #359 June 2, 2:00 PM - 3:30 PM  
**"when Is It Safe For Me To Start My Exercises?"**  
 Alfred B. Gurney. *University of New Mexico, Albuquerque, NM.*  
 Email: bgurney@salud.unm.edu  
*(No relationships reported)*

**PURPOSE:** To measure indwelling electromyography activity (iEMG) of the rotator cuff muscles and surface EMG (sEMG) activity of other shoulder muscles during normal ambulation, shirt and sling donning and doffing, and rehabilitation tasks commonly performed after rotator cuff surgery.

**BACKGROUND:** The activity of the rotator cuff muscles has not previously been measured with iEMG comparing ambulation and other movements. Knowledge of the relative contribution of these muscles during various tasks will help guide rehabilitation progression.

**METHODS:** In 28 volunteers (15 men, 13 women; mean age, 32.2 years), iEMG activity was measured in the supraspinatus, infraspinatus, teres minor, and subscapularis muscles during various tasks; sEMG activity was measured in the middle deltoid, biceps, and upper trapezius muscles.

**RESULTS:** Using median EMG activity, in general, donning and doffing a shirt or sling recruited the rotator cuff muscles more than the other 7 tasks tested. Self-ranging motion using pulleys, especially in the scapular plane, was also consistently associated with greater recruitment of the shoulder muscles. Pendulum exercises, passive range of motion (PROM) by a physical therapist (PT), and self-ranging motion with a dowel recruited the shoulder muscles to a lesser extent.

**CONCLUSIONS:** Our results suggest that rehabilitation tasks early after rotator cuff repair should include pendulum exercises, PROM by a PT, and self-ranging motion with a dowel. Pulleys should be used later, with movement in the sagittal plane done before that in the scapular plane. Ambulation without a sling and donning and doffing a sling and a shirt should be performed with caution early after surgery.

| Mean Values of EMG Activity, From Least to Greatest |                               |                               |                                |                                 |                              |                                 |
|---|-------------------------------|-------------------------------|--------------------------------|---------------------------------|------------------------------|---------------------------------|
| Supraspinatus                                       | Infraspinatus                 | Teres Minor                   | Subscapularis                  | Middle Deltoid                  | Biceps Brachii               | Upper Trapezius                 |
| Dowel: 4.8 (2.9-12.0)                               | PROM PT: 4.6 (3.3-11.6)       | Dowel: 9.4 (5.2-14.4)         | Pulleys Sag: 7.4 (3.0-36.0)    | Pendulum Exer: 2.0 (1.4-3.3)    | PROM PT 0.4 (0.2-1.0)        | Pendulum Exer 6.9 (3.4-10.5)    |
| Pendulum Exer: 5.5 (3.0-9.7)                        | Dowel: 5.1 (2.0-12.2)         | Pendulum Exer: 9.9 (2.9-32.2) | Pendulum Exer: 9.3 (4.8-22.6)  | PROM PT: 2.4 (1.8-4.5)          | Pendulum Exer: 0.4 (0.2-1.1) | PROM PT: 8.0 (3.1-18.2)         |
| Fingers Inter: 7.4 (3.9-14.9)                       | Pulleys Sag: 5.2 (2.3-11.8)   | Fingers Inter: 7.4 (3.9-14.9) | Dowel: 9.6 (2.6-17.3)          | Amb: 2.9 (2.2-4.8)              | Amb: 0.7 (0.4-1.2)           | Dowel: 8.1 (3.4-20.2)           |
| PROM PT: 8.4 (3.6-13.8)                             | Pendulum Exer: 5.4 (2.1-9.1)  | Amb: 11.8 (6.4-58.5)          | PROM PT: 9.8 (2.2-28.6)        | Fingers Inter: 4.1 (2.7-5.7)    | Dowel: 0.7 (0.5-1.3)         | Fingers Inter: 8.3 (4.6-20.5)   |
| Sling D&D: 12.7 (7.4-22.1)                          | Fingers Inter: 6.1 (2.4-13.4) | PROM PT: 11.9 (4.4-28.9)      | Pulleys Scap: 10.4 (6.8-36.7)  | Dowel: 4.1 (2.8-6.9)            | Pulleys Sag: 0.9 (0.5-1.5)   | Amb: 10.4 (4.0-16.8)            |
| Pulleys Sag: 15.2 (8.4-21.5)                        | Pulleys Scap: 7.2 (3.9-13.9)  | Pulleys Sag: 12.9 (6.6-24.2)  | Fingers Inter: 10.4 (2.6-25.6) | Sling D&D: 4.45 (3.4-6.4)       | Pulleys Scap: 0.9 (0.6-1.6)  | Sling D&D: 15.7 (11.0-24.2)     |
| Amb: 15.4 (7.3-27.9)                                | Amb: 11.8 (4.8-36.3)          | Pulleys Scap: 15.8 (7.3-24.3) | Shirt D&D: 23.2 (13.8-50.7)    | Shirt D&D: 6.5 (3.7-9.7)        | Fingers Inter: 0.9 (0.5-1.8) | Pulleys Sag: 21.8 (11.9-29.2)   |
| Pulleys Scap: 18.7 (8.4-24.8)                       | Shirt D&D: 12.9 (6.9-24.7)    | Sling D&D: 20.1 (12.1-37.2)   | Amb: 30.1 (17.4-42.0)          | Pulleys Sag: 10.1 (6.3-14.3)    | Shirt D&D: 2.9 (1.8-3.8)     | Pulleys Scap: 22.85 (14.1-37.1) |
| Shirt D&D: 25.0 (15.3-43.3)                         | Sling D&D: 14.4 (4.5-20.4)    | Shirt D&D: 23.0 (9.8-67.3)    | Sling D&D: 31.2 (15.8-49.0)    | Pulleys Scap: 12.15 (6.3-15.85) | Sling D&D: 3.6 (1.9-5.1)     | Shirt D&D: 29.1 (12.0-35.6)     |

**D-61 Thematic Poster - Concussion Research and Policy**

Thursday, June 2, 2016, 3:15 PM - 5:15 PM  
 Room: 101

2260 **Chair:** Kevin Guskiewicz, FACSM. *University of North Carolina, Chapel Hill, NC.*  
*(No relationships reported)*

2261 Board #1 June 2, 3:15 PM - 5:15 PM  
**Reliability of the King-Devick Test in Baseline Concussion Evaluations of High School Athletes**

James Patrick MacDonald, FACSM<sup>1</sup>, Iris Petersen<sup>2</sup>, Douglas Kyrrouac<sup>3</sup>. <sup>1</sup>Nationwide Children's Hospital, Columbus, OH. <sup>2</sup>Indiana University School of Medicine, Indianapolis, IN. <sup>3</sup>Ohio State University College of Medicine, Columbus, OH.  
 Email: james.macdonald@nationwidechildrens.org  
*(No relationships reported)*

**PURPOSE:** The King-Devick (KD) test is a rapid, sideline screening assessment tool for concussion diagnosis and management. It is a timed test measuring visual impairment associated with concussions. There is increasing evidence for its use in younger athletes. The medical literature for the KD test suggests that i) athletes be baseline tested prior to every season and ii) any slowing of the KD in the setting of a head injury is suspicious for concussion.

**METHODS:** Design: Repeated measures design. Setting: Three Central Ohio high schools. Participants: High school athletes (N = 46) participating in American football or soccer during the 2014 and 2015 academic years with valid baseline KD tests both years were recruited. Interventions: Two baseline KD tests taken one year apart. Main Outcome Measures: Numbers of individuals who sustained a concussion between 2014/2015 KD tests were tallied. Independent samples t tests compared mean KD<sub>2015</sub> between 'concussed' and 'non-concussed' individuals. Test-Retest reliability was assessed by measuring the intraclass correlation coefficient (ICC) between the repeated measures of the KD for 2014 and 2015. Spearman's correlation coefficient (r<sub>s</sub>) was calculated as a secondary outcome measure of reliability.

**RESULTS:** 46 individuals met inclusion criteria. Those sustaining a concussion between 2014 and 2015 (N = 7) were all symptom free by 2015 test date. Mean KD<sub>2015</sub> for those with and without interval concussion (N = 39) were 40.2s and 45.0s respectively (P = 0.238). For the cohort of individuals without interval concussion, 10 (25.6%) had slowing of baseline KD tests. For the entire cohort, ICC = 0.879 and  $r_s = 0.875$  (P < 0.01).

**CONCLUSIONS:** Our results reveal a mixed picture for the use of KD as a baseline assessment tool. It has good test-retest reliability over the course of a year. We would argue that annual baseline testing may be sufficient for the KD. However, even in those with no interval concussion, a substantial percentage had slowing of their KD test speed, which we would suggest may confound sideline assessments in the setting of head injury. Further work needs to be done in this population prior to KD becoming routine standard of concussion care.

2262 Board #2 June 2, 3:15 PM - 5:15 PM  
**Diffusion of Innovations and Sports Concussions: A Mixed Methods Investigation of Policy Decision-Makers**

Cole Youngner, Nancy Thompson, Kirk Elifson. *Emory University Rollins School of Public Health, Atlanta, GA.*  
 Email: cyoungner1a2n@gmail.com  
 (No relationships reported)

**OBJECTIVE:** Identify and assess key decision-makers for high school sports concussion policies, their perceptions of evidence based concussion guidelines, and implementation of these guidelines and policies using a novel application of Diffusion of Innovations and mixed qualitative and quantitative methods

**BACKGROUND:** Over 3 million concussions occur in the US annually. High-school athletes are susceptible since over 7 million play high-school sports, and they often hide concussions and return to play (RTP) too soon. Sports concussion research rarely incorporates socio-behavioral theory and qualitative methods. Diffusion of innovations (DOI) theory has examined social systems and preventive health intervention adoption. DOI incorporates communication and decision-making between key influencers for adopting innovations. Thus, DOI theory will elucidate sports concussion RTP decision-making processes. Finally, Georgia policy has vague RTP standards, meaning schools may have varying policies.

**DESIGN:** In-depth-interviews and surveys assessed key professionals' involvement in RTP policy decision-making. Participants included school administrators, athletic trainers, concussion researchers, parent advocates, and physicians in Georgia. Study instrument topics stemmed from DOI theory: knowledge; innovation characteristics; characteristics of decision-makers: socioeconomic, personality, and communication behavior. Analyses involved codebook development for thematic analysis of key themes from 20 interviews and surveys.

**RESULTS:** Results yielded 13 major themes with several notable findings: school athletic trainers are critical resources for implementing concussion policies; lack of enforcement and monitoring for Georgia's concussion law; competition among providers and diagnostic tools stemming analogous to a business model; variability in high-schools' protocols and possibly compliance due to resource and provider availability.

**CONCLUSIONS:** Understanding decision-making for protecting athletes is critical. Qualitative applications of DOI allow individuals to describe theirs and others' roles in decision-making processes and inform concussion prevention. Results provide suggestions for best practices and improvements of concussion policies and protocols.

2263 Board #3 June 2, 3:15 PM - 5:15 PM  
**A Promising New Protection Against Brain Injury During Collision Sport: A Randomized Clinical Trial**

Gregory D. Myer, FACSM. *Cincinnati Children's Hospital Medical Center, Cincinnati, OH.*  
 Email: greg.myer@cchmc.org  
**Reported Relationships:** G.D. Myer: *Contracted Research - Including Principle Investigator; Q30 Sports Sciences, LLC.*

Sports-related mild traumatic brain injury (mTBI) is limited in available preventative strategies. Protection of the brain from outside the skull (helmets) has failed to significantly reduce mTBI incidence or degree, and equipment modification does not address acceleration or deceleration of the brain inside the cranium during impacts.

**PURPOSE:** We utilized a jugular compression collar to minimally restrict venous outflow and promote cerebral venous sinus engorgement to promote less motion of the brain within the cranium. It is hypothesized this will reduce biomarkers of mTBI during sport. **METHODS:** A prospective, randomized, controlled trial design was used to evaluate effects of mild jugular vein compression among high school hockey players (mean age 16.3±1.2 years). Outcome measures included diffusion tensor imaging (DTI) and electroencephalography derived Brain Network Activation (BNA). Helmet sensors were used to collect impact data. **RESULTS:** In the non-collar group (n=7), DTI measures were associated with disruption of white matter microstructure - mean diffusivity (MD) and radial diffusivity (RD). This disruption increased significantly

from pre- to mid-season (voxel based analysis, paired t-test, p < .05, corrected for multiple comparison) in extensive white matter regions; primarily the corpus callosum, corona radiata, and internal/ external capsule. DTI changes were not observed for the collar group (n=7) despite similar accumulated linear accelerations from head impacts. BNA analysis showed concomitant changes in network dynamics in the non-collar group compared to the collar group (22.1 vs. 4.1; p < .05). The collar effect, derived from the group difference of longitudinal change in DTI measures was found to correlate significantly with altered network dynamics (Pearson correlation, r=.77; p<.05). **CONCLUSION:** Participation in hockey resulted in white matter microstructure disruption concomitant with altered network dynamics in only the non-collar group. Correlations between neuroanatomical and electrophysiological measures in the non-collar group provided initial evidence that mild jugular vein compression may be protective for sport-related mTBI. Our findings could lead to novel and effective methods for protecting the brain from sport-related head impacts.

2264 Board #4 June 2, 3:15 PM - 5:15 PM  
**Neurocognitive Performance and Increased Risk of Lower Extremity Injury after Concussion**

Kevin Hanneken<sup>1</sup>, Jennifer L. Sanfilippo<sup>2</sup>, Scott Hetzel<sup>3</sup>, Alison Brooks<sup>4</sup>. <sup>1</sup>*University of Wisconsin School of Medicine and Public Health, Madison, WI.* <sup>2</sup>*Badger Athletic Performance, Madison, WI.* <sup>3</sup>*University of Wisconsin - Madison, Madison, WI.* <sup>4</sup>*University of Wisconsin Hospital and Clinics, Madison, WI.*  
 Email: khanneken@wisc.edu  
 (No relationships reported)

**BACKGROUND:** Recent studies have shown increased risk of musculoskeletal injury for athletes returning to play from concussion. It is possible that subtle deficits in neurocognition and neuromuscular control, such as inhibited concentration, balance, or prolonged reaction times could increase risk of subsequent injury. However, there is little understanding of the variables that may help characterize risk during this time of vulnerability.

**PURPOSE:** To determine if concussed collegiate athletes with worse neurocognitive or balance performance are at increased risk of acute lower extremity musculoskeletal injury (LEI) following return to play (RTP) from concussion.

**METHODS:** This retrospective cohort study examined male (n=70) and female (n=14) athletes participating in NCAA Division I football, hockey, soccer, wrestling, and basketball, who sustained a concussion between June 2011- May 2015. Athletes completed symptom score, computerized neurocognitive (ImPACT - Immediate Post-concussion Assessment and Cognitive Testing) and balance (BESS - Balance Error Scoring System) testing at baseline and post-injury time points (0-4, 5-11, 12-18, >30 days). The remaining academic school year following RTP from concussion was reviewed for acute, non-contact LEI, and athletes were divided into two groups (LEI, No LEI). Differences in total symptom, ImPACT composite, and BESS scores were compared using repeated measures ANOVA.

**RESULTS:** 152 cases of concussion were identified. Following strict exclusion criteria, 104 cases in 84 athletes were used for analysis. 31 athletes sustained 32 LEI between RTP from concussion and the end of the academic school year. After analyzing "change-from-baseline" for total symptom, ImPACT composite, and BESS scores, it was found that there were no significant differences between LEI and non-LEI groups at any time point.

**CONCLUSIONS:** There was no significant difference in neurocognitive or balance performance in concussed athletes who sustained LEI after RTP compared to athletes who did not sustain LEI. ImPACT and BESS testing may not be sensitive enough to detect athletes with subtle impairments who may be at increased risk of LEI following concussion. Future studies may utilize different methods, such as the Sensory Organization Test or vestibular-oculomotor deficit testing.

2265 Board #5 June 2, 3:15 PM - 5:15 PM  
**Risk for Lower Extremity Injury Following Concussion: a Retrospective Cohort Study in Soldiers**

Joseph R. Kardouni, Tracie L. Shing, Craig J. McKinnon, Dennis E. Scofield, Susan P. Proctor. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.* (Sponsor: Dr. Stephen R. Muza, FACSM)  
 (No relationships reported)

Concussions may increase the risk for subsequent lower extremity injuries in physically active people.

**PURPOSE:**

Examine concussion as a risk factor for lower extremity (LE) injury in soldiers with no history of LE injury.

**METHODS:**

Medical encounter data for all active duty US Army soldiers from 2005-2009 were used to identify soldiers who sustained a concussion by way of International Classification of Diseases, Ninth Revision (ICD-9) codes. Soldiers with a history of a LE injury were excluded from the study. LE injuries were defined according to

the fractures, dislocations, sprains, and strains ICD-9 codes from the Barell injury diagnosis matrix. Matched controls (age, sex, and military occupational specialty [MOS]) were selected from the population of soldiers in the Army during the same month as each concussion case. Soldiers were followed from the time of incident concussion or matching until: 1) a lower extremity injury, 2) loss to follow-up, or 3) conclusion of a 24-month follow-up period. Using concussion as the primary risk factor, a Cox Proportional Hazard Ratio (HR) was calculated for LE injury, controlling for matched factors, time in military service, and race. Life table methods were used to evaluate LE injury rates for qualitative comparison between the two groups across the 24-month follow-up period.

**RESULTS:**

From 2005 to 2009, incident concussions were identified in 7,981 soldiers without a history of LE injuries. Of these cases, 1,892 (~24%) experienced a LE injury within 2 years following concussion. Concussed soldiers were at 53% greater risk of LE injury over the 24-month follow-up period (HR=1.53, 95%CI [1.42, 1.65]) compared to controls. On qualitative examination of unadjusted injury rates, the greatest difference in the rate of LE injuries appeared during the first 6 months post-concussion.

**CONCLUSION:**

These results suggest that a concussion puts soldiers at increased risk for sustaining a LE injury. This risk may be greatest during the first several months post-concussion. These findings may have implications for managing people returning to activity after concussion.

The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

2266 Board #6 June 2, 3:15 PM - 5:15 PM  
**Accumulated G-Forces Sustained During Hockey Correlate With Changes In Brain Network Activation Score**

Amit Reches<sup>1</sup>, Kim D. Barber Foss<sup>2</sup>, Michal Weiss<sup>1</sup>, Staci Thomas<sup>2</sup>, Chris DiCesare<sup>2</sup>, Adam W. Kiefer<sup>2</sup>, Darcy Krueger<sup>2</sup>, Amir B. Geva<sup>1</sup>, Gregory D. Myer, FACSM<sup>2</sup>. <sup>1</sup>*ElMindA, Herzliya, Israel.* <sup>2</sup>*Cincinnati Children's Hospital Medical Center, Cincinnati, OH.* (Sponsor: Gregory Myer, FACSM)  
 Email: amit@elminda.com  
**Reported Relationships:** A. Reches: Salary; ElMindA.

**PURPOSE:** Helmets have been redesigned to reduce the incidence of concussion in sports, but research has shown that even newer helmets are ineffective at preventing concussions. We propose a novel device, worn around the neck, as a solution to reduce concussions in sport. The collar causes gentle compression of the internal jugular veins, thus restricting venous outflow and increasing venous sinus engorgement. This reduces brain movement within the cranial cavity upon impact (slosh). The purpose of this study was to measure brain neurophysiological changes after head impacts. A brain network activation analysis (BNA) evaluated the network dynamics associated with event related potentials in subjects performing a neuro-cognitive task. We hypothesized that the group wearing the collar would demonstrate fewer neurophysiological changes than the control group and that the changes in the control group would correlate with relative G force exposure during the hockey season. **METHODS:** Fourteen male high school ice hockey players (mean age 16.74±1.13 y) participated in a prospective, randomized clinical trial. Subjects underwent pre-season and mid-season EEG assessment; Helmet sensors were used to collect head impact and acceleration data. BNA analysis assessed the similarity of subjects' EEG signals to a reference group and relative to accumulated head impact data. **RESULTS:** Subjects wearing the collar (n=7) exhibited fewer changes in their BNA scores (4.05±4.02) from pre- to mid-season, compared to those who did not wear the collar (n=7, 20.21±13.35, p=0.007). Subjects who did not wear the collar exhibited a correlation between the accumulated G forces (linear acceleration >20g) and the change in BNA score from pre- to mid-season (Spearman's rho=0.82, p=.023). The accumulated G forces for subjects who did or did not wear the collar (6364±1902 and 4583±1304, respectively) were not statistically different. **CONCLUSION:** Subjects who sustained multiple head impacts while playing ice hockey exhibited changes in their EEG data, as measured by BNA analysis. Subjects who wore a jugular vein-compression collar exhibited a smaller change in BNA score than subjects who did not wear the collar. These data support the contention that mild jugular vein compression may be a protective mechanism against sport-related mTBI.

2267 Board #7 June 2, 3:15 PM - 5:15 PM  
**Combining Visual Target Tracking and Time Estimation to Assess Vestibular and Oculomotor Function after Concussion**

Kelsey M. Evans<sup>1</sup>, Tamara R. Espinoza<sup>1</sup>, Brian Geary<sup>2</sup>, Kristopher A. Hendershot<sup>1</sup>, Nicole Kosoris<sup>3</sup>, Michelle C. LaPlaca<sup>2</sup>, Brian Liu<sup>3</sup>, Alessio Medda<sup>3</sup>, Shean E. Phelps<sup>3</sup>, Farris Taha<sup>2</sup>, Justin Tinkler<sup>2</sup>, David W. Wright<sup>1</sup>, Russell K. Gore<sup>2</sup>. <sup>1</sup>*Emory University School of Medicine, Atlanta, GA.* <sup>2</sup>*Georgia Institute of Technology, Atlanta, GA.* <sup>3</sup>*Georgia Tech Research Institute, Atlanta, GA.*  
 Email: kelsey.evans@emory.edu  
*(No relationships reported)*

Concussions affect an estimated 1.6 to 3.8 million people in the United States annually. Dizziness, which may manifest as a result of vestibular or oculomotor impairments, is a common symptom (>50%) following concussion and is associated with increased risk for protracted recovery.

**PURPOSE:** To evaluate a novel measure of vestibular and oculomotor function after sub-acute concussion in an immersive testing environment.

**METHODS:** 26 participants (age: 17.6 ± 4.8 years) presenting with dizziness or imbalance after concussion (32.9 ± 37.2 days post injury, range: 1-156 days) and 100 controls (age: 17.03 ± 3.8 years) were tested in this study. Participants visually tracked a target moving on a 180° arc trajectory toward an optical goal in an immersive visual environment. 10 trials of four conditions were performed including combinations of target speed and visibility (slow-visible, fast-visible, slow-invisible, fast-invisible). During the invisible condition the target disappeared after 60° of arc and the participant predicted when the target would arrive at the optical goal. The angle difference, or error, between the stopped target and the goal was recorded for each trial. A one-way ANOVA was performed for each condition to compare the concussed and control groups.

**RESULTS:** Concussed participants demonstrated increased mean error during the visible-fast (concussed: 5.9 ± 3.9, controls: 4.5 ± 3.7; p<0.01) and invisible-fast (concussed: 16.6 ± 9.8, controls: 14.3 ± 10.3; p<0.05) conditions compared to controls. There were no detectable performance differences tracking slow targets.

**CONCLUSION:** The combination of fast visual target tracking and time estimation may be a suitable measure to assess vestibular and oculomotor dysfunction following concussion. The current findings support the inclusion of vestibular and oculomotor testing presented in a virtual reality or immersive technology format in the assessment of concussion.

This project was supported by the Head Health Challenge II (sponsored by Under Armour, Inc, the National Football League, and General Electric Institution) and the US Army Medical Research Acquisition Activity #W81XWH-12-C-0203

2268 Board #8 June 2, 3:15 PM - 5:15 PM  
**Reliability of Computerized Neurocognitive Tests for Concussion Assessment: A Meta-Analysis**

James L. Farnsworth, II<sup>1</sup>, Lucas Dargo<sup>2</sup>, Brian G. Ragan<sup>1</sup>, Minsoo Kang, FACSM<sup>1</sup>. <sup>1</sup>*Middle Tennessee State University, Murfreesboro, TN.* <sup>2</sup>*Mount Vernon High School, Mount Vernon, IN.* (Sponsor: Minsoo Kang, FACSM)  
 Email: jlf6g@mtmail.mtsu.edu  
*(No relationships reported)*

Multiple review articles have criticized computerized neurocognitive tests (CNTs) for their poor reliability. However, critics argue that empirical quality of these reports was low and that low reliability was more likely the result of inappropriate study designs. The controversy currently remains unresolved. **PURPOSE:** To analyze reliability data for CNTs using meta-analysis and examine factors that may influence reliability of CNT scores.

**METHODS:** A systematic literature search (key terms: reliability, CNT, concussion) was conducted of electronic databases (Medline/PubMed, Google Scholar, and SportDiscus) to identify relevant studies. Studies were included if they met all of the following criteria: test-retest design; at least one CNT; sufficient statistical data to allow for effect size (ES) calculation; and published in English. Each article was investigated by two independent reviewers to assess inclusion status. A total of 18 studies involving 2,250 participants were retained. Intra-class correlation coefficients were extracted to calculate ES and determine the overall reliability of the outcome measures for each CNT (ImPACT, ANAM, Headminder, CogSport, and CNSVS). Fisher's Z-transformation was used to adjust for sampling error associated with averaging correlations. Moderator analyses were conducted to evaluate the effects of test-retest interval, CNT selection, and number of CNTs administered serially on reliability coefficients for each CNT outcome. Heterogeneity was evaluated using Cochran's Q statistic.

**RESULTS:** Overall, adjusted reliability coefficients for CNT outcomes ranged from low to moderate (0.44 - 0.76). Processing speed was the most reliable outcome (0.76), though it still failed to meet the threshold for acceptable reliability for psychomotor

measures (>.80). Moderator analyses indicated that reliability for simple reaction time was significantly different depending on the CNT selected ( $Q=12.355$ ,  $p=.006$ ). No other significant differences were found.

**CONCLUSIONS:** Clinicians should exercise caution when using CNTs because of the low reliability associated with some outcomes, which could lead to incorrect clinical decisions. Additional research is needed to investigate methods for improving CNT reliability.

## D-62 Thematic Poster - Firefighting

Thursday, June 2, 2016, 3:15 PM - 5:15 PM  
Room: 104

2269 **Chair:** Denise L. Smith, FACSM. *Skidmore College, Saratoga Springs, NY.*

(No relationships reported)

2270 Board #1 June 2, 3:15 PM - 5:15 PM

### The Effects of Exercise-Induced Heat Stress on Cognitive Function Assessed Using Serious Game Technology.

F. Michael Williams-Bell<sup>1</sup>, Steven R. Passmore<sup>2</sup>, Tom M. McLellan<sup>1</sup>, Bernadette A. Murphy<sup>1</sup>. <sup>1</sup>University of Ontario Institute of Technology, Oshawa, ON, Canada. <sup>2</sup>University of Manitoba, Winnipeg, MB, Canada.

Email: michael.williams-bell@uoit.ca

(No relationships reported)

Firefighting requires adequate cognition under heat stress to accurately make decisions, remain vigilant, and remember important locations within the fire scene. With emerging advancements in game technology, occupations such as the fire service have the potential to provide assessment and training tools using game-based simulations.

**PURPOSE:** The purpose of this study was to assess aspects of cognitive function while exposed to exercise-induced heat stress using a serious game that simulates the task-level activities of an individual firefighter. **METHODS:** Ten male firefighters (height:  $177.9 \pm 1.7$  cm, body mass:  $89.8 \pm 2.3$  kg, percent body fat:  $17.8 \pm 1.6\%$ ,  $VO_{2peak}$ :  $44.5 \pm 2.0$  ml kg<sup>-1</sup> min<sup>-1</sup>) with a mean age of  $39.4 \pm 3.0$  years and  $15.3 \pm 1.8$  years of service participated in the study. Core temperature, skin temperature, and heart rate were continuously monitored and 5 mL kg<sup>-1</sup> of water was ingested throughout the protocol. Firefighters walked on a motorized treadmill at 4.5 km h<sup>-1</sup> and 2.5% grade, in a climate chamber controlled at 35 °C and 50% relative humidity for  $74.4 \pm 5.0$  min. Cognitive function was tested using the Firefighter Task-Level serious game (FFTL), a computerized simulation of a two-story residential house fire. The FFTL was designed to incorporate 5 scenes in order to have participants complete them at differing levels of  $T_{core}$ : i) scene 1 (cog 1, initial  $T_{core}$ ), ii) scene 2 (cog 2, 37.9°C), iii) scene 3 (cog 3, 38.2°C), iv) scene 4 (cog 4, 38.5°C), and v) scene 5 (cog 5, 37.8°C) following active cooling recovery. **RESULTS:** Post-hoc analyses indicated that the time to search the 2 rooms at cog 4 ( $61.1 \pm 4.6$  s) was significantly longer than room 3 ( $35.0 \pm 5.4$  s) at cog 3 but not different than room 1 or 2. Cog 5 showed a significant decrease in memory recall relative to cog 1 ( $-19.8 \pm 6.4\%$ ). **CONCLUSIONS:** This study revealed that performance was not impaired during an exercise-induced heat stress protocol assessed using a serious game but room search time was prolonged at 38.5°C (cog 4). However, following an active cooling recovery regimen, memory recall was impaired compared to initial performance. The presence of long-term memory impairments may be troubling for subsequent incidents or during fire scene investigation following the emergency.

This research was supported by the Workers Compensation Board of Manitoba.

2271 Board #2 June 2, 3:15 PM - 5:15 PM

### Physical Fitness and Heart Rate During Exercise Testing as Predictors of Cardiac Autonomic Impairment among Firefighters

Luiz Guilherme G. Porto<sup>1</sup>, Maria Korre<sup>2</sup>, Steven Moffatt<sup>3</sup>, Stefanos N. Kales<sup>2</sup>. <sup>1</sup>Harvard T. H. Chan School of Public Health - Visiting Scientist supported by the CNPq - Conselho Nacional de Desenvolvimento Científico e Tecnológico (scholarship number: PDE 207136/2014.9) and University of Brasilia - Brazil; Boston, MA. <sup>2</sup>Harvard T. H. Chan School of Public Health and Cambridge Health Alliance, Harvard Medical School, Boston, MA. <sup>3</sup>Public Safety Medical, Indianapolis, IN. Email: lgpporto@hsph.harvard.edu

(No relationships reported)

Cardiac autonomic impairment (CAI) as characterized by a sympathetic hyperactivity and/or a reduced parasympathetic activity is associated with sudden cardiac death.

**PURPOSE:** To estimate CAI prevalence among firefighters and its association with physical fitness and heart rate (HR) profile using exercise testing. **METHODS:** We performed a cross-sectional study within a large fire department, applying a weighted sampling strategy, selecting randomly 100 participants from the eligible population; 75 at low cardiovascular risk and 25 at high risk. Inclusion criteria were: male with a recorded submaximal Bruce-treadmill test and no restrictions on duty. CAI was defined as at least one of the following: failure to achieve 75% of age-predicted maximum HR; HR recovery (HRR) <18bpm at the 1<sup>st</sup> or <42bpm at the 2<sup>nd</sup> min of the recovery period; autonomic index (resting HR/HRR)  $\geq 3^{\text{rd}}$  tertile value at 1<sup>st</sup> and 2<sup>nd</sup> min of recovery and max blood pressure  $\geq 220/90$  mmHg. 30 participants were excluded due to incomplete data. Crude associations were estimated by the odds ratio (OR-95%CI) and the multivariate analysis was assessed by logistic regression. Mann-Whitney test was used when applicable, at the 5% level of significance. **RESULTS:** FF were  $46.5 \pm 8.3$  yrs and BMI =  $31.1 \pm 4.7$  kg/m<sup>2</sup>. Prevalence estimates were 50.7% for CAI and 55.4% for obesity. Analyses are shown on Table 1.

Table 1: Cardiac autonomic function (CAF) analyses (n=370)

| Variables                              | Impaired CAF<br>n (%)                | Normal CAF<br>n (%) | Crude-OR<br>(CI 95%) | Adjusted-OR<br>(CI 95%) |
|--|--------------------------------------|---------------------|----------------------|-------------------------|
| <b>BMI (&gt;30.0 kg/m<sup>2</sup>)</b> |                                      |                     |                      |                         |
| <b>Obese</b>                           | 122 (65.6)                           | 80 (44.2)           | 2.47 (1.58-3.67)     | 1.64 (1.00 - 2.69)      |
| <b>Non-obese</b>                       | 64 (34.4)                            | 101 (55.8)          |                      |                         |
| <b>Age (years)</b>                     |                                      |                     |                      |                         |
| <b>≥ 40</b>                            | 154 (82.8)                           | 130 (71.8)          | 1.89 (1.15 - 3.11)   | 1.06 (0.57 - 1.98)      |
| <b>&lt; 40</b>                         | 32 (17.2)                            | 51 (28.2)           |                      |                         |
| <b>CRF</b>                             |                                      |                     |                      |                         |
| <b>Low</b>                             | 110 (59.1)                           | 62 (34.3)           | 2.78 (1.82 - 4.25)   | 2.18 (1.30 - 3.65)      |
| <b>High</b>                            | 76 (40.9)                            | 119 (65.7)          |                      |                         |
|  | <b>Median (percentile 25% - 75%)</b> |                     | <b>#p-value</b>      |                         |
| <b>Push-ups (repetitions)</b>          | 20 (12 - 28)                         | 25 (17 - 31)        | 0.001                | 0.98 (0.95 - 1.00)      |
| <b>Max_HR (bpm)</b>                    | 156 (150 - 163)                      | 158 (152 - 165)     | 0.09                 | 1.00 (0.98 - 1.02)      |

CRF: cardiorespiratory fitness; Max\_HR: max HR at exercise testing; #: Mann-Whitney test

**CONCLUSION:** The odds of having CAI were higher in obese FF and among those with lower CRF and weaker upper-limb strength. Lower CRF was the strongest predictor of CAI. Our data support the need for better physical fitness among firefighters.

2272 Board #3 June 2, 3:15 PM - 5:15 PM

### The Effect Of Work-to-rest Ratios On Cardiovascular, Thermal, And Perceptual Responses During Fire Suppression

David Hostler, FACSM, Deanna Colburn, Lindsey Russo.

University at Buffalo, BUFFALO, NY.

Email: dhostler@buffalo.edu

(No relationships reported)

**PURPOSE:** Fire suppression is physically demanding and often results in significant heat stress and hypohydration. Guidelines for the number of work intervals allowed before a structured recovery were consensus derived and have not been tested.

**METHODS:** Firefighters were randomly assigned to complete either two or three intervals of live fire training separated by short rest breaks before entering a 20 minute structured recovery period. Immediately following recovery, the firefighters were timed on a short, high intensity circuit of firefighting skills. The shorter work duration (SWD) group completed two work intervals: one period of firefighting and one period of chopping through a simulated roof. The longer duration group (LWD) completed three work intervals: two periods of firefighting followed by one period of roof chopping.

**RESULTS:** 42 firefighters completed the study. Total work was longer in the LWD compared to the SWD group ( $27.2 \pm 1.0$  vs.  $20.1 \pm 0.4$  min,  $p < 0.001$ ). During the roof chopping station, the LWD group reached fatigue and exited that bout before the SWD group ( $8.3 \pm 1.1$  vs.  $11.5 \pm 1.0$  min,  $p=0.04$ ). Time to complete the skills test after recovery was longer in the LWD group. Heart rate was near maximal immediately after fire suppression. There was a strong effect of time on heart rate ( $p < 0.001$ ) but the heart rate responses did not differ by group. Core temperature increased during the work periods and peaked when subjects entered the recovery phase ( $p < 0.001$ ). Core temperature was higher in LWD at the beginning of the recovery phase. Blood pressure and rate pressure product all changed over time ( $p < 0.001$ ) but did not differ by group. There was a modest decrease in systolic blood pressure and a marked decrease in

diastolic blood pressure in the recovery phase. Sweating sensation, thermal comfort, and thermal sensation were 75-80% of maximum when entering the recovery period in both groups.

**CONCLUSIONS:** Increasing the number of work intervals from two to three, before structured recovery, increases core body temperature and reduces subsequent performance but does not alter heart rate and blood pressure responses. Additional studies are required to determine the interaction of firefighter fitness and work to rest ratios and on the long-term recovery following fire suppression.

2273 Board #4 June 2, 3:15 PM - 5:15 PM  
**Extracellular Heat Shock Protein Responses Following 5- And 10-days Of Heat Acclimatisation In Fire-fighting Trainees**

Wee Hon Ang<sup>1</sup>, Chin Nam Mui<sup>2</sup>, Nazri Bin Isa Muhammad<sup>2</sup>, Ivan Cherh Chiet Low<sup>2</sup>, Janice Hui Hong Oh<sup>3</sup>, Jason Kai Wei Lee, FACSM<sup>1</sup>. <sup>1</sup>DSO National Laboratories, Singapore, Singapore. <sup>2</sup>National University of Singapore, Singapore, Singapore. <sup>3</sup>Singapore Civil Defence Force, Singapore, Singapore. (Sponsor: Jason Kai Wei Lee, FACSM)  
 Email: aweehon@dso.org.sg  
 (No relationships reported)

Heat shock proteins (HSP) are a group of proteins that serves to protect cellular integrity during exposure to heat stress. **PURPOSE:** To assess extracellular HSP (eHSP) responses following 5- and 10-days of heat acclimatisation to compare the degree of adaptation at cellular level. **METHODS:** Thirty fire-fighting trainees were randomly divided into two evenly match groups to undergo 10-days of low-intensity heat acclimatisation (HA) or 5-days of moderate-intensity accelerated HA (AHA). Both HA and AHA sessions were conducted outdoor in a warm and humid climate (dry bulb temperature: 27.9±1.1°C, relative humidity: 73±6%, WBGT: 27.2±1.3°C). Heat Stress Tests (HSTs) were done before and after the HA/AHA programmes, which comprised of a 9 min treadmill walk followed by a time trial inside an enclosed heated maze. Blood samples were taken at baseline and end of each HST to analyse for serum eHSP27 and eHSP72 concentrations. **RESULTS:** Participants showed 23±11% (p<0.001) and 26±9% (p<0.001) improvement in time trial performance following the AHA and HA programmes respectively. No differences in baseline body core temperature and heart rate were observed following both programmes (p>0.05 for all). Nonetheless, sweat rates during HST were increased following the AHA (Pre-AHA: 1.88±0.57 L/h; Post-AHA: 2.11±0.59 L/h; p=0.01) and HA (Pre-HA: 1.41±0.52 L/h; Post-HA: 1.63±0.61 L/h; p=0.01) programmes. Baseline eHSP 27 was reduced by 0.7±0.2 fold (p<0.001) following AHA but was similar after HA (p=0.30). Baseline eHSP 72 remained unchanged following the AHA and HA programmes (p>0.05 for both). Both eHSP27 and eHSP72 increased in response to HSTs before (eHSP27: 1.3±0.4 fold; eHSP72: 1.4±0.5 fold) and after (eHSP27: 1.7±0.7 fold; eHSP72: 1.4±0.4 fold) the AHA programme (p<0.05 for all). In contrast, only eHSP72 increased in response to HSTs before (1.3±0.4 fold; p=0.02) and after (1.2±0.3 fold; p=0.01) the HA programme. **CONCLUSION:** An AHA programme induces similar physiological and cellular heat adaptations as compared to a HA programme, which validated the effectiveness of an accelerated HA programme for fire-fighters. In addition, changes in baseline eHSP27 concentration showed potential as an indicator for improved cellular heat adaptation.

2274 Board #5 June 2, 3:15 PM - 5:15 PM  
**Effects of a 12-hour Work Period on the Cardiac Autonomic Function in Physically Active Firefighters**

Rosenkranz M. Nogueira<sup>1</sup>, Guilherme E. Molina<sup>2</sup>, Keila E. Fontana<sup>2</sup>, Luiz Fernando Junqueira Jr<sup>3</sup>, Luiz Guilherme G. Porto<sup>4</sup>. <sup>1</sup>University of Brasilia - Faculty of Physical Education and Brasilia Firefighter Brigade (CBMDF), BRASILIA, Brazil. <sup>2</sup>University of Brasilia - Faculty of Physical Education, BRASILIA, Brazil. <sup>3</sup>University of Brasilia Faculty of Medicine, BRASILIA, Brazil. <sup>4</sup>Harvard T. H. Chan School of Public Health - Visiting Scientist supported by the CNPq - Conselho Nacional de Desenvolvimento Cientifico e Tecnologico (scholarship number:PDE 207136/2014.9) and University of Brasilia - Brazil; Boston, MA.  
 Email: majbmmacieli@ig.com.br  
 (No relationships reported)

Firefighting is a hazardous profession that requires intermittent cardiac autonomic function (CAF) adjustments. Firefighters have high on-duty mortality that might be related to CAF impairment and low cardiorespiratory fitness. **PURPOSE:** We aimed to evaluate firefighters' CAF and physical activity (PA) during a 12-hour work period. **METHODS:** We evaluated 10 military male firefighters, aged 41±3.5 yrs, with BMI = 28.8 kg/m<sup>2</sup>, recruited from a Brazilian Fire Department. CAF was assessed by 2 temporal heart rate variability indices: PNN50% and rMSSD, accepted as

parasympathetic markers. CAF was evaluated in a basal condition on a free-work day (Eva1) and before (Eva2) and after (Eva3) a 12-hour period of work, at resting supine (SUP) and orthostatic (ORT) postures. PA was objectively assessed by pedometer in the same work day. We compared CAF between SUP and ORT conditions (Wilcoxon test) and between the 3 CAF evaluations (Friedman test), at 5% level of significance. **Results:** The median (25%-75% percentiles) steps/day was 11752 (6711-12377) steps. 70% of the participants achieved the recommended steps/day (10,000) during an usual work day. CAF values and analyses are shown on Table 1.

**Table 1: Comparison of temporal heart rate variability indices at supine (SUP) and orthostatic posture (ORT) at control condition (Eva1), before work (Eva2) and after 12 hours of rotine work (Eva3) (n=10)**

|                | SUP                | ORT               | Rel_Var (ORT-SUP)      | p*   |
|----------------|--------------------|-------------------|------------------------|------|
| PNN50%_iRR (%) |                    |                   |                        |      |
| Eva1           | 17,9 (0,8 / 54,0)  | 2,9 (0,0 / 31,5)  | -56,2 (-62,5 / 100,0)  | 0,02 |
| Eva2           | 6,6 (2,4 / 53,6)   | 2,2 (0,0 / 13,8)  | -85,0 (-93,1 / 100,0)  | 0,05 |
| Eva3           | 6,1 (0,0 / 61,4)   | 1,1 (0,0 / 60,3)  | -90,0 (-100,0 / 228,6) | 0,43 |
| # p            | 0,32               | 0,6               | 0,97                   |      |
| RMSSD_iRR (ms) |                    |                   |                        |      |
| Eva1           | 38,1 (16,7 / 86,6) | 21,6 (5,3 / 59,5) | -35,8 (-80,7 / 17,1)   | 0,01 |
| Eva2           | 28,2 (24,7 / 89,3) | 22,1 (5,9 / 42,5) | -48,7 (-79,1 / 49,5)   | 0,03 |
| Eva3           | 25,2 (5,9 / 83,9)  | 18,2 (3,0 / 71,3) | -46,1 (-68,1 / 49,5)   | 0,16 |
| # p            | 0,09               | 0,6               | 0,83                   |      |

\*: Wilcoxon test; # Friedman test; Rel\_Var: relative variation  
**CONCLUSION:** An usual 12-hour work period was physically active for most of the firefighters but associated with a significant reduction in the parasympathetic response to active standing, what might represent an increased cardiovascular risk. Supported by CNPq grant Universal 480092/2013.3

**D-63 Thematic Poster - Hormone Responses and Physical Activity**

Thursday, June 2, 2016, 3:15 PM - 5:15 PM  
 Room: 109

2275 **Chair:** Laurie Wideman. University of North Carolina-Greensboro, Greensboro, NC.

(No relationships reported)

2276 Board #1 June 2, 3:15 PM - 5:15 PM

**Microdialysis-Assessed Exercised Muscle Reveals Localized And Differential IGF1P Responses To Unilateral Stretch Shortening Exercise Until Exhaustion**

Bradley C. Nindl, FACSM<sup>1</sup>, Juha Ahtianen<sup>2</sup>, Sheila S. Gagnon<sup>3</sup>, Ritva S. Taipale<sup>4</sup>, Joseph R. Pierce<sup>5</sup>, Maarit Lehti<sup>4</sup>, Keijo Hakkinen<sup>4</sup>, Heikki Kyrolainen, FACSM<sup>4</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>University of Jyväskylä, Jyväskylä, PA. <sup>3</sup>University of Jyväskylä, Jyväskylä, Finland. <sup>4</sup>University of Jyväskylä, Jyväskylä, Finland. <sup>5</sup>US Army Research Institute of Environmental Medicine, Natick, MA.  
 Email: bnindl@pitt.edu  
 (No relationships reported)

Microdialysis allows for a preview into local muscle metabolism and can provide physiological insight that blood measurements cannot. **PURPOSE:** To examine the potential differential IGF-1 system regulation during unilateral stretch shortening exercise. **METHODS:** 10 men (26±7 yr) performed unilateral jumping [stretch shortening cycle (SSC) exercise at 50% of optimal jump height] until volitional fatigue on a sled apparatus. Biological sampling took place using a catheter inserted into an antecubital vein (serum), and 100 kDa microdialysis probes inserted into the thigh muscle of each exercise/control leg (dialysate). Serum was drawn before (Pre; -3 h) and after SSC [Post I (+0 h), II (+3 h), or III (+20 h)]; dialysate was sampled for 2 h before (Pre), during/immediately after (Ex), and 2 h into recovery (Rec) following SSC. IGF-1 system parameters (free and total IGF-1 and IGF1Ps 1-6) were measured with immunoassays. Interstitial free IGF-1 was estimated from dialysate IGF-1 and relative recovery (ethanol) correction. Data were analyzed with repeated measures ANOVA. **RESULTS:** Serum total IGF-1 remained elevated +3 h (Post II: 182.8 ± 37.6 vs. Pre: 168.3 ± 35.0 ng/mL, p<0.01), but returned to baseline by +20 h (Post III vs. Pre, P=0.31). No changes in serum free IGF-1 were noted. Serum BP-1 and -3 increased over baseline, but not until +20 h after SSC (Post III vs. Pre: 7.6 ± 4.9 vs. 3.7 ± 2.3 and 1048.6 ± 269.2 vs. 891.4 ± 171.2 ng/mL, respectively). Serum BP-6 decreased +3 h after SSC (p.05). Dialysate BP-1 increased in both exercise

and control legs through 2 h into recovery (Rec vs. Pre,  $p < 0.01$ ). Dialysate BP-3 also demonstrated an elevation over Pre SSC concentrations, but in the exercise leg only (Ex and Rec vs. Pre,  $p < 0.04$ ). Dialysate BP-5 decreases in the exercise leg only (Ex and Rec vs. Pre,  $p < 0.03$ ). There were no changes relative to Pre SSC in dialysate BP-2, -4, or -6. **CONCLUSIONS:** Unilateral exercise drives differential regulation of the IGF-I system at both local and systemic levels. Specifically, localized exercise increased IGFBP-3 and decreased IGFBP-5 in muscle. The views, opinions and/or findings contained herein are those of the authors and should not be construed as an official Department of the Army position, or policy.

2277 Board #2 June 2, 3:15 PM - 5:15 PM  
**Comparing Bioactive And Immunoassay-Based Measurements Of The Growth Hormone Response To Short-Term Resistance Training At Three Intensity Levels**

Shawn D. Flanagan<sup>1</sup>, Tunde K. Szivak<sup>1</sup>, William H. DuPont<sup>1</sup>, Lydia K. Caldwell<sup>1</sup>, Emily C. Barnhart<sup>1</sup>, Emily C. Borden<sup>1</sup>, Catherine Saenz<sup>1</sup>, Robert S. Staron<sup>2</sup>, Wesley C. Hymer<sup>3</sup>, Bradley C. Nindl, FACSM<sup>4</sup>, William J. Kraemer, FACSM<sup>1</sup>. <sup>1</sup>The Ohio State University, Columbus, OH. <sup>2</sup>Ohio University, Athens, OH. <sup>3</sup>The Pennsylvania State University, University Park, PA. <sup>4</sup>University of Pittsburgh, Pittsburgh, PA. (Sponsor: William J. Kraemer, FACSM)  
 Email: flanagan.178@osu.edu  
 (No relationships reported)

Growth hormone (GH) plays an important regulatory role in metabolic homeostasis. However, since GH represents a hormonal super family, numerous assay techniques have been developed to target specific variants, aggregates, and complexes.

**PURPOSE:** To examine changes in the resistance exercise-induced growth hormone response as measured by immunoassay and bioassay after short-term resistance training using different intensity levels. **METHODS:** Thirty-two untrained men (22.5±5.8 yr; 178.3±7.2cm height; 77.8 ±11.9kg weight) were placed into one of four groups, including three eight-week progressive resistance-training interventions and a control condition. Subjects in the training groups performed three exercises (leg press, squat, and knee extension) two days per week for the first four weeks, and three days per week for the remaining four weeks. The programs varied in intensity and rest period length, but were equated in terms of volume and exercise order. Nine subjects performed heavy exercise (3-5 repetition maximum (RM)) for four sets with three min of rest between sets. Eleven subjects performed moderately heavy resistance exercise (9-11RM) for three sets with two min of rest between sets. Seven subjects performed light resistance exercise (20-28RM) for two sets with one min of rest between sets. At the first and last exercise session, blood samples were obtained at rest and immediately after exercise. Serum GH was measured using a Nichols monoclonal radioimmunoassay (RIA), and bioactive GH was measured using a rat lymphoma cell line Nb-2 bioassay. **RESULTS:** **CONCLUSIONS:** A short eight-week training program produced few adaptations in the pattern of GH responses at rest or immediately after a workout. Both assay techniques detected a greater increase in GH after higher repetition training protocols, and the Nb-2 assay detected an order of magnitude more GH compared to the standard monoclonal RIA. Ostensibly, because hypertrophy was only associated with the use of heavy and intermediate loads, the signals arising from GH in the light resistance group were not directed at skeletal muscle protein synthesis, but other metabolic processes.

2278 Board #3 June 2, 3:15 PM - 5:15 PM  
**Hormonal Status As Determinant Of Serum Exosomal MicroRNA Content In Pre- And Postmenopausal Women**

Reeta Kangas<sup>1</sup>, Vidal Fey<sup>2</sup>, Juha Pursiheimo<sup>3</sup>, Markku Alen<sup>4</sup>, Jaakko Kaprio<sup>5</sup>, Sarianna Sipilä<sup>1</sup>, Anna-Marja Sämannen<sup>2</sup>, Vuokko Kovanen<sup>1</sup>, Eija Pöllänen<sup>1</sup>. <sup>1</sup>Gerontology Research Center, University of Jyväskylä, Jyväskylä, Finland. <sup>2</sup>Institute of Biomedicine, University of Turku, Turku, Finland. <sup>3</sup>Turku Clinical Sequencing Laboratory, University of Turku, Turku, Finland. <sup>4</sup>Oulu University Hospital, University of Oulu, Oulu, Finland. <sup>5</sup>National Institute for Health and Welfare / Institute for Molecular Medicine FIMM, University of Helsinki, Helsinki, Finland.  
 Email: reeta.m.s.kangas@jyu.fi  
 (No relationships reported)

**Purpose:** This study investigates the effect of systemic sex steroid status on microRNA content of circulating exosomes (exomiRs) among adult women who differ in menopausal status and use of hormone replacement therapy. Exosomes are small vesicles secreted from various cell types. They function in the intercellular communication as carriers for genetic material, such as mRNAs and microRNAs. We

have previously shown that there are specific freely circulating microRNAs which are sensitive for systemic sex steroid status. Therefore, we hypothesized that also the systemic exomiR content might vary according to the circulating estrogen levels.

**Methods:** We analysed the exomiR content from serum samples of premenopausal women (n=8, 30-40 yrs) and from genetically identical postmenopausal female twin pairs (n=10 pairs, 54-62 yrs) discordant for the use of estrogen based hormone replacement therapy (HRT). Serum exosomes were extracted with precipitation solution followed by RNA extraction by Trisure reagent. Library preparation was performed by TruSeq Small RNA sample preparation protocol (Illumina) and microRNAs were sequenced by MiSeq Desktop Sequencer (Illumina). Data analysis was performed using a customized work-flow including miRDeep2 for microRNA identification and the edgeR R-package for identification of differentially expressed (DE) exomiRs.

**Results:** In total, 241 different exomiRs were detected on the basis of sequencing. The most commonly expressed exomiRs included mir-486-5p, -92a-3p, -16-5p, -451a and -22-3p. In the DE analysis 11 miRs were up- and 20 miRs downregulated significantly in HRT non-users when comparing them to premenopausal women (nominal  $p < .05$ ). DE between the postmenopausal HRT users and premenopausal women showed that 6 miRs were up- and 10 downregulated in HRT users (nominal  $p < .05$ ). DE between the HRT non-user and user co-twins showed that 5 miRs were up- and 6 downregulated in non-users (nominal  $p < .05$ ).

**Conclusions:** Aging- and HRT association with sequenced exomiRs was detected, which warrants further studies, including validation by RT-qPCR, to understand the functional role of exomiRs as potential mediators of hormonal aging process.

**Funding:** The Academy of Finland, Finnish Culture Foundation, The Ministry of Education and Culture and EFCP7 Collaborative project MYOAGE

2279 Board #4 June 2, 3:15 PM - 5:15 PM  
**Effect of High Fat/High Sugar Diet & Physical Activity on Sex Hormone Concentrations**

Jorge Z. Granados<sup>1</sup>, Heather L. Vellers<sup>1</sup>, Ayland C. Letzinger<sup>1</sup>, Nick R. Walker<sup>1</sup>, Madison E. Spier<sup>2</sup>, Isabel Lambert<sup>2</sup>, Robin Fuchs-Young<sup>2</sup>, J. Timothy Lightfoot, FACSM<sup>1</sup>. <sup>1</sup>Texas A&M University, College Station, TX. <sup>2</sup>Texas A&M Health Science Center, College Station, TX. (Sponsor: Dr. J. Timothy Lightfoot, FACSM)  
 Email: j.granados@hlkn.tamu.edu  
 (No relationships reported)

**BACKGROUND:** Physical inactivity in combination with poor nutrition promotes obesity and is the second leading cause of death in the US. It is well known that physical activity (PA) mitigates the incidence of obesity related diseases. Yet, most individuals fail to meet daily recommended PA requirements. Available animal literature suggests that one primary factor that regulates PA is sex hormones.

**PURPOSE:** This study examined the effects of a high fat/high sugar (HF/HS) diet on Testosterone (T) and 17β-Estradiol (E2) concentrations in female mice with and without physical activity.

**METHODS:** All procedures were approved by TAMU IACUC. The offspring of SENCAR breeder pairs (Charles River) were weaned and co-caged at three weeks of age and randomly assigned to a HF/HS diet (45% fat/10% fructose drinking water) (n=6) or ad-lib (AL) control diet (10% fat) (n=4). At four weeks of age, mice were provided with running wheel access. Running speed, distance, and duration were recorded daily until termination at 20wks of age. Serum T and E2 concentrations were analyzed via ELISA. A 2-way ANOVA was utilized to assess significant differences.

**RESULTS:** E2 concentrations in the AL fed mice with- and without-PA (0.30±0.03; 0.26±0.03 ng/ml) and in the HF/HS fed mice with- and without-PA (0.28±0.04; 0.27±0.23 ng/ml), were not affected by diet type, but were significantly affected by PA ( $p = 0.03$ ). T concentrations in the AL fed mice with- and without-PA (0.33±0.01; 0.31±0.34 ng/ml) and in the HF/HS fed mice with- and without-PA (0.46±0.22; 0.21±0.14 ng/ml) demonstrated no significant effect of diet or PA.

**CONCLUSION:** In this study neither T nor E2 concentrations were altered by HF/HS diet. However, PA increased the serum concentrations of E2, but not T. Therefore, physical activity can affect estradiol levels independent of diet.

**ACKNOWLEDGMENTS:** This project was funded by the US Army through the Department of Defense projects W81XWH-13-1-0278 (Fuchs-Young) and W81XWH-13-1-0279 (Lightfoot).

2280 Board #5 June 2, 3:15 PM - 5:15 PM  
**Prolonged Effects of Estrogen on Physical Activity Levels Following Orchidectomy**  
 Nicole L. Stott, Mitchell Abreu, Brittany Cates, Bryce Dillard, Brittany Foster, Myrrhande Haskett, James Lee, Helen Simoes, Thomas Spivey, Robert S. Bowen. *Truett-McConnell College, Cleveland, GA.*  
 Email: nstott@truett.edu  
 (No relationships reported)

The prevalence of several chronic diseases is associated with habitually low physical activity. The biological mechanisms that regulate physical activity patterns appear to be linked to the sex steroids. Elucidation of these regulatory mechanisms may aid in developing therapeutic strategies to enhance individual physical activity patterns. **PURPOSE:** The purpose of this study was to evaluate the prolonged effects of estrogen on physical activity in orchidectomized mice. **METHODS:** The physical activity patterns of C57BL/6j male mice (n=29) were observed beginning at nine weeks of age. Wheel running distance, duration, and speed were assessed under physiological conditions in all animals for seven days. Next, physical activity patterns were evaluated following bilateral orchidectomy (n=15) or sham orchidectomy (n=14) for an additional seven days. Lastly, bilateral orchidectomy treated mice were provided estrogen containing capsules for three weeks. Sham treated mice were provided an estrogen-free control capsule. Wheel running distance, duration, and speed were analyzed by two-way (treatment group x phase of study) analysis of variance. **RESULTS:** Wheel running speed was unaffected by orchidectomy and estrogen treatment. Distance [ $F(1, 4) = 5.91, p = 0.0002$ ] and duration [ $F(1, 4) = 7.73, p = 0.0001$ ] were influenced by orchidectomy and estrogen treatment. Distance (mean±SD: 6.84±2.09 km at baseline) decreased significantly after orchidectomy (2.27±1.55 km) and exhibited very little recovery following one week of estrogen treatment (3.04±1.05 km). Prolonged estrogen exposure, on the other hand, induced a significant and sustained increase in daily distance (4.90±1.79 km). Duration exhibited a similar trend throughout the study (baseline: 251±58 min; post-orchidectomy: 102±53 min; prolonged exposure: 170±63 min). **CONCLUSION:** Wheel running behavior was reduced significantly following orchidectomy and slowly recovered over a prolonged period of time following the reintroduction of estrogen. The estrogenic mechanisms that regulate wheel running behaviors in mice appear to be dependent upon extensive and slow acting or delayed modifications to genes or cellular biomolecules in order to elicit the hormone's effects.

2281 Board #6 June 2, 3:15 PM - 5:15 PM  
**Progressive Resistance Exercise Elicits Significant Brain-Derived Neurotrophic Factor Expression**  
 Jacob A. Goldsmith, Justin M. Quiles, Rocky Blanco, Alex Klemp, Chad Dolan, Arun Maharaj, Chun-Jung Huang, FACSM, Michael Whitehurst, FACSM, Michael C. Zourdos. *Florida Atlantic University, Boca Raton, FL.*  
 (No relationships reported)

Exercise-mediated neuroplasticity occurs via upregulation of neurotrophins. Specifically, the neurotrophin brain-derived neurotrophic factor (BDNF) is particularly reactive to aerobic exercise and promotes cell survival, differentiation, and subsequently enhanced cognition. Despite the neuroprotective benefits of exercise, there is limited data examining the BDNF response to resistance exercise. **PURPOSE:** To examine the effect of progressive resistance exercise on acute changes in peripheral BDNF levels over a 6-week resistance training program and to compare the response between volume-equated high repetition (HR) and low repetition (LR) training programs. **METHODS:** Sixteen males (Age: 23±3yrs, Body Mass: 84.4±12.3kg, Body Fat Percentage: 11.7±4.7%) with at least two yrs. of resistance training experience were counterbalanced by relative strength and assigned to one of two groups, which performed the squat and bench press exercises 3x/wk. for 6 weeks: 1) HR (n=8): 12 repetitions (Mon.), 10 repetitions (Wed.), and 8 repetitions (Fri.) or 2) LR (n=8): 6 repetitions (Mon.), 4 repetitions (Wed.), and 2 repetitions (Fri.). Blood samples were collected 30min. prior to and immediately following the Monday session in both groups (i.e. 12 or 6 repetition day) on weeks 1 and 6. Blood was centrifuged and plasma was separated and stored in aliquots at -80°C until analysis. A 2x2 repeated measures ANOVA was used at each time point to examine the acute BDNF response. Significance was set at  $p \leq 0.05$ . **RESULTS:** There was no difference ( $p > 0.05$ ) in BDNF between groups prior to training at either time point. At week-1 there was no main time effect ( $p > 0.05$ ) for BDNF response (1929.73±287.91 to 1922.68±294.16 pg/mL). However, analysis revealed a significant main time effect ( $p = 0.018$ ) at week-6 demonstrating acute elevation of peripheral BDNF from pre-training (1723.54±244.23pg/mL) to post-training (2087.39±285.31pg/mL; +21.11%); no group differences ( $p > 0.05$ ) were detected. **CONCLUSION:** Our results indicate that progressive resistance exercise utilizing multi-joint compound movements can sufficiently enhance the BDNF response independent of repetition range. The lack of BDNF response in week-1 suggests that an accumulation of training volume may be necessary for resistance training to promote neuroplasticity.

**D-64 Thematic Poster - IMU's- More than Step Counters**  
 Thursday, June 2, 2016, 3:15 PM - 5:15 PM  
 Room: 103

2282 **Chair:** Ajit Mw Chaudhari, FACSM. *The Ohio State University, Columbus, OH.*  
 (No relationships reported)

2283 Board #1 June 2, 3:15 PM - 5:15 PM  
**Wearable Sensors Can Detect Knee Loading Asymmetries: Applications For Clinical Use**  
 Kristamarie A. Pratt, Olivia Panchal, Lindsay E. Kirlin, Rachel S. Christensen, Susan M. Sigward. *University of Southern California, Los Angeles, CA.*  
 Email: kristamp@usc.edu  
 (No relationships reported)

The inability to quantify knee loading deficits without the use of 3D motion capture systems (MoCap) following anterior cruciate ligament reconstruction (ACLR) may contribute to their long term persistence during dynamic tasks. The strong relationship between thigh angular velocity, measured with wearable inertial measurement units (IMU), and knee power absorption, calculated with MoCap, suggests that IMU may be used as a proxy for quantifying knee power absorption deficits clinically. **PURPOSE:** To determine the clinical accuracy of using angular velocities measured with IMUs to detect asymmetrical knee loading during a dynamic single limb loading (SLL) task in individuals following ACLR. **METHODS:** 21 subjects 5.1±1.5 months post-ACLR participated. MoCap and IMU data were collected concurrently during SLL (3 trials). Peak sagittal plane knee power absorption (kPW) was calculated using 3D kinematics (250 Hz), ground reaction forces (1500 Hz) and anthropometrics (inverse dynamics). Peak sagittal plane thigh angular velocity (ThAV) was extracted from IMU gyroscopes (z plane, 128 Hz). Between limb ratios (reconstructed/non-surgical limb) were calculated for kPW and ThAV. Regression analyses were performed to determine the relationship between kPW and ThAV ratios. Sensitivity and specificity of ThAV in diagnosing asymmetrical knee loading, kPW ratio <0.85, was determined using receiver operating characteristic (ROC) curve analysis. Significance  $\alpha < 0.05$ . **RESULTS:** ThAV ratios ( $0.62 \pm 0.29$ ; range 0.21-1.22) were strong predictors of kPW ratios ( $0.73 \pm 0.24$ ; range 0.15-1.25) explaining 66.4% of the variance in kPW ratios ( $R^2 = 0.664$ ;  $p < 0.001$ ). 15 of 21 subjects were categorized as asymmetrical kPW. ROC analysis determined that ThAV ratios can discriminate between asymmetrical and symmetrical kPW (AUC=0.90;  $p = 0.008$ ). ThAV ratios less than 0.811 can classify individuals performing the SLL task with asymmetrical kPW at 81.2% sensitivity and 100% specificity. **CONCLUSIONS:** Between limb ThAV ratios can identify individuals with knee power absorption asymmetries greater than 15% during this SLL task with high sensitivity and specificity. These data support the use of more cost effective wearable IMUs as a clinical surrogate for identification of knee loading deficits following ACLR.

2284 Board #2 June 2, 3:15 PM - 5:15 PM  
**IMU Assessment Of Agility Performance While Wearing An Energy-harvesting Backpack**  
 Meghan P. ODonovan, Jonathan T. Kaplan, Clifford L. Hancock. *Natick Soldier Research Development and Engineering Center, Natick, MA.*  
 Email: meghan.p.odonovan.civ@mail.mil  
 (No relationships reported)

Due to the unique energy requirements of combat Soldiers, the military is investigating the use of energy harvesting technology that uses the kinetic energy of human movement to generate electrical power. The current system under investigation is an oscillating backpack used to carry soldier load and generate electrical power during movement. However, the effects of the system on Soldier performance during dynamic movement tasks are unknown. **PURPOSE:** The purpose of this study was to use Inertial Measurement Units (IMUs) to analyze performance on an agility task while wearing either a standard issue Modular Lightweight Load-carrying Equipment (MOLLE) backpack system or an Energy Harvesting Backpack (EHB) system. **METHODS:** Twelve U.S. Army Soldiers had IMU data recorded during a five-cone agility task with two military-relevant load conditions: a MOLLE condition (53 kg) and an EHB condition (57 kg). Participants performed three maximal effort runs through the agility course for each load condition with a sacrum-mounted IMU. Subject-based means of time to complete the course as well as average pelvic tilt, horizontal speed, angular velocity, and acceleration at the turns were submitted to a

one-way repeated measures ANOVA with alpha level 0.05. **RESULTS:** As shown in Table 1, there was a significant effect of pack condition on time to complete the course, vertical angular velocity, and normal acceleration at the turns. There was no significant effect of pack condition on average horizontal speed, pelvic tilt, or tangential acceleration at the cones.

**Table 1:** Mean (SE) of dependent variables for the agility course task

|   | MOLLE        | EHB           | p-value |
|---|--------------|---------------|---------|
| Time to complete (s)                              | 11.72 (0.11) | 12.00 (0.09)* | 0.002   |
| Speed (horizontal; m·s <sup>-1</sup> )            | 1.49 (0.08)  | 1.49 (0.08)   |         |
| Angular velocity (vertical; deg·s <sup>-1</sup> ) | 1.78 (0.04)  | 1.85 (0.03)*  | 0.014   |
| Acceleration (tangential; m·s <sup>-2</sup> )     | 1.09 (0.15)  | 0.98 (0.11)   |         |
| Acceleration (normal; m·s <sup>-2</sup> )         | 4.64 (0.12)  | 4.345 (0.11)* | 0.009   |
| Tilt (tangential; deg)                            | 18.67 (2.78) | 16.43 (2.46)  |         |
| Tilt (normal; deg)                                | 22.94 (2.29) | 19.57 (1.15)  |         |

**CONCLUSION:** Use of an EHB system significantly decreased several important performance measures of a five-cone agility test.

2285 Board #3 June 2, 3:15 PM - 5:15 PM  
**Validation Of Using A Mobile Application And Ankle-worn Accelerometers To Calculate Stance Time Asymmetry**

Steve Jamison, Irene Davis, FACSM. *Harvard Medical School; Spaulding National Running Center, Cambridge, MA.* (Sponsor: Irene Davis, FACSM)  
 Email: stevetjamison@gmail.com  
 (No relationships reported)

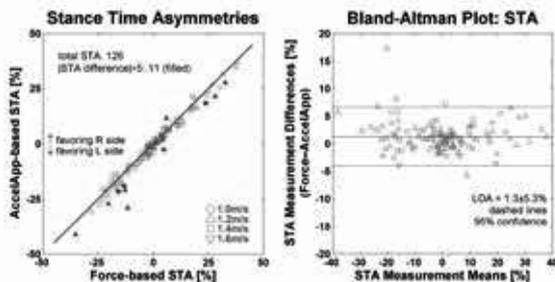
Symmetry of loading during gait has been improved in individuals with amputations and joint replacements using an instrumented treadmill. However, this equipment is not readily available in clinics or at home where training typically occurs. Development of a cheaper, mobile system would allow for clinical adoption of these gait retraining techniques.

**PURPOSE:** To determine the validity of calculating stance time asymmetry (STA) using a mobile application wirelessly connected to ankle-worn accelerometers.

**METHODS:** A healthy male subject (35 yrs) walked on an instrumented treadmill for 30 seconds at 4 different speeds [1 - 1.6m/s] while varying between favoring his right side (RS), favoring his left side (LS), and normal (NL) walking. One 30 second trial of exclusive RS, LS, and NL walking were also collected at 1.2m/s. Accelerometers secured at both distal medial tibias streamed data via Bluetooth (approx. 500 Hz) to a mobile device. In real-time, a custom program on the mobile device calculated STA from the accelerometer data (AccelApp-based STA). Concurrently, treadmill force data (1500Hz) and foot markers were collected and used to calculate STA post-hoc (force-based STA). STA is the percent difference in stance time between successive right and left steps.

**RESULTS:** 126 STAs were compared (Figure 1). STAs showed excellent agreement [Limits of Agreement (LOA): 1.3±5.3% (95% CI)] and were significantly correlated (r<sup>2</sup>=0.96, y=x+0.24%, p<0.0001 for intercept and slope).

**CONCLUSIONS:** Based on this subject, STAs calculated with an ankle based accelerometer and mobile application system hold promise as a valid method to calculate STA. Additional subjects are currently being tested. Supported by BADER Consortium (DoD OR100017).



2286 Board #4 June 2, 3:15 PM - 5:15 PM

**Measuring Fatigue Induced Changes In 3d Trunk Kinematics, Measured By Inertial Magnetic Measurement Units.**

Jasper Reenalda, Erik Maartens. *Roessingh Research and Development, University of Twente, Enschede, Netherlands.* (Sponsor: Brian W Noehren, FACSM)  
 Email: j.reenalda@rrd.nl  
 (No relationships reported)

Trunk Range of Motion (RoM) during running is hypothesized to be related to back and pelvis injuries. Fatigue might increase this trunk motion. Research on 3D trunk motion has been limited to the laboratory but advances in sensor technology now allow for quantification of the 3D trunk ROM outside the lab on the athletic track.

**PURPOSE:** To investigate 3D trunk RoM as a consequence of fatigue at the athletic track

**METHODS:** As part of an ongoing study, five male runners (30.6 +/- 5.6 years, 181.6 +/- 4.0 cm, 69.2 +/- 2.7 kg) performed a fatiguing 20 minute run at Critical Velocity on an athletic track. Two Inertial Magnetic Measurement Units (sampling freq. = 240Hz) were fixed on sternum and sacrum. 3D sternal and sacral orientation was calculated from gyroscope, accelero- and magnetometer IMMU data with respect to a global, static reference frame, constructed from gravity and the Earth's magnetic north. A calibration procedure is used to translate sensor to body orientations. The relative movement between the trunk and pelvic bodies was calculated and expressed in Euler angles. The RoM is defined as the peak-to-peak amplitude of axial rotation, combining the frontal, sagittal and transversal movement, at every stride. At two stages (3 and 18 min.) RoM over 100 strides was calculated and expressed in angles (degrees). An unpaired two-sample t-test was used to analyse the differences in RoM at the two stages on an individual level.

**RESULTS:** 3D trunk RoM increased significantly (p<0.001) in all runners.

**CONCLUSIONS:** Increased trunk RoM was seen towards the end of the fatiguing run. This might increase the risk of back and pelvis injuries as a consequence of repetitive running in the runners natural environment. More subjects are needed to test this hypothesis.

Table 1: 3D trunk RoM [mean +/- SD and p value and confidence interval] for the 5 runners

| Runner # | Mean  |       | SD      |         | P value | Confidence interval low | Confidence interval high |
|----------|-------|-------|---------|---------|---------|-------------------------|--------------------------|
|          | RoM   | RoM   | Phase 1 | Phase 2 |         |                         |                          |
| 1        | 35.38 | 38.72 | 1.6     | 1.99    | <0.001  | -3.85                   | -2.84                    |
| 2        | 36.23 | 33.31 | 1.83    | 2.38    | <0.001  | -3.68                   | -2.49                    |
| 3        | 22.95 | 24.4  | 1.86    | 1.78    | <0.001  | -1.94                   | -0.58                    |
| 4        | 33.05 | 35.63 | 1.43    | 1.45    | <0.001  | -2.99                   | -2.18                    |
| 5        | 33.97 | 35.77 | 1.58    | 1.18    | <0.001  | -1.63                   | -0.98                    |

2287 Board #5 June 2, 3:15 PM - 5:15 PM

**Evaluation Of Smartphone-Based Assessment System In Chronic Ankle Instability**

Ya-Lan Chiu<sup>1</sup>, Ching-I Chang<sup>2</sup>, Chueh-Ho Lin<sup>3</sup>, Wen-Hsu Sung<sup>1</sup>. *<sup>1</sup>National Yang-Ming University, Taipei, Taiwan. <sup>2</sup>National Taiwan University Hospital, Taipei, Taiwan. <sup>3</sup>Taipei Medical University, Taipei, Taiwan.*  
 Email: skywing0527@hotmail.com  
 (No relationships reported)

Ankle sprains are the most common sports-related injury. About 80% subjects suffer recurrent sprains. Repeated injuries may cause chronic ankle instability, which will affect sports efficacy and postural control ability. In recent years, smartphones had become very popular and powerful devices, and been showed to have good validity on measuring range of motion and assessing gait patterns.

The purpose of this study is to evaluate the feasibility of smartphone-based system in postural control ability assessment on chronic ankle instability.

**Methods:** Fifteen subjects (6 male, 9 female; age=23.4±5.28 y/o) who have at least one leg scoring lower than 27 points in Cumberland Ankle Instability Tool were recruited. ASUS Zenfone 2 smartphone was used to conduct the postural control assessment, by recording its built-in accelerometer data with an App developed using MIT App inventor. Subjects performed single leg stance for 20 seconds in eyes-open and eyes-closed conditions with each leg. The smartphone was fixed on the middle of shin with an exercise armband. The average of recorded acceleration data was used to represent the postural control performance, and the higher value indicated more instability. Data was analyzed with paired t-test with SPSS 17.0, and statistical significance was set as alpha < 0.05.

Results: Significant difference was found between sound leg and injured leg under both eyes-open and eyes-closed conditions (eyes-open: sound leg  $0.051\pm 0.018$  vs injured leg  $0.072\pm 0.034$ ,  $p=0.027$ ; eyes-closed: sound leg  $0.100\pm 0.031$  vs injured leg  $0.123\pm 0.038$ ,  $p=0.001$ , unit: g). Significant difference was also found between eyes-open and eyes-closed conditions under both single leg standing with sound leg and injured leg (sound leg: eyes-open  $0.051\pm 0.018$  vs eyes-closed  $0.100\pm 0.031$ ,  $p<0.001$ ; injured leg: eyes-open  $0.072\pm 0.034$  vs eyes-closed  $0.123\pm 0.038$ ,  $p=0.001$ , unit: g). The results demonstrate that the smartphone can be used to discriminate the different performance between sound leg and injured leg, and also between eyes-open and eyes-closed conditions.

Conclusion: The study shows that smartphone may have the potential to be a convenient, easy-used and valid tool for assessment of postural control ability on chronic ankle instability.

2288 Board #6 June 2, 3:15 PM - 5:15 PM  
**Associations Between Vertical Ground Reaction Forces and Trunk-Mounted Accelerometry During a Jump-Landing**

Laura E. Stanley, Barnett S. Frank, Darin A. Padua. *The University of North Carolina at Chapel Hill, Chapel Hill, NC.* (Sponsor: Claudio Battaglini, PhD, FACSM)  
 Email: lstanley@unc.edu  
 (No relationships reported)

Higher landing forces are predictive of lower extremity injury. Traditional biomechanical analyses use ground reaction forces to quantify magnitudes of lower extremity joint loading. However, these traditional analyses are resource-intensive and restricted to laboratory environments. Today's micro-sensor technology may provide accessible and mobile approaches to quantify variables of biomechanical loads in real-world environments. **PURPOSE:** To determine if there are associations between peak vertical acceleration (vACCL), measured by a trunk-mounted accelerometer (TMA), and peak vertical ground reaction force (vGRF) during a jump-landing task. **METHODS:** A tri-axial TMA was secured and centered proximal to the xiphoid process. Two piezoelectric force plates (1,000 Hz) and a TMA (200 Hz; + up, - down) sampled vertical ground reaction forces (vGRF) and vertical trunk accelerations during a jump-landing task. 59 jump-landing trials from 7 participants (age=22.8±1yr; height=166.3±9.3cm; weight=59.3±6.8kg) were included for analysis. Per TMA manufacturer guidelines,  $1g \approx 2000$  arbitrary units (AU). Associations between raw and normalized TMA-derived and vGRF-derived peak loading magnitude variables were calculated using Pearson Product-Moment coefficients. A vector sum of the left and right vGRF was calculated ( $\sqrt{vGRF_x^2 + vGRF_y^2}$ ) to quantify total-body vGRF for both raw and normalized vGRF data. **RESULTS:** There was a moderate positive correlation between raw peak vACCL and peak vGRF (vACCL:  $8403.37\pm 3596.89$  AU, vGRF:  $1686\pm 465.14$  N;  $r=0.400$ ,  $p<0.05$ ) and a weak positive correlation between normalized peak vACCL and peak vGRF (vACCL:  $14.98.37\pm 5.71$  AU, vGRF:  $2.92\pm 0.78$  N\*kg<sup>-1</sup>;  $r=0.317$ ,  $p<0.05$ ). The vector sum of total-body vGRF was weakly associated with vACCL for both raw (vACCL:  $8403.37\pm 3596.89$  AU, vGRF:  $2175.91\pm 549.35$  N;  $r=0.381$ ,  $p<0.05$ ) and normalized (vACCL:  $14.98.37\pm 5.71$  AU, vGRF:  $3.78\pm 0.94$  N\*kg<sup>-1</sup>;  $r=0.29$ ,  $p<0.05$ ) data, respectively. **CONCLUSION:** Our results indicate that there are moderate associations between peaks in vACCL and vGRF, suggesting that the TMA may be a promising tool to detect vertical joint loading in a real-world environment. Further research should explore associations between asymmetry in side-to-side limb loading and peak vertical acceleration.

2289 Board #7 June 2, 3:15 PM - 5:15 PM  
**Can Thigh and Shank Accelerations Detect Between Limb Deficits during Running after ACL Reconstruction?**

Sarah C. Ebner<sup>1</sup>, Kathryn L. Havens<sup>1</sup>, Kristamarie A. Pratt<sup>1</sup>, Ming-Sheng M. Chan<sup>1</sup>, Paige E. Lin<sup>1</sup>, Daniele P. Nascimento<sup>2</sup>, Susan M. Sigward<sup>1</sup>. <sup>1</sup>University of Southern California, Los Angeles, CA. <sup>2</sup>University of Montana, Missoula, MT.  
 Email: sarahebn@usc.edu  
 (No relationships reported)

**PURPOSE:**

To determine if thigh and shank axial accelerations captured with accelerometers are related to between-limb differences in peak knee power absorption (kPW) during running in subjects following anterior cruciate ligament reconstruction (ACLr).

**METHODS:**

14 individuals (7 females,  $29 \pm 12$  yrs) post-ACLr ( $20.3 \pm 7.1$  wks) ran 15 meters at a self-selected speed during their first month of running. 3-D kinematics (340 Hz), ground reaction forces (1360 Hz), anthropometrics, and inverse dynamics were used to calculate peak sagittal plane knee absorption kPW. Peak positive axial accelerations from inertial measurement units (IMUs; 128 Hz) affixed to lateral thighs (TAA) and shanks (SAA) were identified after heel strike. Differences between limbs (nonsurgical-surgical) were calculated for all variables; (+) difference indicates less

kPW, SAA, and TAA in surgical limb. Pearson correlations were used to determine the relationship between kPW and both SAA and TAA. Stepwise regression was used to determine the best predictors of between limb differences in kPW using between limb differences in TAA and SAA.

**RESULTS:**

Between-limb differences in kPW, SAA, and TAA ranged from -4.6 to 21.8 Nm/kg, -11.8 to 10.3 m/s<sup>2</sup>, and -24.3 to 25.9 m/s<sup>2</sup>, respectively. TAA and SAA were positively correlated with kPW; greater kPW is related to greater TAA and SAA ( $r=0.74$ ,  $p=0.001$  and  $r=0.45$ ,  $p=0.017$ , respectively). Between limb difference in TAA was positively correlated with between limb difference in kPW ( $r=0.65$ ,  $p=0.013$ ) and was the only variable to enter the prediction model explaining 42% of the variance in kPW ( $R^2=0.42$ ,  $p=0.006$ ). Less kPW in surgical limb was related to smaller TAA in the surgical when compared to the non-surgical limb.

**CONCLUSION:**

The relationship between knee power absorption and axial accelerations of both the shank and thigh suggest that they provide information about either the magnitude or rate of knee loading during running. Between limb differences in thigh accelerations predicted between limb differences in power but only explained 42% of the variance in knee power suggesting it may not be sensitive enough to identify individuals with knee loading deficits during running following surgery.

D-65 Thematic Poster - Physical Activity, Mental Health, and Cognition - Youth

Thursday, June 2, 2016, 3:15 PM - 5:15 PM  
 Room: 110

2290 **Chair:** Matthew P. Herring. *University of Limerick, Limerick, Ireland.*  
 (No relationships reported)

2291 Board #1 June 2, 3:15 PM - 5:15 PM  
**Cognitive Responses to Intermittent Physical Activity In Elementary School-Age Children**

Shannon S. Block, Trevor R. Tooley, Matt R. Nagy, Molly P. O'Sullivan, Rebecca E. Hasson. *University of Michigan, Ann Arbor, MI.*  
 Email: shansb@umich.edu  
 (No relationships reported)

Physical activity is associated with cognitive improvements in children. However, school systems across the country are reducing time allotted for structured physical activity (i.e., recess and physical education) to allow for more instructional time to prepare for standardized exams. Although classroom instruction is important, the lack of physical activity in the school day may come at a cost to children's academic performance. Intermittent physical activity, a form of exercise that can be integrated into a classroom curriculum, may be an effective way to increase physical activity and improve cognition in school-age children. **PURPOSE:** The purpose of this study was to examine the effects of intermittent physical activity on immediate mental performance (IMP). **METHODS:** Thirty-nine children (18 males, 21 females; ages 7-11 years; 33% overweight/obese; 59% non-white) completed four experimental conditions in random order: (1) 8 hours of sitting interrupted with 2-min light-intensity activity breaks performed at 25% of maximal heart rate (HRmax) every 18 minutes; (2) 8 hours of sitting interrupted with 2-min moderate-intensity activity breaks (50% HRmax); (3) 8 hours of sitting interrupted with 2-min high-intensity activity breaks (75% HRmax); and (4) 8 hours of sitting interrupted with 2 minutes of sedentary screen time. Throughout each condition, participants completed a total of 20 breaks. IMP was assessed three times during the day using a 90-second math test consisting of 40 single-digit addition and subtraction questions; scores were marked as number correct out of attempted. **RESULTS:** Across all conditions, IMP scores were significantly lower after 20 compared to 10 activity breaks (-2.4% vs. -0.4%,  $p=0.02$ ). Compared to the sedentary condition, IMP scores were significantly higher during the moderate-intensity condition (-2.5% vs. 0.1%,  $p=0.047$ ). There were no significant time-by-condition interactions ( $p>0.05$ ). **CONCLUSION:** These data suggest intermittent activity breaks interspersed throughout the school day may be an effective way to increase structured physical activity in schools without negatively impacting cognition in children. Future research should determine the optimal dose of intermittent activity needed to improve IMP in this age group.

2292 Board #2 June 2, 3:15 PM - 5:15 PM  
**Associations Of Physical Activity, Cardiorespiratory Fitness And Motor Skill With Cognition In Children: The Ask-study**

Katrine N. Aadland<sup>1</sup>, Geir K. Resaland<sup>1</sup>, Sigmund A. Anderssen<sup>1</sup>, Vegard F. Moe<sup>1</sup>, Eivind Aadland<sup>1</sup>, Yngvar Ommundsen<sup>2</sup>. <sup>1</sup>*Sogn og Fjordane University College, Sogndal, Norway.* <sup>2</sup>*Norwegian School of Sports Sciences, Oslo, Norway.*  
 Email: katrine.nyvoll.aadland@hisf.no  
 (No relationships reported)

There is a call for multidisciplinary studies examining independent associations of physical activity and physical fitness characteristics with executive function and academic performance. Purpose: To examine the independent associations of objectively measured physical activity, cardiorespiratory fitness and motor skill with executive function and academic performance in 10-year-old children. Methods: We included 787 children (mean (SD) age 10.2 (0.3) years, body mass index 18.0 (3.0), 50.8 % girls) from 57 schools in Sogn og Fjordane county, Norway. Independent variables were physical activity (moderate to vigorous and sedentary time measured by accelerometry), cardiorespiratory fitness (measured by the Andersen test) and a sum-score of motor skills (measured by Aiming and Catching 1 and 2 from the Movement ABC test battery (ageband 3) and the shuttle-run (10x5m) from the Eurofit test battery), as well as age, puberty stage, skinfold thickness and socioeconomic status. Dependent variables were two composite scores: 1) executive function (measured by Stroop, Verbal fluency, WISC-IV (digit span) and Trail Making) and 2) academic performance (reading, English and numeracy). A linear mixed model was used to analyze the data. Due to interactions with sex, analysis was run separately for girls and boys. Clinicaltrials.gov ID number NCT02132494. Results: Executive function was significantly associated with moderate to vigorous physical activity (regression coefficient (CI) p) (0.17 (0.01-0.33) p = 0.035), sedentary time (0.18 (0.03-0.34) p = 0.022) and motor skills (0.27 (0.16-0.38) p < 0.001) in girls and with cardiorespiratory fitness (0.24 (0.11-0.38) p = 0.001), sedentary time (0.17 (0.02-0.31) p = 0.026) and motor skills (0.12 (0.01-0.24) p = 0.036) in boys. Academic performance was only associated with motor skills (0.18 (0.07-0.30) p = 0.001) in girls, and for cardiorespiratory fitness (0.18 (0.04-0.31) p = 0.013) and sedentary time (0.16 (0.01-0.31) p = 0.033) in boys. Conclusions: The present study revealed sex differences in associations for physical characteristics with executive function and academic performance. Comprehensive physical activity targeted to increase both physical fitness and motor skill holds potential to positively affect executive function and academic performance.

2293 Board #3 June 2, 3:15 PM - 5:15 PM  
**Preschoolers' Inhibitory Control: Associations with Physical Activity and Sleep**

Catherine Gammon, Karin A. Pfeiffer, FACSM, Kimberly Fenn, Matthew B. Pontifex. *Michigan State University, East Lansing, MI.*  
 Email: gammonc2@msu.edu  
 (No relationships reported)

Inhibitory control refers to the ability to resist distractions and exert self-control. Higher inhibitory control is associated with academic success and a healthy weight status among youth. Identifying other, health-related factors associated with inhibitory control is of value. Activity variables (such as physical activity [PA] and sleep) are associated with inhibitory control among adolescents and adults; less is known about these associations among preschool-aged children. PURPOSE: To examine associations among activity variables (PA and sleep duration) and pre-schoolers' inhibitory control. METHODS: Sixty-four children (48% male; 75% Caucasian; mean [SD] age=4.3 [0.8] years; mean [SD] BMI percentile=61.4% [25.5]) wore an accelerometer for one week. Minutes per hour spent in moderate-to-vigorous PA (MVPA) were calculated. During the same week, participant's parents reported the child's sleep duration. Participants performed a computer task, which assessed inhibitory control. Response accuracy interference scores were calculated for the computer task, with higher interference scores indicating poorer inhibitory control. Regression models were used to examine associations among activity variables and interference scores. RESULTS: Regression models indicated a negative association between sleep duration and interference scores (R<sup>2</sup>=0.127, β=-.356, p=.01; n=58) and a positive association between MVPA and interference scores (R<sup>2</sup>=0.119, β=.344, p=.03; n=41). CONCLUSIONS: Consistent with previous findings, longer sleep duration was associated with better inhibitory control among young children. Contrary to observations among older youth and adults, higher PA was associated with poorer inhibitory control. It is plausible that among this age group, lower inhibitory control may result in a greater tendency to move, although the cross-sectional study design prohibits causal inference. Longitudinal research is needed to confirm or refute a causal relationship among these variables, and additional studies with larger, more diverse samples are needed to substantiate the findings.

Funded by the North American Society for Pediatric Exercise Medicine

2294 Board #4 June 2, 3:15 PM - 5:15 PM  
**Duration Of Aerobic Exercise And Effects On Self-Regulation Among Children With Behavioral Health Disorders**

April B. Bowling<sup>1</sup>, Sebastien J. Haneuse<sup>1</sup>, Daniel P. Miller<sup>2</sup>, James D. Slavet<sup>3</sup>, Kirsten K. Davison<sup>1</sup>. <sup>1</sup>*Harvard T.H. Chan School of Public Health, Boston, MA.* <sup>2</sup>*Boston University, Boston, MA.* <sup>3</sup>*Judge Baker Children's Center, Boston, MA.*  
 Email: april.bowling@mail.harvard.edu  
 (No relationships reported)

Purpose: Aerobic bouts as short as 10 minutes have been shown to positively affect impulsivity and mood in clinical settings among typically developing children. Recent studies show similar effects in children with neurodevelopmental or affective disorders. However, little research has been conducted on effects of exercise on behavior and affect among populations with behavioral health challenges in naturalistic settings like schools.

Manville Moves is an exercise intervention using exergame-cycling in physical education (PE) classes at a therapeutic day school serving children with complex behavioral health challenges. This study examined if minutes of riding had a dose-response relationship with impulsivity and emotional lability scores.

Methods: A 14-wk crossover design was used. Children (n=105, 81.3% male, age 11.9±2.3, 70.0% with multiple diagnoses, 72.2% taking medication) were randomly assigned by classroom to receive the 7-wk intervention during fall or spring, during which they used the bikes 2x/wk in PE and could elect to ride during self-breaks from class. Real-time data on exercise duration was collected via bikes using student ID codes. School staff completed the Conners Abbreviated Teacher Rating Scale (CATRS-10) (n=5,252) daily for each student. Clinically relevant a priori thresholds were established for CATRS-10 score (≥15), impulsivity sub-score (≥9) and emotional lability sub-score (≥6). Ride duration was categorized as reference (0 min), short (0<min<10) and long (≥10 min). Mixed effects logistic regression was used to assess relationships between score thresholds and ride duration category accounting for individual and classroom random effects and controlling for elective rides occurring in response to behavioral episodes.

Results: Both short and long riding categories were significantly associated with reduced odds of elevated CATRS-10 (short: OR=0.46, p<0.001; long: OR=0.64, p=.035) and impulsivity (short: OR=0.58, p=0.004; long: OR=0.62, p=0.030) versus no riding. Short rides were associated with reduced odds of elevated emotional lability (OR=0.58, p=0.008).

Conclusions: Even short duration school-based exergaming rides of 10 minutes or less may meaningfully improve impulsivity and affect among children with behavioral health challenges.

2295 Board #5 June 2, 3:15 PM - 5:15 PM  
**Depression Related To Activity In Typically Developing Children But Not In Children With Autism**

Karl F. Kozlowski, Christin A. McDonald, Marcus L. Thomeer, Christopher Lopata. *Canisius College, Buffalo, NY.* (Sponsor: Frank J. Cerny, FACSM)  
 Email: kozlow13@canisius.edu  
 (No relationships reported)

**PURPOSE:** Physical activity (PA) has been shown to reduce symptoms of depression and anxiety in various populations. This study was conducted to compare PA levels between children with autism spectrum disorder (ASD) and typically developing children (TD) and to determine whether a relationship exists between PA and depression or anxiety in children with ASD.

**METHODS:** 17 TD and 15 children with ASD (μ: 9.5 ± 1.8 yrs) wore triaxial accelerometers to assess PA across 6 consecutive days except during sleep and water activities. Cut points were assessed for sedentary, light, moderate, and vigorous PA (Evenson, 2008). Moderate and vigorous counts were then combined (MVPA). Each child's parents completed ratings on their child's ASD symptom expression and the degree of depression and anxiety symptoms their child exhibited via the Behavior Assessment System for Children, 2nd Ed. (BASC-2). Independent t-tests were used for group differences and Pearson's correlations were used to identify relationships between variables.

**RESULTS:** TD children recorded a significantly greater average daily wear time than ASD children (791.4 vs. 723.9 min. respectively; p<0.001). There were however, no significant differences between TD and ASD participants across percentage of time spent nor average daily minutes spent in sedentary (489.6 vs. 446.8; p=0.07), light (250.6 vs. 234.1; p=0.32), moderate (35.0 vs. 28.1; p=0.08), or vigorous (16.2 vs. 14.8; p=0.67) PA nor in average total activity counts (126.6 vs. 121.97; p=0.71). Neither group reached minimal recommendations for MVPA in children. ASD participants had significantly higher BASC-2 scores for depression (57.6 ± 10.9 vs. 45.1 ± 6.9; p<0.001) but not anxiety than TD participants. Relationships between PA and BASC-2 scores were not significant in the ASD group. In the TD group, there were significant

negative relationships between depression scores and average moderate PA ( $r=-0.656$ ,  $p=0.006$ ), vigorous PA ( $r=-0.656$ ,  $p=0.006$ ), MVPA ( $r=-0.735$ ,  $p<0.001$ ), and average total counts ( $r=-0.637$ ,  $p=0.008$ ).

**CONCLUSIONS:** While PA did not differ significantly between groups, a significant negative relationship between PA and depression in TD but not ASD suggests that a greater dose of intentional PA may be required to demonstrate an effect on symptoms of depression in children with ASD.

2296 Board #6 June 2, 3:15 PM - 5:15 PM  
**Early Adversity, Psychopathology and Latent Class Profiles of Physical Health Problems from Preschool through Adolescence**  
 Diana J. Whalen, Andy C. Belden, Rebecca Tilman, Joan Luby, Deanna Barch. *Washington University, Saint Louis, MO.*  
 (Sponsor: Stavros Kavouras, FACSMM)  
 Email: whalend@psychiatry.wustl.edu  
 (No relationships reported)

**Purpose:** Early psychiatric disorders represent one potential, yet underexplored mechanism that may explain the link between social adversity and physical health problems throughout childhood. The purpose of the present report was to describe the longitudinal trajectories of physical health beginning during preschool and continuing into adolescence and explore whether social adversity, family income-to-needs, and psychiatric disorders occurring during the preschool period predicted these trajectories. **Methods:** Participants included 288 children participating in a longitudinal study of early-onset psychopathology spanning ten years. Clinical interviews were conducted with caregivers to determine children's psychiatric diagnoses between ages 3-6. Caregivers also completed annual assessments of their child's physical health problems (ages 3-13), as well as reported on the family's income and indicators of early adversity (e.g. single-parent household, maternal psychopathology, parental arrest, foster care, physical abuse, sexual abuse, and inability meet the family's financial needs). **Results:** This study applied growth mixture modeling to physical health problems and found two distinct trajectories of physical health problems: a stable, low group indicating good physical health across time and a high, increasing group indicating linear increases in physical health problems from ages 3-13. The presence of psychiatric diagnoses ( $X^2_{(1)} = 12.67$ ,  $p<.000$ ), family income-to-needs ratio ( $F = 5.66$ ,  $p<.018$ ), and social adversity ( $F = 4.28$ ,  $p<.039$ ) occurring during the preschool period differentiated the increasing trajectory class of physical health problems. **Conclusions:** These findings indicate the importance and predictive power of early indicators of risk: low family income-to-needs ratios, high social adversity, and psychiatric disorders occurring during the preschool period for contributing to increasing physical health problems from preschool through adolescence. The findings from this study suggest that the co-occurrence between early physical and mental health problems, as well as early adversity may be of significant public health importance.

2297 Board #7 June 2, 3:15 PM - 5:15 PM  
**Psychological Responses to Intermittent Physical Activity in Elementary School-Age Children**  
 Matthew R. Nagy, Molly P. O'Sullivan, Shannon S. Block, Trevor R. Tooley, Rebecca E. Hasson. *University of Michigan, Ann Arbor, MI.*  
 Email: mnrnagy@umich.edu  
 (No relationships reported)

It is well-established that intermittent physical activity has a positive impact on children's physical health. However, less is known regarding the psychological outcomes associated with intermittent activity in children. **PURPOSE:** The purpose of this study was two fold: (1) to examine the acute effects of intermittent physical activity on enjoyment and mood in children ages 7-11 years and (2) to determine the effects of exercise intensity on these psychological outcomes. **METHODS:** Thirty-nine children (18 males, 21 females; 33% overweight/obese; 59% non-white) completed four experimental conditions in random order: (1) 8 hours of sitting interrupted with 2-minute light-intensity activity breaks performed at 25% maximal heart rate (HRmax) every 18 minutes; (2) 8 hours of sitting interrupted with 2-minute moderate-intensity activity breaks (50% HRmax); (3) 8 hours of sitting interrupted with 2-minute high-intensity activity breaks (75% HRmax); and (4) 8 hours of sitting interrupted with 2 minutes of sedentary screen time. Throughout each condition, participants completed a total of 20 breaks. Enjoyment was assessed using the Physical Activity Enjoyment Scale during each condition day. The Subjective Exercise Experience Scale was used to analyze pre-post changes in mood responses to physical activity. **RESULTS:** Enjoyment was significantly higher during the low- (4.4±0.1), moderate- (4.4±0.1), and high-intensity (4.3±0.1) conditions, compared to the sedentary condition (4.1±0.1;  $p's<0.05$ ). Positive well-being was significantly higher during the low- (23.0±0.8) and moderate-intensity (23.4±0.7) conditions compared to the sedentary

condition (21.8±1.0;  $p's<0.05$ ). Fatigue was significantly higher during the moderate- (9.7±0.7) and high-intensity (10.1±0.9) conditions, compared to the sedentary condition (8.2±0.8;  $p's<0.01$ ). Psychological distress significantly decreased between pre-post measures for all conditions (5.8±0.21 vs. 5.3±0.19;  $p<0.01$ ). **CONCLUSIONS:** These data suggest intermittent physical activity elicits short-term psychological benefits in children. Future research should determine whether these benefits are sustained with repeated sessions of intermittent physical activity.

2298 Board #8 June 2, 3:15 PM - 5:15 PM  
**The Relationship Between BMI and Sedentary Behavior is Mediated by Negative Peer Interaction in Boys**  
 Jacob E. Barkley. *Kent State University, Kent, OH.* (Sponsor: Ellen Glickman, FACSMM)  
 Email: jbarkle1@kent.edu  
 (No relationships reported)

Overweight/obese children spend more time sitting (i.e. are more sedentary) than their non-overweight peers. Additionally, overweight/obese children are more likely to encounter negative social interaction (e.g., bullying) than non-overweight children and this negative social interaction is associated with greater sedentary behavior regardless of a child's weight status. It is unknown if negative social interaction mediates the relationship between overweight status and sedentary behavior in children. **Purpose:** To determine if self-reported negative social interaction acts as a mediator of the relationship between objectively-measured sedentary behavior and body mass index (BMI) percentile for age in boys, in a controlled environment. **Methods:** Twenty six boys (10.5 ± 1.5 years old) were assessed for height and weight and BMI percentile for age was calculated. Twelve boys were overweight/obese (i.e., ≥85<sup>th</sup> BMI percentile) and 14 were non-overweight (i.e., <85<sup>th</sup> BMI percentile). Children completed validated surveys that assessed overt peer victimization (OV) such as physical violence and/or threats of violence and relational victimization (RV) such as ostracism. Children were then individually given access to a gymnasium with a variety of physical activity equipment options (e.g., balls, obstacle courses) and a table with sedentary activities (e.g., books, toys) for 30 minutes. If a child played with sedentary options they did so while seated. Children could play with any of the equipment options in any pattern they wished for the entire session. The amount of time children allocated to sedentary activities (i.e., sitting time) was recorded via stopwatch. **Results:** Both OV and RV were positively associated with BMI percentile ( $r = 0.46$ ,  $p = 0.02$  for OV,  $r = 0.40$ ,  $p = 0.04$  for RV) and sitting time ( $r = 0.40$ ,  $p = 0.05$  for OV,  $r = 0.42$ ,  $p = 0.04$  for RV) and sitting time was positively associated with BMI percentile ( $r = 0.4$ ,  $p = 0.05$ ). When individually controlling for both OV and RV the previously significant positive correlation between sitting time and BMI percentile was rendered non-significant ( $r = 0.28$ ,  $p = 0.18$  for OV,  $r = 0.26$ ,  $p = 0.21$  for RV). **Conclusion:** The relationship between BMI percentile and sedentary behavior was mediated by both measures of negative social interaction: OV and RV.

THURSDAY, JUNE 2, 2016

**D-66 Free Communication/Slide - Exercise Training in Chronic Disease**

Thursday, June 2, 2016, 3:15 PM - 5:15 PM  
Room: 102

2299 **Chair:** Cemal Ozemek. *University of Colorado Denver, Denver, CO.*  
(No relationships reported)

2300 June 2, 3:15 PM - 3:30 PM

**Inflammation and Resistance Exercise in Breast Cancer Patients undergoing Adjuvant Radiotherapy: a Mediation Analysis**

Karen Steindorf<sup>1</sup>, Martina E. Schmidt<sup>1</sup>, Anna Meynköhn<sup>1</sup>, Nina Habermann<sup>1</sup>, Joachim Wiskemann<sup>2</sup>, Jan Oelmann<sup>2</sup>, Oliver Klassen<sup>3</sup>, Juergen Debus<sup>2</sup>, Karin Potthoff<sup>2</sup>, Cornelia M. Ulrich<sup>4</sup>.  
<sup>1</sup>National Center for Tumor Diseases (NCT) and German Cancer Research Center (DKFZ), Heidelberg, Germany. <sup>2</sup>National Center for Tumor Diseases (NCT) and Heidelberg University Hospital, Heidelberg, Germany. <sup>3</sup>National Center for Tumor Diseases (NCT), German Cancer Research Center (DKFZ), and Clinic Muensterland, Bad Rothenfelde, Heidelberg, Germany. <sup>4</sup>National Center for Tumor Diseases (NCT) and Huntsman Cancer Center, Salt Lake City (USA), Heidelberg, Germany.  
(Sponsor: Prof. Dr. Juergen Scharhag, FACSM)  
Email: k.steindorf@dkfz.de  
(No relationships reported)

**PURPOSE:** Exercise interventions have shown to reduce **cancer-related** fatigue and pain in breast cancer patients undergoing radiotherapy. Within a randomized controlled trial, we aimed to explore the mediating role of inflammatory parameters in the development of **these symptoms** during adjuvant radiotherapy and its mitigation by resistance exercise.

**METHODS:** The randomized trial compared a 12-week progressive resistance exercise training (EX) with a 12-week relaxation control group. In 103 chemotherapy-naïve participants, interleukin-6 (IL-6) and interleukin-1 receptor antagonist (IL-1ra) were measured in serum samples collected before, at the end, and 6-weeks post-radiotherapy. Fatigue was assessed with the multidimensional Fatigue Assessment Questionnaire (FAQ), and pain with the EORTC QLQ-C30. Analysis of covariance (ANCOVA) models, partial correlations, Freedman-Schatzkin tests, and R<sup>2</sup> effect-size measures for mediation were calculated.

**RESULTS:** The ANCOVA models revealed a significant intervention effect on IL-6 (p=0.010) and the IL-6/IL-1ra ratio (p=0.018), characterized by a marked increase during radiotherapy among controls, but no significant change in EX. IL-1ra did not change significantly in either group (p=0.88). Increased IL-6 and IL-6/IL-1ra levels at the end of radiotherapy were significantly associated with increased physical fatigue and pain 6 weeks post-radiation. The effect of resistance exercise on physical fatigue was significantly mediated by IL-6 and IL-6/IL-1ra, **but not by IL-1ra**. IL-6 and IL-6/IL-1ra mediated between 15% and 24% of the variance of physical fatigue and pain explained by the intervention.

**CONCLUSIONS:** This randomized controlled trial showed a significantly increased pro-inflammatory cytokine level after adjuvant radiotherapy in breast cancer patients. This effect was counteracted by progressive resistance exercise training. IL-6 and the IL-6/IL-1ra ratio appeared to mediate the beneficial effect of exercise on physical fatigue and pain, but only to a small extent. Supported by Intramural Funding of the National Center for Tumor Diseases (NCT), Heidelberg, Germany.

2301 June 2, 3:30 PM - 3:45 PM

**Influence Of Exercise On Mitochondrial And Nuclear Gene-expression Among Patients With Cancer-related Fatigue**

Karen M. Mustian, Michelle Janelsins, Luke Peppone, Charles Kamen, Ian Kleckner, Mathew Asare, Charles Heckler.  
*University of Rochester School of Medicine, Rochester, NY.*  
Email: karen\_mustian@urmc.rochester.edu  
(No relationships reported)

**PURPOSE:** Radiation therapy (RT) and androgen deprivation therapy (ADT) impair muscular, mitochondrial and immune function, and result in weakness and cancer-related fatigue (CRF) among prostate cancer patients. We investigated the influence of an exercise intervention (EXCAP®), including resistance and aerobic training, on expression of 4825 mitochondrial and nuclear genes, muscular strength, and CRF.

**METHODS:** In this phase II randomized clinical trial, prostate cancer patients (N=58; mean age=67), receiving RT (47%) or ADT (53%), were randomized to 6 wks of EXCAP® (7 days/wk) or standard care (RT or ADT with no exercise). RNA was isolated from muscle biopsies for microarray analyses of 4825 mitochondrial and nuclear genes. Muscular strength was assessed using multiple repetition maximum testing (chest press and leg extension). CRF was assessed via valid self-report questionnaires (BFI, MFSI). Assessments were pre- and post-intervention. Analyses included robust multi-array average normalization, analyses of covariance (ANCOVA), correlations and partial least squares (PLS) with cross-validation.

**RESULTS:** Analyses revealed >2-fold down regulation in MYH8 and XIRP1 in the exercise group, no >2-fold changes in expression in the control group, and a >2-fold difference between groups on MTTM where MTTM was down-regulated >1.5-fold in controls with no change in exercisers (all p<0.05). ANCOVAs revealed a trend for group differences in muscular strength (all p<0.10) with significant group differences in CRF for the BFI (p<0.05) and a trend on the MFSI (p<0.10): exercisers improved while controls worsened. MYH8, MYL5, ACTN3, XIRP1, MTTM, and HLA-DQB1 were significantly correlated with muscular strength and CRF (all p<0.05). PLS suggested down-regulation of MYL5, ACTN3, and HLA-DQB1 may optimally predict increases in CRF.

**CONCLUSIONS:** Results suggest exercise alters gene expression, muscular strength and CRF in prostate cancer patients. Expression changes in genes that are involved in muscle atrophy and inflammatory myopathies are related to and may mediate the relationship between exercise and CRF. Future research is needed to confirm these findings in larger phase III clinical trials. ClinicalTrials.gov: NCT00815672 Funding: DOD W81XWH-07-1-0341

2302 June 2, 3:45 PM - 4:00 PM

**Strength-Training Induces Skeletal Muscle Adaptations in Patients with Myotonic Dystrophy Type I: A Case Study**

Marie-Pier Roussel<sup>1</sup>, Marika Morin<sup>1</sup>, Émile Petitclerc<sup>2</sup>, Anne-Marie Fortin<sup>1</sup>, Cynthia Gagnon<sup>2</sup>, Luc J. Hebert<sup>3</sup>, Mario Leone<sup>1</sup>, Elise Duchesne<sup>1</sup>.  
<sup>1</sup>Université du Québec à Chicoutimi, Chicoutimi, QC, Canada. <sup>2</sup>Université de Sherbrooke, Sherbrooke, QC, Canada. <sup>3</sup>Université Laval, Québec, QC, Canada.  
Email: marie-pier.roussel1@uqac.ca  
(No relationships reported)

**PURPOSE:** Myotonic dystrophy type 1 (DM1) is the most prevalent inherited neuromuscular disease in adults. This multisystemic disease is characterized by skeletal muscle impairments including muscle wasting. Slowing muscle wasting in this population using strength training seems a promising strategy, but it remains unknown if it would trigger cellular and molecular responses similar to the ones observed in healthy people. The objective of this case study is to evaluate the effect of a strength-training program on skeletal muscle adaptations in a DM1 patient.

**METHODS:** One male with DM1 (age = 36) underwent a 12-week strength-training program, twice a week, consisting of 2 sets of 6 exercises at 6 RM supplemented by functional tasks. Vastus lateralis muscle biopsy samples were obtained pre- and post-training program. The proportion of type I and II myofibers and the cross sectional area (CSA) of each type were determined by immunohistochemistry. The percentage of centrally nucleated fibers (CNF) was obtained following staining with hematoxyline/eosine. Two blinded evaluators analyzed the data.

**RESULTS:** Following the 12-week strength-training program, the patient showed an increase in the CSA of type I myofibers evaluated at 46% (p<0.05) by evaluator #1 and 51% (p<0.05) by evaluator #2. For type II myofibers, the increase in CSA was evaluated to 24% (p<0.05) and 29% (p<0.05) by evaluator #1 and #2, respectively. A muscle fiber-type switching was also induced by the 12-week strength-training program as shown by the increase in the proportion of type II myofibers from 29% to 71% (p<0.05) noted by the evaluator #1 and the similar observation noted by evaluator #2 (28% to 72%, p<0.05). No change was observed in the percentage of CNF by both evaluators.

**CONCLUSIONS:** Our results suggest that skeletal muscle of patients with DM1 could undergo adaptations linked to muscle growth as demonstrated by the increase in the CSA of type I and type II myofibers. It also seems that strength-training parameters used in this study could also influence the distribution of myofibers, in favour of type II. Further studies comprising a higher number of participants are needed to validate our findings and determine to which extent and how skeletal muscles of patients with DM1 adapt to strength training stimulus.

2303 June 2, 4:00 PM - 4:15 PM

**High Intensity Interval- Vs Moderate Intensity- Training For Improving Cardiometabolic Health In Overweight Or Obese Males: A Randomized Controlled Trial.**

Gordon Fisher, FACSM<sup>1</sup>, Andrew W. Brown<sup>1</sup>, Michelle M. Bohan-Brown<sup>2</sup>, Amy Alcorn<sup>1</sup>, Corey D. Noles<sup>1</sup>, Leah Winwood<sup>1</sup>, Holly Resuehr<sup>1</sup>, Brandon George<sup>1</sup>, Madeline M. Jeanson<sup>1</sup>, David B. Allison<sup>1</sup>. <sup>1</sup>University of Alabama - Birmingham, Birmingham, AL. <sup>2</sup>Clemson University, Clemson, SC.  
Email: grdnfs@uab.edu

(No relationships reported)

**Purpose:** To compare the effects of six weeks of high intensity interval training (HIIT) vs continuous moderate intensity training (MIT) for improving body composition, insulin sensitivity ( $S_i$ ), blood pressure, blood lipids, and cardiovascular fitness in a cohort of sedentary overweight or obese young men. We hypothesized that HIIT would result in similar improvements in body composition, cardiovascular fitness, blood lipids, and  $S_i$  as compared to the MIT group, despite requiring only one hour of activity per week compared to five hours per week for the MIT group.

**Methods:** 28 sedentary overweight or obese men (age,  $20 \pm 1.5$  years, body mass index  $29.5 \pm 3.3$  kg/m<sup>2</sup>) participated in a six week exercise treatment. Participants were randomly assigned to HIIT or MIT and evaluated at baseline and post-training. DXA was used to assess body composition, graded treadmill exercise test to measure cardiovascular fitness, oral glucose tolerance to measure  $S_i$ , nuclear magnetic resonance spectroscopy to assess lipoprotein particles, and automatic auscultation to measure blood pressure.

**Results:** A greater improvement in  $VO_{2peak}$  was observed in MIT compared to HIIT (11.1% vs 2.83%,  $P=0.0185$ ) in the complete-case analysis. No differences were seen in the intention to treat analysis, and no other group differences were observed. Both exercise conditions were associated with temporal improvements in % body fat, total cholesterol, medium VLDL, medium HDL, triglycerides,  $S_i$ , and  $VO_{2peak}$  ( $P < 0.05$ ).

**Conclusion:** Participation in HIIT or MIT exercise training displayed: 1) improved  $S_i$ , 2) reduced blood lipids, 3) decreased % body fat, and 4) improved cardiovascular fitness. While both exercise groups led to similar improvements for most cardiometabolic risk factors assessed, MIT led to a greater improvement in overall cardiovascular fitness. Overall, these observations suggest that a relatively short duration of either HIIT or MIT training may improve cardiometabolic risk factors in previously sedentary overweight or obese young men, with no clear advantage between these two specific regimes (Clinical Trial Registry number NCT01935323).

2304 June 2, 4:15 PM - 4:30 PM

**Effect Of High-intensity Interval Training On Insulin Quality In Participants With Metabolic Syndrome**

Joyce S. Ramos<sup>1</sup>, Lance C. Dalleck<sup>2</sup>, Fabio Borrani<sup>3</sup>, Robert G. Fasset<sup>1</sup>, Shelley E. Keating<sup>1</sup>, Jeff S. Coombes, FACSM<sup>1</sup>. <sup>1</sup>University of Queensland, Brisbane, Australia. <sup>2</sup>Western State Colorado University, Gunnison, CO. <sup>3</sup>University of Lausanne, Lausanne, Switzerland. (Sponsor: Professor Wendy Brown, FACSM)

Email: mary.ramos@uq.net.au

(No relationships reported)

The continuous demand for insulin in the face of insulin resistance, coupled with the glucolipotoxic environment associated with the metabolic syndrome (MetS), adversely affects the 'quality' of insulin produced and secreted by the pancreatic beta cells. This is depicted by increased circulating intact proinsulin concentration (IPC) which is associated with increased MetS severity and risk of cardiovascular (CV) mortality. High-intensity interval training (HIIT) has been shown to reduce insulin resistance and other cardiovascular disease risk factors to a greater degree than moderate-intensity continuous training (MICT).

**PURPOSE:** We therefore aimed to investigate the impact of MICT and different volumes of HIIT on circulating IPC. **METHODS:** Sixty-six individuals with the MetS were randomized into 16 weeks of either: i) MICT (n=21, 30mins at 60-70%HRpeak, 5x/week); ii) 4HIIT (n=22, 4x4min bouts at 85-95%HRpeak, interspersed with 3min of active recovery at 50-70%HRpeak, 3x/week); or iii) 1HIIT (n=23, 1x4min bout at 85-95%HRpeak, 3x/week). A sub-analysis investigated the differential impact of these training programs on IPC in MetS individuals with type 2 diabetes mellitus (T2DM) (MICT, n=6; 4HIIT, n=9; 1HIIT, n=12) and without the condition (MICT, n=15; 4HIIT, n=13; 1HIIT, n=11). Intact proinsulin, insulin, and C-peptide serum concentrations were measured in duplicate following a 12-hour fast, via enzyme linked immunosorbent assays, before and after the exercise program. Fasting IPC was also expressed relative to insulin and C-peptide concentrations. **RESULTS:** Following the training programs, there were no significant ( $p>0.05$ ) between or within

group differences in fasting IPC indices (Pre vs Post proinsulin, proinsulin:insulin, proinsulin:C-peptide: MICT  $\downarrow 19\%$ ,  $\uparrow 6\%$ ,  $\uparrow 4\%$ ; 4HIIT  $\downarrow 19\%$ ,  $\downarrow 8\%$ ,  $\downarrow 11\%$ ; 1HIIT  $\uparrow 34\%$ ,  $\uparrow 49\%$ ,  $\uparrow 36\%$ ). In participants that did not have T2DM, only 4HIIT significantly reduced fasting IPC indices from pre- to post-intervention (Pre vs Post proinsulin, proinsulin:insulin, proinsulin:C-peptide: 4HIIT  $\downarrow 32\%$ ,  $\downarrow 26\%$ ,  $\downarrow 32\%$ ,  $p<0.05$ ; 1HIIT,  $\uparrow 14\%$ ,  $\uparrow 32\%$ ,  $\uparrow 16\%$ ,  $p>0.05$ ; MICT  $\downarrow 27$ ,  $\downarrow 17\%$ ,  $\downarrow 11\%$ ,  $p>0.05$ ). There were no significant ( $P>0.05$ ) changes in IPC indices in participants with T2DM. **CONCLUSION:** Higher volume HIIT (4HIIT) improved insulin quality in MetS participants without T2DM.

2305 June 2, 4:30 PM - 4:45 PM

**Heterogeneity in Fitness Response to a Lifestyle Intervention: The DEXLIFE Intervention Study**

Kristine Faerch<sup>1</sup>, Aileen Kennedy<sup>2</sup>, Grainne O'Donoghue<sup>2</sup>, Eoin Durkan<sup>2</sup>, Helena Kenny<sup>2</sup>, Stephen Cleary<sup>2</sup>, Noel McCaffrey<sup>2</sup>, Gregers S. Andersen<sup>1</sup>, John J. Nolan<sup>1</sup>, Donal O'Gorman<sup>2</sup>. <sup>1</sup>Steno Diabetes Center, Gentofte, Denmark. <sup>2</sup>Dublin City University, Dublin, Ireland.

Email: krif@steno.dk

(No relationships reported)

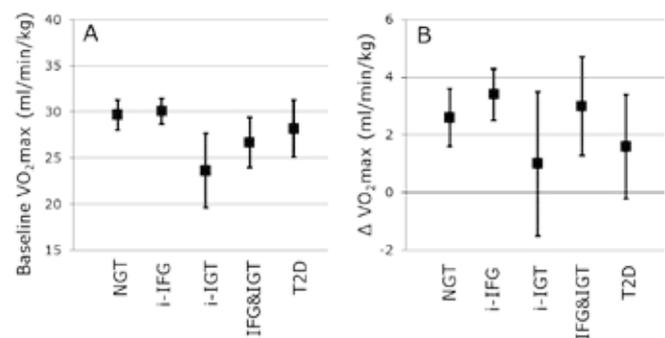
The term pre-diabetes covers subgroups of individuals with distinct pathophysiology. Despite this heterogeneity, the current approach to diabetes prevention is uniform.

**Purpose:** To examine the heterogeneity in fitness responsiveness to a self-selected lifestyle intervention in individuals with normal glucose tolerance (NGT), isolated impaired fasting glucose (i-IFG), isolated impaired glucose tolerance (i-IGT), combined IFG&IGT, and screen-detected type 2 diabetes (T2D).

**Methods:** A total of 243 high-risk individuals (mean (SD) age 54 (11) y; BMI 31 (5) kg/m<sup>2</sup>; 50.1% men) participated in a 12-week supervised exercise training programme accompanied with dietary advice. At baseline and follow-up, oral glucose tolerance and  $VO_{2max}$  tests were performed. Heterogeneity in  $VO_{2max}$  response to the lifestyle intervention was analysed by linear regression analysis with baseline glucose tolerance status as explanatory variable. Analyses of  $VO_{2max}$  changes were adjusted for age, sex, and baseline level of  $VO_{2max}$ .

**Results:** At baseline,  $VO_{2max}$  levels were significantly lower in i-IGT and IFG&IGT compared with NGT and i-IFG ( $P<0.05$ , Fig. A). Heterogeneity was observed in 12-week changes in  $VO_{2max}$  ( $P=0.034$ ). Improvement in  $VO_{2max}$  was significantly higher in NGT, i-IFG and IFG&IGT than in i-IGT and T2D ( $P\leq 0.01$ , Fig. B).

**Conclusion:** Cardiorespiratory fitness level was lower in pre-diabetic individuals with i-IGT and IFG&IGT but not in those with i-IFG compared with NGT. Paradoxically, improvement in fitness level after a 12-week lifestyle intervention was not seen in individuals with i-IGT. Our findings suggest that lifestyle strategies for prevention of type 2 diabetes may not be equally beneficial for all pre-diabetic individuals.



2306 June 2, 4:45 PM - 5:00 PM

**Effects of 3 Months of Nitrate plus Exercise Training on Tissue Perfusion in Peripheral Arterial Disease**

Mary N. Woessner<sup>1</sup>, Mitch VanBruggen<sup>2</sup>, Cassandra Smith<sup>1</sup>, Thomas Stabler<sup>2</sup>, Johanna L. Johnson<sup>2</sup>, Carl Pieper<sup>2</sup>, William E. Kraus<sup>2</sup>, Jason David Allen, FACSM<sup>1</sup>. <sup>1</sup>Victoria University, Institute of Sport, Exercise and Active Living, Melbourne, Australia. <sup>2</sup>Duke University, Durham, NC.

(No relationships reported)

Peripheral Arterial Disease (PAD) is a condition of hypoxia in the peripheral tissues. Any intervention which improves blood flow and oxygenation to these areas could delay claudication pain onset time (COT), decrease recovery time, and increase physical function. This would be a significant therapeutic option for patients with PAD. We have previously shown acute inorganic nitrate supplementation increased plasma nitrite, pain-free walking time, and reduced gastrocnemius fractional  $O_2$  extraction.

**PURPOSE:** To determine the effects of 3 months of supervised exercise training plus chronic dietary provision of an inorganic nitrate (4.2mmol in the form of concentrated beetroot juice, BR) beverage (EX+BR) versus exercise training and placebo beverage (EX+PL) on COT and rate of tissue oxygenation recovery (T50% HbO<sub>2</sub>).

**METHODS:** At baseline testing, all subjects underwent a maximal graded cardiopulmonary exercise test using a modified Gardner protocol. The oxygenation status of the gastrocnemius muscle of the leg with the worst PAD symptoms and ABI measures was monitored at 850 and 764nm using Near Infrared Spectroscopy (NIRS). Subjects were then randomized to either the EX+BR (n=9) or EX+PL (n=10) group. Exercise training involved 3 sessions per week consisting of at least 30 minutes walking at a moderate claudication pain level. Subjects consumed BR or PL 3 hours prior to each exercise session. The 3-month testing protocol was identical to baseline. Comparisons were made using a two-way ANOVA with repeated measures.

**RESULTS:** COT was not different between groups at baseline and was correlated with T50% HbO<sub>2</sub>,  $p \leq 0.05$  ( $r^2 = 0.33$ ). Following 3M EX+BR increased COT (180 ± 154sec,  $p \leq 0.01$ ), and decreased T50% HbO<sub>2</sub> (32.11sec ± 41.81,  $p = 0.05$ ) in the EX+BR group only. The correlation between COT and T50% HbO<sub>2</sub> remained significant at 3M for both the EX+BR group ( $p \leq 0.05$ ,  $r^2 = 0.53$ ) and the EX+PL group ( $p \leq 0.05$ ,  $r^2 = 0.46$ ).

**CONCLUSION:** Chronic administration of a high nitrate drink plus supervised exercise training increased pain-free exercise performance time and decreased the time required to re-oxygenate the ischemic tissue. This suggests a capacity to increase performance of activities of daily living in patients with PAD. Supported by grants R21HL111972 and R21HL113717 to JDA

2307 June 2, 5:00 PM - 5:15 PM

### Prolonged Elevated Cardiac Troponin After Marathon Running Is a Sign For Myocardial Damage

Johannes Scherr<sup>1</sup>, Fabien Hyafil<sup>1</sup>, Viola Grabs<sup>1</sup>, Bernhard Haller<sup>1</sup>, Siegmund Braun<sup>2</sup>, Tim Roeper<sup>1</sup>, Markus Schwaiger<sup>1</sup>, Martin Halle<sup>1</sup>. <sup>1</sup>Klinikum rechts der Isar, Technische Universität München, Munich, Germany. <sup>2</sup>Deutsches Herzzentrum München, Technische Universität München, Munich, Germany.

Email: scherr@sport.med.tum.de

(No relationships reported)

**PURPOSE:** The pathophysiological mechanism of cardiac troponin (cTn) elevation after marathon running is still not clear. It is discussed controversially whether (especially a prolonged) elevation reflects rather physiological than pathological processes.

We hypothesized that a prolonged elevation of cTn (pecTn) post-marathon is associated with late gadolinium enhancement (LGE) in cardiac magnetic resonance (CMR) imaging as a sign of myocardial damage.

**METHODS:** We examined cTn T values in 162 healthy male marathon runner (age: 42.1 ± 10.9 yrs) before (V2) and immediately (V3), 24 hrs (V4), and 72 hrs (V5) after a marathon race. A pecTn was defined as follows: a high-sensitive cTnT > 25 ng/L at V4 or > 14 ng/L at V5. The participants with pecTn were compared to controls without pecTn which were similar with respect to age and previous finished long-distance races. Both groups were examined with CMR in the days post-race and those with LGE in the first CMR also with a second CMR approximately 3 month post-race.

**RESULTS:** We examined in total 22 out of 162 runners (13.6%). 12 of 162 (7.4%, age 38.7 ± 10.4 yrs) had prolonged elevated cTn T values. 7 in the pecTn group (58.3%) and 2 in the control group (20%,  $p = 0.099$ ) had a LGE in the first CMR. In the second CMR, 5 participants in the pecTn group (41.7%) and 1 in the control group (10%,  $p = 0.162$ ) presented LGE. In the ROC analyses, cTnT values immediately post-race were not associated with LGE (1st CMR: AUC = 0.671,  $p = 0.182$ , 2nd CMR: AUC = 0.474,  $p = 0.854$ ). However, LGE in first CMR was significantly associated with cTnT at V4 (AUC = 0.769,  $p = 0.035$ ) and LGE in second MRI with cTnT at V5 (AUC = 0.807,  $p = 0.030$ ), however not reaching level of significance for V4 (AUC = 0.750,  $p = 0.077$ ). Regarding mean cTn values at V4 and V5, LGE in both CMRs were significantly associated with cTn values (first CMR: AUC = 0.752,  $p = 0.049$ ; second CMR: AUC = 0.828,  $p = 0.020$ ).

An optimal cut-point regarding LGE at the first MRI determined by maximizing the Youden index for a cTn value at 24 hrs post-race was found at 23.5 ng/L (estimated sensitivity: 66.7%, specificity: 84.6%).

**CONCLUSIONS:** Prolonged elevation of cTn after marathon running is associated with LGE in CMR and therefore, seems to be a sign for myocardial damage.

Furthermore, high-sensitive cTnT values  $\geq 24$  ng/L 24 hrs post-race are highly suspicious for a pathological process.

## D-67 Free Communication/Slide - Oh Baby! Physical Activity and Pregnancy

Thursday, June 2, 2016, 3:15 PM - 5:15 PM

Room: 313

2308 **Chair:** Linda E. May. *East Carolina University, Greenville, NC.*

(No relationships reported)

2309 June 2, 3:15 PM - 3:30 PM

### Influence of Maternal Exercise on Neonatal Body Composition

Camien Moyer<sup>1</sup>, Kellie Baker<sup>2</sup>, Natalia Favoreto<sup>2</sup>, Ed Newton<sup>2</sup>, Linda E. May<sup>2</sup>. <sup>1</sup>Bridgewater College, Bridgewater, VA. <sup>2</sup>East Carolina University, Greenville, NC.

Email: cmoyer@bridgewater.edu

(No relationships reported)

**PURPOSE:** Overweight & obesity is a growing health concern in the US, affecting over one-third of children and adolescents, which increases the risk of premature all-cause mortality and heart disease. The purpose of this study was to compare the effects of exercise mode throughout pregnancy on neonatal health outcomes.

**METHODS:** Participants completed 3 sessions weekly of aerobic, circuit, or resistance training from 16 to 36 weeks gestational age compared to non-exercising controls. At birth, neonatal morphometrics were assessed, including abdominal circumference (AC), head circumference (HC), and weight, from which ponderal index (PI) and body mass index (BMI) were calculated. Statistical analyses included t-tests and multiple ANOVAs.

**RESULTS:** Maternal exercise during pregnancy, regardless of the type, had no adverse effect on overall growth and development. Children exposed to maternal aerobic exercise training had significantly smaller abdominal circumferences compared to circuit ( $p = 0.009$ ), resistance ( $p = 0.003$ ), and control ( $p = 0.034$ ) groups. BMI of children exposed to maternal circuit training was significantly different from the resistance group ( $p = 0.028$ ).

**CONCLUSIONS:** These results suggest that abdominal fat and BMI may be influenced in utero, which may influence future disease risk and diagnosis at a later age. These findings have further implications for the general public in combatting cardiovascular disease and obesity by intervening during a key time of development to improve childhood health and wellbeing, utilizing an effective, safe, low-cost intervention.

2310 June 2, 3:30 PM - 3:45 PM

### Effects of an Exercise Intervention on Gestational Weight Gain: Preliminary Results Of The PAMELA Trial

Shana G. da Silva<sup>1</sup>, Bruna G C da Silva<sup>1</sup>, Carolina V N Coll<sup>1</sup>, Marlos R. Domingues<sup>1</sup>, Kelly R. Evenson<sup>2</sup>, Pedro C. Hallal<sup>1</sup>. <sup>1</sup>Federal University of Pelotas, Pelotas, Brazil. <sup>2</sup>University of North Carolina, Chapel Hill, NC.

Email: sginar@gmail.com

(No relationships reported)

Excessive weight gain (EWG) during pregnancy increases the risk of adverse outcomes for the mother and the newborn, such as gestational hypertension, diabetes mellitus, preterm birth and obesity. Some randomized controlled trials indicate an inverse association between EWG and exercise during pregnancy, but few of these trials are adequately powered. **PURPOSE:** This study evaluated the effect of a supervised exercise - based intervention performed during 16 weeks of pregnancy on maternal weight gain.

**METHODS:** The PAMELA (Physical Activity for Mothers Enrolled in a Longitudinal Analysis) is a randomized controlled trial nested into the 2015 Pelotas (Brazil) Birth Cohort Study. A total of 394 healthy pregnant women were randomly assigned to a control group (n=263) or exercise intervention group (n=131). The intervention included moderate-intensity aerobic and resistance exercises performed three days/week for 60 minutes/session. Gestational weight gain was calculated on the basis of the weight measured at the baseline (16-20 weeks' gestation) and weight measured at the last visit to the clinic after the end of the intervention program (32-36 weeks' gestation). Analyses were performed using T-tests for mean differences.

**RESULTS:** To date, a total of 291 women, 198 in the control group and 93 in the intervention group, completed the study. The intervention and control groups did not differ at baseline regarding their mean age (27.2 years ± 0.5 vs. 27.1 years ± 0.4) and mean prepregnancy weight (68.5 kilogram (kg) ± 1.2 vs. 69.7 ± 0.8). Women in the intervention group gained less weight (mean difference, 0.89 kg; 95% confidence interval: 0.02-1.76 kg;  $p < 0.05$ ) compared with those in the control group after 16 weeks of intervention.

**CONCLUSIONS:** Our preliminary findings show that the exercise intervention contributed to reduced weight gain during pregnancy. Future studies on the effect of adherence strategies to enhance motivation for regular participation in exercise during pregnancy are warranted.

**Trial registration:** Clinicaltrials.gov identifier: NCT02148965.

2311 June 2, 3:45 PM - 4:00 PM

### Antenatal Weight Training and Maternal Health Conditions among Postpartum Runners

Liga Blyholder<sup>1</sup>, Elizabeth Chumanov<sup>2</sup>, Bryan Heiderscheid<sup>1</sup>.  
<sup>1</sup>University of Wisconsin-Madison, Madison, WI. <sup>2</sup>University of Wisconsin Hospital and Clinic, Madison, WI. (Sponsor: Joseph Weir, FACSM)  
Email: blyholder@wisc.edu  
(No relationships reported)

Exercise during pregnancy has many known maternal health benefits. While most research on antenatal exercise has investigated the effects of aerobic training, few studies have examined how weight training during pregnancy may impact maternal health conditions. **PURPOSE:** To examine relationships between antenatal weight training and stress urinary incontinence (SUI), rectus abdominis (RA) separation, and musculoskeletal pain in an active postpartum population. **METHODS:** Thirty running organizations throughout the U.S. were contacted to distribute an anonymous, online survey to their female members. Participants included 648 women with at least 1 child who were running a minimum of once per week. The survey consisted of questions regarding maternal history, exercise during pregnancy, and postpartum health conditions. Statistical analyses were restricted to women who reported giving birth within the last 2 years (n=244), unless otherwise specified. Associations were calculated using two-sided Chi-square tests and logistic regression. **RESULTS:** Antenatal weight training was significantly associated with lower odds of postpartum SUI (OR=0.49, 95% CI=0.24–0.98, p=0.044) and RA separation (OR=0.46, 95% CI=0.25–0.83, p=0.009), as well as postpartum musculoskeletal pain after adjusting for antenatal musculoskeletal pain (OR=0.52, 95% CI=0.28–0.95, p=0.033). Among women who did not weight train during pregnancy, antenatal pain was significantly associated with postpartum pain (OR=3.14, 95% CI=1.51–6.70, p=0.002). This association was insignificant among women who reported weight training during pregnancy (OR=1.97, 95% CI=0.72–5.35, p=0.167). When analyses were expanded to include women who gave birth within the last 10 years (n=531), vaginal delivery was significantly associated with postpartum SUI among women who did not weight train during pregnancy (OR=1.76, 95% CI=1.06–2.97, p=0.029). This association was insignificant among women who reported weight training during pregnancy (OR=1.30, 95% CI=0.59–3.14, p=0.513). **CONCLUSION:** Antenatal weight training may be beneficial in reducing postpartum pain, SUI, and RA separation.

2312 June 2, 4:00 PM - 4:15 PM

### Physical Activity during Pregnancy and Postpartum Depressive Symptoms

Ashley Heslep, David L. Nichols, FACSM, Kyle Biggerstaff, Vic Ben-Ezra. *Texas Woman's University, Denton, TX.*  
(No relationships reported)

**PURPOSE:** To determine the association of physical activity during the third trimester of pregnancy with postpartum depression symptoms. **METHODS:** Data were obtained from the Centers for Disease Control (CDC) through the Pregnancy Risk Assessment Monitoring System (PRAMS). Phase 5 of PRAMS was used for the current study. Women who participated in PRAMS completed a survey with questions regarding pregnancy-related issues, physical activity frequency, depression symptoms, demographic, and other health-related items. Participants received access to the survey 2-4 months postpartum. For the current study, women were classified as having feelings of postpartum depression (yes or no) based on their responses to two questions on the survey. Logistic regression was then used to examine the association between physical activity and feelings of postpartum depression in 20,258 mothers. Additional data from PRAMS on income during pregnancy, stress, occurrence of physical abuse during pregnancy, age, multivitamin use, current smoking status, current drinking status, and weight were used as covariates in an adjusted model. **RESULTS:** Women had a mean age of 28 ± 6.3 years and 5.5% of the sample self-reported experiencing postpartum depression symptoms. Compared to sedentary mothers, exercising or being physically active 1-4 days/week during the third trimester significantly decreased the odds of having feelings of postpartum depression, in both an unadjusted (OR = 0.68; 95% CI: 0.59-0.77) and adjusted analyses (OR = 0.70; 95% CI: 0.61-0.81). Being active 5 or more days/week in the third trimester had no association with feelings of postpartum depression in either the unadjusted (OR = 0.90; 95% CI: 0.74-1.09) or adjusted analyses (OR = 0.91; 95% CI: 0.74-1.13). **CONCLUSION:** Thus, physical activity done 1-4 days/week during the third trimester was associated with a reduced prevalence of feelings of postpartum depression. However, since there was no reduction in the odds of feelings

of postpartum depression when activity was performed 5 or more days/week, it appears that frequency of physical activity may play a role in the association between physical activity and postpartum depression.

2313 June 2, 4:15 PM - 4:30 PM

### Relations Between Smoking and Serum Lipid Levels in Mid-To- Late Pregnancy

Cameron Meyer. *Michigan State University, East Lansing, MI.*  
(Sponsor: Lanay Mudd and Karin Pfeiffer, FACSM)  
Email: meycercam@msu.edu  
(No relationships reported)

MWACSM Abstract

Cameron A. Meyer<sup>1</sup>, Alicja B. Stannard<sup>1</sup>, Karin A. Pfeiffer<sup>1</sup>, FACSM, Lanay M. Mudd<sup>2</sup>, FACSM

<sup>1</sup>Michigan State University, Department of Kinesiology, East Lansing, Michigan  
<sup>2</sup>National Center for Complimentary and Integrative Health, Bethesda, Maryland  
While serum lipid levels increase during pregnancy, excessively high lipids in mid-pregnancy are associated with adverse pregnancy outcomes. Smoking has been associated with adverse lipid profiles in non-pregnant adults, but this association has not been adequately explored during pregnancy.

**PURPOSE:** To examine relations between smoking and lipids among women in their second (T2) and third trimesters (T3).

**METHODS:** Seventy-eight gravidas were recruited from a Midwest OBGYN clinic. Women completed a questionnaire on health behaviors, which included current smoking (any/none) and pre-pregnancy smoking (any/none). Non-fasting finger stick blood draws measured total cholesterol (TC), triglycerides (TG), high- (HDL) and low-density lipoprotein (LDL) in mg/dl. Data were analyzed separately for women in the T2 and T3. Independent t-tests were used to determine whether mean lipid levels differed by current or pre-pregnancy smoking.

**RESULTS:** Among 2<sup>nd</sup> trimester women, 9 (19%) reported current smoking while 21 (45%) reported pre-pregnancy smoking. Five (18%) of 3<sup>rd</sup> trimester women were current smokers, while 11 (41%) smoked pre-pregnancy. There were no significant differences in lipid levels by pre-pregnancy or current smoking for 2<sup>nd</sup> or 3<sup>rd</sup> trimester women. However, TC, LDL and TG levels tended to be higher among current smokers in both trimesters, and these differences approached statistical significance when comparing TG levels for smokers in the 3<sup>rd</sup> trimester (mean: 254 mg/dl) to non-smokers (mean: 203 mg/dl, p-value = 0.08).

**CONCLUSION:** While our results were not significant, current smokers tended to have higher lipids, particularly in the 3<sup>rd</sup> trimester. This pilot study is limited by a small sample size, thus larger studies are warranted to see if the relationship between smoking and serum lipid levels during pregnancy shows significance. Future studies should examine how other health behaviors, like physical activity and diet, may also contribute to lipid changes during pregnancy.

2314 June 2, 4:30 PM - 4:45 PM

### Maternal Physical Activity During Pregnancy: Association With The Newborn's Bone Health

Michèle Bisson<sup>1</sup>, Étienne Pronovost<sup>1</sup>, Odette St-Onge<sup>1</sup>, Julie Robitaille<sup>2</sup>, Isabelle Marc<sup>1</sup>. <sup>1</sup>CHU de Québec-Université Laval, Québec, QC, Canada. <sup>2</sup>INAF-Université Laval, Québec, QC, Canada.

Email: michele.bisson@crchudequebec.ulaval.ca  
(No relationships reported)

**PURPOSE:** Maternal physical activity during pregnancy influences infant's birth weight and body composition, but its association with bone health has been poorly evaluated. This study aims at documenting in a longitudinal study the effect of objectively measured physical activity during pregnancy on infant's bone mineral content (BMC) and density (BMD).

**METHODS:** 7-day accelerometry recordings (Actigraph GT3X+) were performed in low-risk pregnant women at 17 and 36 weeks of gestation. BMC and BMD were evaluated by DXA in mothers and infants within 2 weeks after birth. Sociodemographics, maternal lifestyle habits, pre-pregnancy physical activity, medical history and pregnancy outcomes were collected through interview and charts' review. Mean counts per minute (CPM) and daily time spent at moderate and vigorous physical activity (MVPA) were calculated for each period from accelerometry data. The association between physical activity data and infant's BMC and BMD was evaluated through multiple regression models, adjusting for infant sex and length, parity, maternal pre-pregnancy BMI, gestational weight gain, multivitamin use, gestational age at delivery, infant's age at DXA, maternal BMD and pre-pregnancy physical activity.

**RESULTS:** For this preliminary analysis, DXA assessment and accelerometry data for at least one visit were available for 108 pregnant women (age=29.7 ± 3.7 y; pre-pregnancy BMI=23.6 ± 4.7 kg/m<sup>2</sup>; 59.3% nulliparous) and their baby (birth weight=3451 ± 424 g; gestational age=39.7 ± 1.2 weeks; 45.4% boys). Daily time spent at MVPA at 17 weeks was negatively associated with infant's BMC and BMD

( $\beta = -0.45$  g and  $-0.0009$  g/cm<sup>3</sup> per 10 min of MVPA,  $p=0.033$  and  $0.026$ ), after adjustment for confounders. Similarly, mean CPM at 17 weeks was significantly associated with infant's BMC and BMD ( $\beta = -1.92$  g and  $-0.004$  g/cm<sup>3</sup> per 100 CPM,  $p=0.010$  and  $p=0.004$ ). Mean CPM at 36 weeks was also associated with child's BMC ( $\beta = -0.004$  g/cm<sup>3</sup> per 100 CPM,  $p=0.024$ ).

**CONCLUSIONS:** Higher levels of maternal physical activity measured by accelerometry during pregnancy were associated with a decrease in infant's BMC and BMD. The impact of maternal nutrition on this association remains to be investigated. Supported by the Fondation des Étoiles, Canadian Institutes of Health Research and Fonds de Recherche du Québec-Santé.

2315 June 2, 4:45 PM - 5:00 PM

**A Randomized Lifestyle Intervention Trial to Prevent Gestational Diabetes: Effects on Self-rated Health from Pregnancy to Postpartum**

Elina Engberg<sup>1</sup>, Beata Stach-Lempinen<sup>2</sup>, Kristiina Rönö<sup>3</sup>, Hannu Kautiainen<sup>2</sup>, Johan G. Eriksson<sup>3</sup>, Saira B. Koivusalo<sup>3</sup>. <sup>1</sup>University of Helsinki, Helsinki, Finland. <sup>2</sup>South-Karelia Central Hospital, Lappeenranta, Finland. <sup>3</sup>University of Helsinki and Helsinki University Hospital, Helsinki, Finland.

Email: elina.engberg@helsinki.fi

(No relationships reported)

Self-rated health is a strong predictor of both morbidity and mortality. Gestational diabetes mellitus (GDM) has been associated with adverse self-rated health even three to five years after the diagnosis.

**PURPOSE:** To examine the effects of a lifestyle intervention trial on self-rated health from first trimester of pregnancy to 12 months postpartum in women at high risk for GDM.

**METHODS:** This study is part of the Finnish Gestational Diabetes Prevention Study (RADIEL); a multi-center randomized controlled trial targeting women at high risk for GDM in a primary health care setting. Women with a history of GDM and/or prepregnancy BMI  $\geq 30$  kg/m<sup>2</sup> were enrolled at  $<20$  weeks of gestation. In this study, we included women who answered the question on self-rated health at baseline ( $n=266$ ). The intervention group ( $n=144$ ) received individualized counseling on diet, physical activity and weight management from trained study nurses at six time-points (first, second and third trimester and six weeks, six months and 12 months postpartum) and had a group meeting with a dietitian once during the pregnancy and twice during the postpartum period. The control group ( $n=122$ ) received standard antenatal care. Self-rated health was assessed by a single question with five response options ranging from good (1) to poor (5). Baseline adjusted mean changes in self-rated health level were assessed using the mixed-model for repeated measure methods.

**RESULTS:** The mean (SD) for self-rated health at baseline was 1.8 (0.8) in the intervention group and 2.1 (0.9) in the control group. Self-rated health changed over time across the six time-points (time effect  $p<0.001$ ) and was poorest in the third trimester. There was a trend that self-rated health improved in the intervention group and worsened in the control group from first trimester to 12 months postpartum, but the difference between the groups did not reach statistical significance (group effect  $p=0.064$ ).

**CONCLUSION:** Self-rated health level varied over time during pregnancy and the postpartum period but the lifestyle counseling intervention did not improve self-rated health when compared to the control group.

2316 June 2, 5:00 PM - 5:15 PM

**Impact Of Physical Activity During Pregnancy On Obstetric Outcomes In Obese Women**

Rachel A. Tinius<sup>1</sup>, Alison G. Cahill<sup>2</sup>, W.Todd Cade<sup>2</sup>. <sup>1</sup>Western Kentucky University, Bowling Green, KY. <sup>2</sup>Washington University School of Medicine, Saint Louis, MO. (Sponsor: James M. Green, FACSM)

Email: rachel.tinius@wku.edu

(No relationships reported)

Maternal obesity is associated with complications and adverse outcomes during labor and delivery. In pregnant women with a healthy body weight, maternal physical activity during pregnancy is associated with better obstetric outcomes (e.g. shorter labors, less incidence of surgical delivery); however, the effects of maternal physical activity during pregnancy on obstetric outcomes in obese women is not known.

**PURPOSE:** To determine the influence of self-reported physical activity on obstetric outcomes in pregnant obese women. **METHODS:** A retrospective chart review was performed on 48 active obese women and 48 inactive obese women ( $N=96$ ) who received prenatal care and delivered at the medical center during the past five years. Physical activity level was determined by clinic-administered questionnaires and personal telephone calls. Obstetric and neonatal outcomes were compared between active and inactive groups. **RESULTS:** Obese women who were active during pregnancy spent less total time in labor (13.4 hours vs. 19.2 hours,  $p=0.048$ ) and were less likely to request an epidural (92% vs. 100%,  $p=0.04$ ). When stratified by parity,

active multiparous women spent significantly less total time in labor compared to inactive multiparous (6.2 hours vs. 16.7 hours,  $p=0.018$ ). Inactive women tended to be more likely to exceed gestational weight gain guidelines and develop gestational hypertension; however, these results did not reach statistical significance. There were no differences between groups in rates of cesarean deliveries or neonatal outcomes. **CONCLUSION:** Maternal physical activity during pregnancy appears to improve obstetric outcomes in obese women, and improvement may be more pronounced among multiparous women. Our finding is of particular importance as pregnant obese women are at higher risk for adverse and delivery outcomes.

**D-68 Clinical Case Slide - Lower Extremity Issues II**

Thursday, June 2, 2016, 3:15 PM - 4:55 PM

Room: 206

2317 **Chair:** Thomas Best, FACSM. *The Ohio State University, Columbus, OH.*

(No relationships reported)

2318 **Discussant:** Pierre L. Viviers, FACSM. *Stellenbosch University, Stellenbosch, South Africa.*

(No relationships reported)

2319 **Discussant:** William Mann. *Naval Health Clinic New England, Sports Medicine, Newport, RI.*

(No relationships reported)

2320 June 2, 3:15 PM - 3:35 PM

**Leg Pain in Swimmer**

Barry Rott, Mark Lavallee, FACSM. *Wellspring Hospital, York, PA.* (Sponsor: Mark Lavallee, FACSM)

Email: brott@wellspring.org

(No relationships reported)

**HISTORY:** 20 year old NCAA Div. 3 female swimmer who was recently diagnosed with Hashimoto's thyroiditis and placed on Levothyroxine 50mcg, about one month prior to presentation with no other significant PMH. She was running on the treadmill when she developed pain over the lateral right ankle. This was her only third time training on a treadmill, she typically does not run. She denied any trauma or falling while on the treadmill. She immediately stopped running, thinking the pain would subside, however it did not. She reported to the athletic trainer at her college. Her monthly menses that had not changed in frequency or intensity.

**PHYSICAL EXAMINATION:** Well developed, well nourished, in NAD, slight limp. Thyroid: slight enlarged, no nodules. Skin: not dry Hair: not falling out CV: RRR, no murmurs, rubs. MSK: demonstrated normal strength, intact gross sensation of the foot and ankle, with TTP over the distal fibula, no deformity, minimal swelling of distal fibula. Her fibular rock test was negative. Her ATFL, CFL, and PTFL were all intact. Distal sensation was intact. Single leg heel raise was painful but could perform.

**DIFFERENTIAL DIAGNOSIS:** 1) Lateral Ankle Sprain

2) Distal Tibia or Fibula occult or pathologic fracture

3) Tarsal Tunnel syndrome

4) Gout/ Pseudogout

5) Peroneal Tendon subluxations vs. tear

6) Degenerative Joint Disease

7) Osteochondral Lesion of Talus

8) Distal Fibular Stress Fracture

9) Popliteal Artery Entrapment

10) Exertional Compartment Syndrome

**TEST AND RESULTS:** X-rays demonstrated a non-displaced transverse fracture of the distal fibula just proximal to level of the mortise. CBC: WNL, Chem 7: WNL. Following labs were ordered: PTH, TSH, estrogen, CBC and vitamin D levels. **FINAL WORKING DIAGNOSIS:** Non-traumatic Distal Fibular fracture in a swimmer

**TREATMENT AND OUTCOMES:** She was placed in Short leg cast and made non-weight-bearing for 6 weeks. She progressed and did well. Lab work that was ordered was never acquired. She ended up transferring to a college in Colorado. Phone follow up was done. She has returned to swimming without issue. She no longer runs.

2321 June 2, 3:35 PM - 3:55 PM

**Successful Treatment Of The Underlying Cause Of ITB Syndrome**Lindsay Troilo, Irene Davis, FACSM. *Spaulding Outpatient Center Cambridge, Cambridge, MA.* (Sponsor: Irene Davis, FACSM)*(No relationships reported)*

**HISTORY:** Patient is a 28 yr. old female who developed pain at her L lateral knee at the end of a marathon. Pain persisted after the marathon and gradually extended to the hip and lateral thigh. She was treated with Active Release Therapy and foam rolling, as well as yoga to address her core strength. She returned to running with low-grade pain, which increased with more than 3-4 miles of running or an increase in her speed. Patient reported a VAS of 1/10 pain in the L hip and leg today, but symptoms will increase to a 7/10.

**PHYSICAL EXAMINATION:** Pain noted along the L iliac crest, gluteals, along the iliotibial band (ITB) down to Gerty's tubercle. Weakness of her L hip extensors, abductors and external rotators was also noted. The patient presented with a (+) Ober's test, L>R. During running, she presented with a contralateral hip drop L>R during mid stance. Patient also exhibited increased femoral adduction L>R. At the foot, she presented with pes planus, decreased ankle dorsiflexion and lack of intrinsic and extrinsic foot strength. This was associated with prolonged midfoot pronation. Patient landed with increased impacts L>R. Impacts were reduced by half when running with a forefoot strike pattern.

**DIFFERENTIAL DIAGNOSIS:**

Sciatica from lumbar spine, LCL strain

**FINAL/WORKING DIAGNOSIS:**

ITB syndrome, associated with abnormal foot and hip mechanics.

Hip adduction is associated with increased ITB strain, as well as ITB syndrome.

Increased foot pronation leads to increased knee internal rotation, which is also associated with ITB syndrome. Increased impact loading has been related to the development of injuries in runners.

**TREATMENT:**

Goal: Reduce the mechanics associated with ITBS

1. Progressive intrinsic and extrinsic foot strengthening and hip strengthening exercises to provide capacity for improving foot and hip mechanics.
2. Soft tissue mobilization of tight ITB, increase ROM of ankle dorsiflexors to reduce compensatory pronation
3. Gait training to decrease contra-lateral hip drop, femoral adduction and foot pronation
4. Transition to a forefoot running pattern, in minimal footwear, to reduce impact loading as well as facilitate foot strengthening.

**OUTCOME:**

Hip adduction and foot pronation was reduced and patient was able to run for 3 miles pain-free at discharge.

2322 June 2, 3:55 PM - 4:15 PM

**Thigh Compartment Syndrome in a Factor VII Deficient High School Football Player**Jeremy M. Burnham, Jessica McQuerry, Raymond Wright, Mary Lloyd Ireland, FACSM. *University of Kentucky, Lexington, KY.* (Sponsor: Mary Lloyd Ireland, FACSM)

Email: jeremy.burnham@uky.edu

*(No relationships reported)*

**HISTORY:** 16 year old male football player presented to the ER 1 week after sustaining a direct blow to his right thigh. He complained of increased thigh pain, difficulty bending his knee, and trouble sleeping. He reported that the pain had worsened steadily since the initial injury, with significantly increased pain in the last 12 hours. He denied any numbness or tingling.

**PHYSICAL EXAMINATION:** Noticeable swelling of his right thigh with associated tenderness to palpation. Anterior compartment of thigh firm. + Pain with passive flexion of the knee, and 0/5 knee extension. Neurovascularly intact distally, palpable pedal pulses.

**DIFFERENTIAL DIAGNOSIS:**

1. Delayed onset compartment syndrome
2. Thigh hematoma
3. Muscle strain
4. Fracture

**TEST AND RESULTS:**

1. Imaging: Plain films of the hip, femur, and knee showed no acute bony abnormalities. A CT scan of the thigh showed a large hematoma in the anterior compartment.
2. Labs: WBC and CBC within normal limits. INR was 1.6 and PTT was 33 (normal is 20-31).

**FINAL WORKING DIAGNOSIS:** Delayed onset thigh compartment syndrome due to a traumatic thigh hematoma and possible undiagnosed clotting abnormality.

**TREATMENT AND OUTCOMES:** The patient was taken emergently to the operating room where an IT-band fasciotomy of the anterior thigh compartment was performed. The wound was packed open and closed on a delayed basis. His pain immediately improved postoperatively and he regained quadriceps function slowly over the following weeks. Pediatric hematology was consulted and initiated a thorough workup which ultimately led to a diagnosis of Factor VII deficiency. The patient was started on a Factor VII replacement regimen. At his six-week follow up his quadriceps strength was 4+/5 and he had started a strengthening program with physical therapy.

2323 June 2, 4:15 PM - 4:35 PM

**Thigh Pain-football**Joseph Edison<sup>1</sup>, Mark Rogers<sup>1</sup>, Anthony McPherron<sup>2</sup>, Kieth Doolan<sup>2</sup>, Matt Wallman<sup>2</sup>, Michael Polascik<sup>2</sup>, Matt O'Reilly<sup>3</sup>, Delmas Bolin, FACSM<sup>2</sup>. <sup>1</sup>Virginia Tech/VCOM, Blacksburg, VA. <sup>2</sup>Virginia Tech, Blacksburg, VA. <sup>3</sup>VCOM, Blacksburg, VA. (Sponsor: Delmas Bolin, FACSM)*(No relationships reported)***Thigh Pain - Football**

Authors: Joseph Edison, Mark Rogers, Anthony McPherron, Keith Doolan, Matt Wallman, Michael Polascik, Mathew O'Reilly, Delmas Bolin

Sponsor: Delmas Bolin MD FACSM

**History**

18 year old NCAA Division 1 football player presents with right quad pain during a scrimmage. The exact mechanism was unclear but review of video and witnesses shows he was tackled from behind. Right hip in extension with the knee in full flexion feeling a pop as he was falling back. Immediate pain in the Vastus Medialis Obliquus (VMO) region and he was unable to continue. Evaluation after practice and the following morning demonstrated worsening pain and swelling.

Past History includes high ankle sprain. No surgeries.

Medications include Doxycycline for acne, Celecoxib and Hydrocodone-Acetaminophen for pain.

Vital signs: BP 118/64, HR 62, weight 193 pounds, Height 5'11

General: Well developed, no acute distress. He had significant guarding. Right thigh marked tenderness to palpation over VMO, rectus femoris - quad tendon junction, and insertion of quad tendon at the superior pole of the patella. Patella stable with no apprehension sign. Negative patellar grind. No joint effusion. Joint was stable.

Tolerates SLR; patient reports pain in the quad tendon, and VMO region. Neuro: No sensory deficits. Vascular intact and 2+ pulses.

**Differential Diagnosis**

1. VMO tear
2. Quad tendon tear
3. Quad contusion
4. ACL tear
5. Patella Fracture
6. Patella Avulsion Fracture

**Tests and Results**

-Initial US shows edema and fluid in the VMO region, but the quad tendon itself was intact on its most superior aspect.

-F/U US 24 hours post injury showed partial quad tendon and/or VMO tear

-MRI results showed a vertical quad tendon tear with horizontal involvement.

**Final Diagnosis**

1. Quad Tendon Tear

**Treatment**

1. Orthopedic consultation
2. Platelet Rich Plasma injection to tear
3. Placed in immobilizer - Initial mobilization to begin at 6 weeks
4. Sports specific rehabilitation beginning in 6 weeks

2324 June 2, 4:35 PM - 4:55 PM

**Leg Pain- Adolescent Male Triathlete.**Amy E. Valasek. *Nationwide Children's Hospital; The Ohio State College of Medicine, Westerville, OH.* (Sponsor: James MacDonald, FACSM)

Email: amy.valasek@nationwidechildrens.org

*(No relationships reported)***HISTORY:**

17 year old male triathlete presented for initial evaluation for right thigh pain radiating to the calf. Injury occurred when squatting with weights one week prior. He initially felt a sharp pain right groin but was able to continue. Four days later he ran 6 miles and groin/thigh pain increased. Two days later pain radiated from groin to calf. At day seventh day he presented with a limp and right leg swelling. He is recreationally training for triathlon and current weekly regimen includes 10 miles running, 50 miles on bike, 5 days of swimming.

**PHYSICAL EXAMINATION:**Ht 195.8 cm (77.09") Wt 77.1 kg (169 lb 15.6 oz) BMI 20.11 kg/m<sup>2</sup>

On exam he ambulates with right leg externally rotated and significant limp. There is no pelvic bony tenderness throughout. 4/5 strength right quadriceps and hamstring limited due to pain. Pain with active and passive range of motion of right ankle and knee. Tender to palpation of right thigh and right calf. Right thigh swollen and 4 cm greater than left. Right calf swollen and 2 cm greater than left. Non-pitting edema of the right ankle with 2+ posterior tibial pulse and 1+ dorsalis pedis pulse. Sensation and reflexes intact.

**DIFFERENTIAL DIAGNOSIS:**

Pelvic mass/space occupying lesion  
DVT

Stress fracture femoral neck  
Muscular strain

**TEST AND RESULTS:**

Radiographs of the pelvis, femur and tibia demonstrated no osseous abnormality. Right lower extremity ultrasound demonstrated extensive occlusive venous thrombus extending from posterior tibia and peroneal veins to the level of the proximal superficial femoral vein and common femoral vein.

**LAB STUDIES:**

D-dimer > 50

**FINAL WORKING DIAGNOSIS:** Unprovoked DVT

**TREATMENT AND OUTCOMES**

He had catheter placement and TPA infusion in the right lower extremity for thrombolysis. The TPA was continued for 14 hours without any event and clot in the femoral vein resolved. He was transitioned enoxaparin subcutaneous for residual clot in below the knee. At two week follow up the ultrasound demonstrated full resolution of thrombus.

**SUMMARY**

Investigation for his spontaneous clot included inherited and acquired causes of thrombosis. Mildly low protein C levels were found. At 3 month follow up he remains on enoxaparin SQ, shows no signs of post-thrombotic syndrome, and is awaiting genetic testing PROC1 gene.

**D-69 Clinical Case Slide - Oncology II**

Thursday, June 2, 2016, 3:15 PM - 4:35 PM  
Room: 202

2325 **Chair:** Benjamin Hasan. *Northwest Community Hospital Medical Group, Arlington Heights, IL.*  
(No relationships reported)

2326 **Discussant:** Jeffrey M. Mjaanes, FACS. *Rush University Medical Center, Chicago, IL.*  
(No relationships reported)

2327 **Discussant:** David Smith. *University of Minnesota, Minneapolis, MN.*  
(No relationships reported)

2328 June 2, 3:15 PM - 3:35 PM  
**Malignant Ovarian Tumor In A Tennis Pro: A Case Report**

Donald L. Hoover, William R. VanWye, M. Laurie Branstetter. *Western Kentucky University, Bowling Green, KY.* (Sponsor: Alan E. Mikesky, FACS)  
Email: don.hoover.pt.phd@gmail.com  
(No relationships reported)

**HISTORY:** A 23 year old apparently healthy, former-Division I tennis player and current tennis pro presented for evaluation in a physical therapy scenario. She was asymptomatic, participated in fitness activities on a near-daily basis, and regularly offered tennis lessons to youth in the community. The client's medical history was positive for an intra-abdominal procedure as a child for removal of a "cyst".

**PHYSICAL EXAMINATION:** Routine screen and examination of all physiological systems revealed a palpable mass approximately 12 cm diameter across the left and right lower abdominal quadrants and extending from the symphysis pubis to 2 cm below the umbilicus; the mass was ballotable without discomfort. The abdomen was slightly rounded in the right and left lower quadrants, with a well-healed midline scar from the suprapubic region to 1 cm below the umbilicus. The client's skin was evenly colored without lesions, telangiectasia, or venous patterns. Typical bowel sounds were auscultated in all abdominal quadrants, no bruits or venous hums were present. The abdomen was non-pulsatile, there was unusual dullness to percussion over the left and right lower quadrants, no palpable hepatosplenomegaly, and the kidneys were non-tender.

**DIFFERENTIAL DIAGNOSIS:**

1. Pregnancy
2. Cyst
3. Hernia
4. Tumor

**TEST AND RESULTS:**

1. Abnormal presentation/ screening findings for an asymptomatic individual.
  2. Urgent referral to client's gynecologist (GYN), who completed an office visit the next day.
  3. GYN subsequently performed diagnostic ultrasound and scheduled client for exploratory surgery.
  4. Client underwent surgery within 8 days of initial evaluation in physical therapy.
- FINAL WORKING DIAGNOSIS:** Suspicious for abdominal tumor.  
**TREATMENT AND OUTCOMES:** The client underwent abdominal surgery, in which a 5 kg ovarian mass with clear margins was successfully removed. Post-surgical biopsy on the mass indicated it was a malignant ovarian tumor. She returned to previous activities when released by her surgeon. Follow-up tests at 6 months (endoscopy, colonoscopy, and CT Scan) were negative and at 7 months (genetic testing) were inconclusive. This case report highlights a routine systems screen by a primary care provider that resulted in identification of pathology in an asymptomatic individual.

2329 June 2, 3:35 PM - 3:55 PM

**Right Groin Pain - Basketball**

John Luksch, Kevin DuPrey, David Webner. *Crozer-Keystone Health System, Springfield, PA.* (Sponsor: Thomas Kaminski, ATC, PhD, FACS)  
Email: john.luksch@gmail.com  
(No relationships reported)

**History:** A 12-year old male presented with right groin pain that started immediately after a quick cut during basketball. He felt a pop with immediate pain, localized to the proximal adductor. Pain improved after a week of rest but increased with return to basketball. Pain was worse with hip flexion and better with rest.

**Physical Examination:** Right hip: There was moderate tenderness along the proximal adductor muscle extending to the lesser trochanter but no tenderness over the ASIS, AHS, greater trochanter or pubic symphysis. There was pain with active flexion, adduction and abduction and full passive ROM with flexion, internal rotation and external rotation. Strength was 5/5, except for 4+/5 with abduction. Log roll was negative. There was anterior pain with FABER and FADIR testing.

**Differential Diagnosis:**

1. Adductor strain
2. Avulsion fracture of the lesser trochanter
3. Slipped capital femoral epiphysis
4. Acetabular labral tear
5. Athletic pubalgia
6. Avascular necrosis of the femoral head/Legg-Calvé-Perthes Disease
7. Femoral neck stress fracture
8. Iliopsoas bursitis

**Test and Results:****Right Hip Ultrasound:**

- Small area of hypoechoogenicity in the proximal adductor musculotendinous unit

**Right Hip/Pelvis X-ray:**

- Sclerosis of medial intertrochanteric region of the right femur
- Ill-defined lucent lesions within the right ischium and right proximal femoral diaphysis, no bony expansion or periosteal reaction

**Whole Body Nuclear Bone Scan:**

- Increased uptake in the bilateral long bones

**MRI Right Hip**

- Multifocal regions of intramedullary signal abnormality involving bilateral proximal femurs
- Lobulated fluid signal lesion within the right posterior acetabular column/ischium
- No bone marrow edema, stress fracture or reaction, or soft tissue injury

**Final/Working Diagnosis:**

Right Proximal Adductor Strain with underlying Polyostotic Fibrous Dysplasia

**Treatment and Outcomes:**

1. Labs showed elevated Alkaline Phosphatase, normal PTH and Calcium
2. Referral to Orthopedic Oncology
3. Biopsy confirmed Polyostotic Fibrous Dysplasia
4. MRI with and without contrast to evaluate cystic lesion
5. Endocrinology evaluation
6. Physical Therapy

**Outcome -** Five weeks after initial visit, patient was pain free and cleared to return to sport with Orthopedic Oncology and Endocrinology follow up.

2330 June 2, 3:55 PM - 4:15 PM

**Lump on Left Leg - Runner**

Jeremy A. Alland. *Rush University Medical Center, Chicago, IL.*  
(Sponsor: Jeffrey Mjaanes, MD, FACSM)  
Email: jeremy.alland@gmail.com  
(No relationships reported)

**HISTORY:**

A 33-year-old healthy female runner presents to clinic with concerns of a lump on her left thigh. She initially noticed a small, painless lump two years ago. She saw her primary care physician who told her to observe closely and notify him if any growth or pain. She did not notice any changes until two months ago when she was unable to set her foot on the ground at a movie theatre secondary to pain in her leg. She felt her thigh and noticed the lump was larger. She had also intentionally lost ten pounds over the last several months, which had made the lump more prominent. She currently has intermittent aching pain. She has had to cease all running due to pain in the thigh. She denies numbness, tingling, fevers, chills or sweats. She has no medical history, takes no medications and has no family history of cancer.

**PHYSICAL EXAMINATION:**

Well appearing female. 5'7" and 150 lbs. Normal vital signs. There is a palpable firm, non-mobile, non-tender mass along the medial aspect of her proximal left thigh. The mass can be traced posteriorly to lateral aspect of the mid-thigh. No warmth or erythema. Full hip range of motion, negative FADIR/FABER tests and normal straight leg raise. No pain with any resisted motions of hip and knee, except for minimal discomfort with hamstring strength testing. She has a normal sensation to light touch and 2+ peripheral pulses throughout. Skin exam is normal.

**DIFFERENTIAL DIAGNOSIS:**

1. Tumor: Malignant (i.e. rhabdomyosarcoma, liposarcoma) vs Benign (i.e. rhabdomyoma, lipoma)
2. Chronic Muscle Tear
3. Chronic Hematoma
4. Abscess

**TEST AND RESULTS:**

AP and Lateral Radiographs of Left Femur:

— No bony abnormalities. The mass is visible in the soft tissue.

MRI w/ & w/o Contrast of Left Femur:

— Ill-defined cerebriform appearing mass in deep medial compartment of the thigh deep to the semimembranosus and semitendinosus.

— 18.0 x 13.0 x 10.5 cm in the CC, TV and AP dimensions, respectively

— Heterogenous enhancement and multiple central areas of necrosis

— Adjacent femur with no periosteal reaction or marrow abnormalities

Tissue Biopsy: Myxoid Liposarcoma

**FINAL WORKING DIAGNOSIS:**

Myxoid Liposarcoma, left thigh

**TREATMENT AND OUTCOMES:**

1. Referred to Orthopedic Oncology
2. Beginning chemotherapy followed by radiation therapy, then surgical resection
3. Further outcome pending

2331 June 2, 4:15 PM - 4:35 PM

**Leg Pain - Swimming**

Kelly Estes. *The Ohio State University, Columbus, OH.*  
(Sponsor: James Borchers, FACSM)  
Email: drkellyestes@gmail.com  
(No relationships reported)

**History**

A 19 year-old female division I collegiate swimmer presented to the training room early into the season with two days of bilateral calf pain. She reported gradual onset of pain while in the middle of kick sets, left more than right. The athletic trainer massaged the areas, which made the pain worse. Her symptoms progressed to pain with walking. She denied fever, nausea, vomiting, back pain. She reported dark-colored urine and associated numbness to the bilateral calves. She had been cross training by running over the summer.

**Physical Examination**

Skin- Bilateral lower extremities with quarter-sized ecchymosis to the posterior mid calves.

Msk- Compartments supple and soft. Fullness to the patella fossa bilaterally. +TTP to the bilateral mid and distal anterior tibia. No cervical/thoracic/lumbar TTP. Normal active range of motion to the knee and ankle. Pain reproduced with resisted plantarflexion and standing toe raises.

Full strength to the bilateral lower extremity.

Neuro- 2+ DP and PT pulses bilaterally. 2+ patellar and ankle reflexes bilaterally. Sensation intact to light touch throughout. Special Tests- +tuning fork testing at the bilateral tibias.

**Differential**

**Diagnosis**

1. Rhabdomyolysis
2. Stress response/Medial tibial stress syndrome
3. Exertional Compartment Syndrome
4. Muscle spasm
5. Radiculopathy

**Tests and Results**

CK 555

Mg 2.1

BUN/Na/K/Cl/CO2/Cr 18/141/3.5/107/26/91/0.88

**XR left tibia/fibula**

6.5 x 3.6 x 3.7 cm lucent expansile lesion of the proximal left tibia is associated with cortical thinning. This lesion may represent a giant cell tumor or chondroblastoma, however the epiphysis is uninvolved.

**MRI left tibia**

1. Mixed signal lesion within the proximal lateral tibial diaphysis likely

representing a fibrous lesion such as a nonossifying fibroma. Given the size of the lesion, the location and significant cortical thinning there may be an impending fracture.

2. Stress response of the mid tibia. No evidence of fracture.

**Final Working**

**Diagnosis**

Non-ossifying fibroma with tibial diaphyseal stress response

**Treatment and**

**Outcomes**

Athlete was referred to orthopedic oncology surgery due to the size and location of the mass. A discussion was had regarding conservative management versus surgical intervention for curettage and grafting. At the time of this writing surgery is scheduled.

**D-70 Clinical Case Slide - Spine II**

Thursday, June 2, 2016, 3:15 PM - 4:35 PM

Room: 203

2332 **Chair:** Gary P. Chimes. *Lake Washington Sports & Spine, Bellevue, WA.*

(No relationships reported)

2333 **Discussant:** Joseph Ihm, FACSM. *Rehabilitation Institute of Chicago, Chicago, IL.*

(No relationships reported)

2334 June 2, 3:15 PM - 3:35 PM

**Low Back Injury**

Nevin Ergun, FACSM<sup>1</sup>, Aynur Demirel<sup>1</sup>, Elif Özkaleli<sup>2</sup>, Mehmet Yörübulut<sup>3</sup>. <sup>1</sup>hacettepe university, ankara, Turkey. <sup>2</sup>Private Fonksiyon Physical Therapy Center, ankara, Turkey. <sup>3</sup>Acibadem Hospital, ankara, Turkey.

Email: nergun@hacettepe.edu.tr

(No relationships reported)

**HISTORY:** A 34-year-old woman has severe back and radiating right leg pain applied to our clinic. This was the second time coming to our clinic. When she came first, she applied with back and radiating pain to both legs. As to Magnetic Resonance Imagination (MRI) she had tear of annulus lomber 4 and 5 level intervertebral disc and severely bilaterally narrowed neural canal. A large, posterior median and right paramedian extrude disc protrusion was seen at L5-S1 level. At this level bilateral nerve canal narrowed and right S1 nerve root was compressed. After 21 sessions of non-invasive spinal decompression therapy applied, her pain was over. One week ago, after she weighted heavy bags, she felt back pain again.

**PHYSICAL EXAMINATION:** Paravertebral and right quadratus lumborum muscle spasm were palpated. Straight leg raise test were positive at 60° on right side. Valleix sign was positive on right sciatic nerve. There was no strenght and sensorial deficit. Lumbar lordosis decreased and lumbar "C" shaped scoliosis were noted.

**DIFFERENTIAL DIAGNOSIS**

Strain of lumbar paravertebral muscles

Radiating pain

Positive sciatic nerve provocation test

**TEST AND RESULTS**

Lumbar spine T1 and T2 weighted MRI:

– Posterior protrusion and annular tear at lumbar 4-5 level (annular tear and protrusion still exists)

– Broad-based posterocentral and right posterolateral transligamentous extrude herniation (extrude fragment's volume decreased from 12 mm to 8 mm comparing the first MRI)

**FINAL/WORKING DIAGNOSIS:**

Lumbar Disc Herniation (L5- S1 and L4-L5 level)

**TREATMENT AND OUTCOMES**

- 21 sessions of Non-invasive Spinal Decompression Therapy conservative protokol applied.
- During the first two weeks of therapy, lumbar orthoses was used to stabilization.
- Physiotherapist guided lumbar stabilization exercise applied to prevent reherniation (after non-invasive spinal decompression therapy was over).
- Advanced lumbar stabilization exercised taught as home programme.
- After therapy she has painless straight leg raise test and no radiating pain.

2335 June 2, 3:35 PM - 3:55 PM

**Sacrum Injury**

Özlem Güven Ülger, Aynur Demirel, Altan Şahin. *Hacettepe University, Ankara, Turkey.*

Email: ozlemulger@yahoo.com

(No relationships reported)

Özlem Ülger, Aynur Demirel, Altan Şahin, Hacettepe University, Ankara, Turkey

e-mail: ozlemulger@yahoo.com

(Sponsor : FACSM )

**HISTORY :** A 44-year-old secretary fell down from 4 meter above from the ground. After detailed physical and neurologic examination she had fixation operation due to fracture of left sacrum and pubic bones. While staying at the hospital , she had an decubitus ulceration on left sacroiliac joint and posterior inferior iliac spine. In spite of decubitus ulceration needed flapping, she rejected operatively treatment. After decubitus ulceration healed itself, she had pain on right side of sacrum and she had an corticostreoid injection on right sacroiliac joint. After injection, pain decreased but still exists.

**PHYSICAL EXAMINATION :** Examination of paravertebral muscles and T12- L5 spinos processes pain and moderate tenderness detected. There was no numbness, allodynia and reflex deficits. Both flexion and extension movements of back were painful. active lumbar flexion, her hands reached knee level. She could not sit symetrically. When she sits longer than ten minutes, she felt severe pain on sacrum.

**DIFFERENTIAL DIAGNOSIS**

- Strain of paravertebral, piriformis and Quadratus Lumborum muscles.
- Sacroiliac dysfunction
- Facet Joint Syndrome

**TEST AND RESULTS**

- Special provocation tests for sacroiliac joint
- Lomber facet Joint stress tests
- Pressure Pain Thresholds
- Back Performance Scale

**Treatment and Outcomes**

- Myofascial releasing technics applied to muscles and thoracolumbar fascia.
- Post-isometric relaxation technics for Piriformis and Quadratus Lumborum muscles on right side.
- Physiotherapist guided lumbar stabilization exercise
- Kinesiotaping application for scar tissue on decubitus ulceration area.
- After 4 months later she had painless sitting, standing and walking abilities.

2336 June 2, 3:55 PM - 4:15 PM

**A High School Football Player with Mid-back Pain**

Nancy Vuong, Melody Hrubes, Terry Nicola, FACSM. *University of Illinois at Chicago, Chicago, IL.* (Sponsor: Terry Nicola, MD, FACSM)

Email: NancyV120@gmail.com

(No relationships reported)

**A High School Football Player with Mid-back Pain****History:**

AR is a 17-year-old football player with mid back pain for the past two years. The pain began after he was thrown onto his back during a tackle, with the opposing player landing on top of his chest. He had some initial coughing that resolved within minutes and was able to complete the game. The pain started a few hours later. Since then AR has had intermittent episodes of achy dull pain that worsens with prolonged sitting and exercise. He denies any tingling, numbness, or weakness. He also denies any shortness of breath, coughing, or wheezing. AR has been able to continue playing football despite the pain.

**Physical Examination:**

Exam reveals normal respiratory effort with lungs clear to auscultation. Spine range of motion is full. There is no tenderness over the spinous processes. There are multiple taut bands palpable along the thoracic paraspinals that reproduce pain. Neurological testing is otherwise normal for gait, strength, sensation, and reflexes.

**Differential Diagnosis:**

1. Myofascial pain/thoracic paraspinal strain
2. Occult thoracic vertebral body fracture
3. Thoracic facet fracture

**Tests and Results:**

T-spine XR

-No evidence of fracture.

T-spine MRI

-Healed but displaced left medial T5 rib fracture with exuberant callus producing a pseudoarthrosis with a healed left T6 medial rib fracture.

-Indentation of the left posterior lung pleura by exuberant callus with atelectasis.

T-spine CT

-Unchanged bone callus along medial portion of the left T5 creating a pseudoarthrosis with the 6<sup>th</sup> rib, indenting the pleura.

**Final Working Diagnosis:**

Healed 5<sup>th</sup> and 6<sup>th</sup> rib fractures with hyperostosis resulting in a pseudoarthrosis and pleural effacement.

**Treatment and Outcomes:**

1. Physical therapy with focus on costovertebral and thoracic vertebral joint mobilization.
2. Deep breathing techniques and monitoring for respiratory symptoms.
3. Return to full contact play.



2337 June 2, 4:15 PM - 4:35 PM

**Back Pain in a Lacrosse Player**

Ashley D. Zapf, Kevin R. Vincent, FACSM. *University of Florida, Gainesville, FL.* (Sponsor: Dr. Kevin R. Vincent, FACSM)

(No relationships reported)

**History**

A 14yo male lacrosse player presented to sports medicine clinic with an acute exacerbation of chronic low back pain. The pain had originally started several years prior without inciting event or trauma. The patient had noted worsening of his back pain while participating in a lacrosse tournament 3 months earlier. In particular, he noticed pain during during hard overhand lacrosse shots. His back pain improved with rest after the tournament, however, he had a persistent “tightness” along the bilateral lumbar paraspinal muscles.

**Physical Exam**

Examination revealed mild hypertonicity and tenderness to palpation of the bilateral lumbar paraspinal muscles. The remainder of the examination was normal.

**Differential Diagnosis**

1. Lumbar Strain
2. Spondylosis
3. Spondylolysis
4. Spondylolithesis
5. Sacroilitis

**Test and Results**

XR of the Lumbar Spine revealed a subacute ring apophysis fracture of the superior endplate of the L4 vertebral body anteriorly with similar changes in the interior endplates of L1 and L2 anteriorly.

MRI of the Lumbar Spine revealed a subacute superior L4 apophyseal ring fracture, and irregularity of multiple additional endplates (T11, T12, L1, L2, and L3 with Schmorl's node) reflecting chronic ring fractures or anatomic variants.

Final/Working Diagnosis

Juvenile Disc Disorder

Treatment and Outcomes

The patient was started in a physical therapy program for strengthening of the spine and core. The athlete was instructed on the importance of maintaining these exercises and the need for symptomatic rest, as he will likely encounter intermittent episodes of lumbar back pain throughout his life. Neither bracing nor surgery were required, as the patient did not have Scheuermann's Kyphosis.

The athlete completed a physical therapy program, and was able to return to full play in lacrosse. He has remained asymptomatic during play, including participation in several lacrosse tournaments.

Radiographic imaging helped differentiate this athlete's back pain from a common lumbar strain. Further advanced imaging with MRI demonstrated that a new lesion and end plate compression which coincided with his most recent exacerbation of pain. The imaging modalities in this case helped expedite proper diagnosis and treatment, allowing the athlete to return to play in a safe and timely manner.

## D-76 Clinical Poster/Reception - Clinical Poster Reception

Thursday, June 2, 2016, 5:45 PM - 6:45 PM

Room: Hotel-Back Bay A

2346 **Chair:** Kevin R. Vincent, FACSM. *University of Florida, Gainesville, FL.*

(No relationships reported)

2347 Board #1

### Accumulated G-Forces Sustained During Hockey Correlate With Changes In Brain Network Activation Score

Amit Reches<sup>1</sup>, Kim D. Barber Foss<sup>2</sup>, Michal Weiss<sup>1</sup>, Staci Thomas<sup>2</sup>, Chris DiCesare<sup>2</sup>, Adam W. Kiefer<sup>2</sup>, Darcy Krueger<sup>2</sup>, Amir B. Geva<sup>1</sup>, Gregory D. Myer, FACSM<sup>2</sup>. <sup>1</sup>*ElMindA, Herzlyia, Israel.* <sup>2</sup>*Cincinnati Children's Hospital Medical Center, Cincinnati, OH.*

**Reported Relationships:** A. Reches: Salary; ElMindA.

**PURPOSE:** Helmets have been redesigned to reduce the incidence of concussion in sports, but research has shown that even newer helmets are ineffective at preventing concussions. We propose a novel device, worn around the neck, as a solution to reduce concussions in sport. The collar causes gentle compression of the internal jugular veins, thus restricting venous outflow and increasing venous sinus engorgement. This reduces brain movement within the cranial cavity upon impact (slosh). The purpose of this study was to measure brain neurophysiological changes after head impacts. A brain network activation analysis (BNA) evaluated the network dynamics associated with event related potentials in subjects performing a neuro-cognitive task. We hypothesized that the group wearing the collar would demonstrate fewer neurophysiological changes than the control group and that the changes in the control group would correlate with relative G force exposure during the hockey season. **METHODS:** Fourteen male high school ice hockey players (mean age 16.74±1.13 y) participated in a prospective, randomized clinical trial. Subjects underwent pre-season and mid-season EEG assessment; Helmet sensors were used to collect head impact and acceleration data. BNA analysis assessed the similarity of subjects' EEG signals to a reference group and relative to accumulated head impact data. **RESULTS:** Subjects wearing the collar (n=7) exhibited fewer changes in their BNA scores (4.05±4.02) from pre- to mid-season, compared to those who did not wear the collar (n=7, 20.21±13.35, p=0.007). Subjects who did not wear the collar exhibited a correlation between the accumulated G forces (linear acceleration >20g) and the change in BNA score from pre- to mid-season (Spearman's rho=0.82, p=.023). The accumulated G forces for subjects who did or did not wear the collar (6364±1902 and 4583±1304, respectively) were not statistically different. **CONCLUSION:** Subjects who sustained multiple head impacts while playing ice hockey exhibited changes in their EEG data, as measured by BNA analysis. Subjects who wore a jugular vein-compression collar exhibited a smaller change in BNA score than subjects who did not wear the collar. These data support the contention that mild jugular vein compression may be a protective mechanism against sport-related mTBI.

2348 Board #2

### Utility Of An Incongruent Visual, Cognitive-balance Dual Task To Assess Impairment In Athletes With Concussion

Anthony P. Kontos, Josh Woolford, Jamie McAllister-Detrick, Patrick Sparto, Michael W. Collins, Joseph Furman. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: Barbara Warren, FACSM)

**Reported Relationships:** A.P. Kontos: Contracted Research - Including Principle Investigator; GE-NFL Head Health Initiative..

Previous research indicates that dual task paradigms- which negate the effectiveness of compensatory strategies- may augment current single task (e.g., balance only, cognitive only) assessments of athletes with SRC. However, most dual task paradigms employ auditory cognitive stimuli that may not sufficiently disrupt compensatory strategies.

**Purpose:** To compare athletes with SRC to matched healthy controls on a novel, visual-based, cognitive-balance dual task paradigm and commonly used symptom reports and assessments of balance, cognitive, vestibular, and oculomotor impairment.

**Methods:** A prospective, case control design was used to compare 21 athletes with SRC (8-F, aged 15.2 ± 1.8 years) to 11 healthy age/sex-matched controls (4-F, aged 15.2 ± 2.7 years). Participants completed a visual, cognitive-balance dual task-involving incongruent stimuli/response patterns- and Balance Error Scoring System (BESS) with force plate data; Immediate Post-concussion Assessment and Cognitive Test (ImPACT); Post-concussion Symptom Scale (PCSS); and Vestibular and Ocular Motor Screening (VOMS) tool with near-point convergence (NPC) distance. Athletes with SRC were tested at 1-10 and 11-21 days post-injury. Controls were tested once. Independent samples t-tests were used to examine differences between groups, and dependent samples t-tests were used to examine change from 1-10 to 11-21 days post-injury. Statistical significance was set at a p < .05 (Bonferroni-corrected).

**Results:** Results revealed worse scores in concussed athletes for the incongruent component of the dual task (p=.03), PCSS (p=.001), visual memory (p=.05), reaction time (p=.05), VOMS (p=.001), and NPC (p=.02). Balance performance on BESS and during the dual task was consistent between groups. Results supported slower performance (57.3 to 44.9 ms) from 1-10 to 11-21 days on the incongruent component of the dual task (p=.01), in spite of improvements (p<.05) on PCSS, ImPACT, and VOMS.

**Conclusions:** An incongruent visual, cognitive dual-task detected persistent deficits at 11-21 days post injury when other measures demonstrated improvements. Visual-based dual task paradigms involving incongruent stimuli-responses patterns may negate compensatory strategies and help clinicians to identify athletes with SRC and monitor recovery from SRC.

2349 Board #3

### Effect Of Autograft On Strength And Functional Performance In Adolescents Following Anterior Cruciate Ligament Reconstruction

Dai Sugimoto, Benton Heyworth, Dennis Kramer, Mininder Kocher, Lyle Micheli, FACSM. *Boston Children's Hospital, Waltham, MA.*

(No relationships reported)

**PURPOSE:** To compare the effect of bone-patellar tendon-bone (BTB), hamstring tendon (HS), and iliotibial band (ITB), on physical and functional recovery at 6-month post-anterior cruciate ligament reconstruction (ACLR).

**METHODS:** A prospective cohort study design was used. At 6-month post-operative visits following ACLR, bilateral strength (quadriceps, hamstrings, hip abductor, and hip extensor), Y-balance (anterior, posterolateral, and posteromedial reach), and hop (single, triple, cross-over, and timed hops) tests were assessed from adolescent males. Deficits between ACLR and uninvolved limb was compared using paired t-tests. The deficits were further compared among graft types with analysis of covariance (ANCOVA) including demographics (height, weight, and age) and meniscus tear differences.

**RESULTS:** A total of 71 male ACLR patients (mean age: 16.7±2.2) were enrolled. The BTB group demonstrated reduced quadriceps strength in the ACLR limb compared to uninvolved limb (19%, p=0.004). The HS group showed reduced hamstring strength in the ACLR limb relative to uninvolved limb (29%, p=0.001). ANCOVA detected significant quadriceps (p=0.001) and hamstring (p=0.001) deficits of BTB and HS cohorts compared to ITB cohort, respectively. The poorer anterior (13%, p=0.006) and posterolateral reach (3%, p=0.038) performance of ACLR limb were recorded in BTB and HS groups, and ANCOVA indicated the anterior reach deficits of BTB group was significant compared to ITB (p=0.022). BTB cohort showed slower timed hop in ACLR limb (12%, p=0.037). The HS group showed shorter single (10%, p=0.001) and triple hop distances (7%, p=0.001) as well as slower timed hop (5%, p=0.008) in ACLR limb. However, the ANCOVA did not find differences in hop outcome among graft types.

**CONCLUSIONS:** Autograft type influences strength and functional parameters following ACLR in adolescent males. 6 months may not be sufficient time period for

safe return to sports, especially BTB and HS graft types. Rehabilitative emphasis need be placed on optimal physical and functional development, particularly in muscle groups involving donor sites.

## 2350 Board #4

### Effects of Sports Specialization on the Rates of Iliotibial Band Syndrome in Pediatric Athletes

Sarah S. Jackson, Dai Sugimoto, David R. Howell, William P. Meehan, III, Andrea Stracciolini, FACSM. *Boston Children's Hospital, Boston, MA.* (Sponsor: Pierre d'Hemecourt, FACSM) (No relationships reported)

Sports specialization has recently been defined as participation in year round intensive training in a single sport at the exclusion of all other sports. Studies suggest an increased risk of overuse injuries among athletes who are specialized to a single sport when compared to multisport athletes. The effect of sports specialization on rate of specific injuries such as iliotibial band (ITB) syndrome has not been reported.

**PURPOSE:** To examine the effect of sports specialization on rates of ITB syndrome history in pediatric athletes.

**METHODS:** In this cross-sectional study, participants completed electronic questionnaires describing their current sport participation and previous injury history (N=549). Participants were categorized into three groups: those athletes who participated in 1, 2, or 3 sports throughout the year. The proportions of athletes with a history of ITB syndrome were compared between the three groups using a chi-square analysis.

**RESULTS:** 18 ITB cases were reported (mean age of athletes = 15.2±1.9 years). The mean age in which athletes reported beginning organized sport(s) participation was; 1 sport athletes: 5.5±2.3 years, 2 sport athletes: 5.7±2.5 years, and 3 sport athletes: 5.1±1.8 years. Thus, the athletes participated in organized sport(s) for approximately 10 years. A higher proportion of 1 sport athletes reported a history of ITB syndrome than 3 sport athletes (9% vs. 2%;  $p=0.045$ ). No significant differences in the proportion of ITB cases were found between 1 and 2 sport athletes ( $p=0.294$ ) or between 2 and 3 athletes ( $p=0.707$ ).

**CONCLUSION:** Pediatric athletes who participate in a single sport reported a higher proportion of history of ITB syndrome when compared to multiple sport athletes. The findings of this study support the notion that training in a single sport place pediatric athletes at an increased risk for overuse injuries. Future research is needed to evaluate effect of sports specialization on other musculoskeletal injuries in pediatric athletes.

## 2351 Board #5

### The Incidence of Osteochondritis Dissecans in Adolescents Complaining of Chronic Anterior Knee Pain

James MacKenzie<sup>1</sup>, Michael Shrader<sup>2</sup>, Carla Boan<sup>3</sup>, Jeffrey Vaughn<sup>3</sup>. <sup>1</sup>University of Arizona Medical School- Phoenix, Phoenix, AZ. <sup>2</sup>University of Mississippi Medical Center, Jackson, MS. <sup>3</sup>Phoenix Children's Hospital, Phoenix, AZ. (No relationships reported)

**PURPOSE:** Osteochondritis dissecans (OCD) is a rare condition in which avascular necrosis of subchondral bone may lead to fragmentation of the avascular portion commonly into the joint space. OCD can progress to become crippling for adolescents and may require multiple surgeries. If detected in a timely manner, conservative treatment may be utilized to prevent considerable morbidity. We hypothesized that OCD has a high prevalence in pediatric orthopaedic patients complaining of chronic anterior knee pain without inciting trauma. We also hypothesized that 4 view x-ray screening in these patients is an effective diagnostic technique for OCD.

**METHODS:** This was a retrospective chart review. The inclusion criteria consisted of chronic anterior knee pain (greater than two weeks) without causal trauma. Charts from 2009 through 2010 were reviewed. It is standard practice in this clinic to use 4-view radiographs to assess these patients (anteroposterior, lateral, tunnel, and sunrise views). We reviewed radiographs, clinical notes, and demographic data.

**RESULTS:** A total of 134 pediatric patients between the ages of 5-18 were identified over the two year period. Four-view screening radiographs were performed on all 134 patients. Of the 134 patients, 10 were identified and diagnosed with OCD (7.5%). 7 of the diagnoses were in female subjects (9.5% incidence), while 3 were in males (5%). The lesion was in the medial femoral condyle in 7 patients, the lateral femoral condyle in 2, and the patella in one.

**CONCLUSIONS:** This study demonstrates that the incidence of OCD in pediatric patients with chronic anterior knee pain without causative trauma was considerably higher than that of the general adolescent or adult population. The elevated incidence of OCD in this subset of pediatric patients and the importance of its early diagnosis supports the use of four view radiographs in these patients. Failure to identify OCD in its early stages can allow the lesion to progress, with a potentially more invasive treatment and poorer prognosis.

## 2352 Board #6

### A Prospective Examination Of Abnormal Menstrual Patterns In Adolescent Female Athletes Following Concussion

Meredith L. Snook<sup>1</sup>, Luke C. Henry<sup>2</sup>, Joseph S. Sanfilippo<sup>1</sup>, Anthony J. Zelznik<sup>1</sup>, Anthony P. Kontos<sup>2</sup>. <sup>1</sup>Magee-Womens Hospital of UPMC, Pittsburgh, PA. <sup>2</sup>UPMC Sports Concussion Program, Pittsburgh, PA. (Sponsor: Barbara Warren, FACSM) (No relationships reported)

Retrospective studies suggest that brain injury may interrupt menstrual patterns in adult women via its effects on hypothalamic-pituitary function. Investigators have yet to evaluate the effects of concussion on menstrual patterns in adolescent athletes. Accordingly, menstrual status is not routinely assessed or managed following a concussion.

**PURPOSE:** To prospectively compare menstrual bleeding patterns of adolescent athletes with a sport-related concussion (SRC) to those with an orthopaedic sport-related injury during the first 120 days following injury.

**METHODS:** Female athletes ages 13-21 years with either a SRC (n=58) or orthopaedic sport-related injury (n=34) who presented to a concussion or sports medicine clinic within 30 days of injury were enrolled. Inclusion criteria included: greater than two years from menarche, regular menses, no use of hormonal contraception. Menstrual patterns were assessed for 120 days post-injury using a weekly text message link to an online survey inquiring about bleeding episodes each week. Response rate was 94% across all weeks. Abnormal menstrual patterns were defined by intermenstrual interval < 21 (short) or > 35 (long) days, or bleeding duration < 3 days.

**RESULTS:** A significantly higher proportion of menstrual patterns were abnormal following SRC (47/237, 19.8%) than orthopaedic sport-related injury (20/163, 12.3%) (OR 1.77, 95% CI 1.00-3.12,  $\chi^2=3.96$ ,  $p=0.047$ ). Although a prolonged intermenstrual interval was the most common abnormality observed (49/67, 73.1%), menstrual patterns were 5 times more likely to be short following SRC (OR 5.05, 95% CI 1.13-22.5,  $\chi^2=5.51$ ,  $p=0.019$ ). Female athletes with SRC were over 10 times more likely to have two or more abnormal bleeding patterns following injury (OR 10.5, 95% CI 1.13-59.69,  $\chi^2=7.06$ ,  $p=0.008$ ). Among athletes with SRC, initial signs/symptoms of injury severity, neurocognitive testing, and vestibular/ocular screening were not predictive of abnormal menstrual patterns.

**CONCLUSIONS:** Adolescent female athletes were at increased risk for abnormal menstrual patterns following SRC. Because abnormal menstrual patterns are likely associated with disruptions in ovarian estrogen production, monitoring menstrual patterns following SRC is warranted in order to avoid potential consequences of estrogen deficit.

## 2353 Board #7

### Bilateral Leg Pain in a 15 Year Old Runner

Melissa Roscher, David Stone. *University of Pittsburgh Medical Center, Pittsburgh, PA.* (No relationships reported)

## HISTORY

A 15 year old female complained of bilateral posterior lower leg pain and paresthesias during running that resolved with rest. Symptoms occurred during track and soccer, but not between seasons. Her PCP suggested a stretching program and adding salt to her Gatorade. Work up showed an abnormal ankle-brachial index and mildly elevated ESR.

## PHYSICAL EXAM

In our clinic, she had mild tenderness of the posterior tibiae and deep compartments of the lower legs, as well as pain with stretch of the anterior compartments bilaterally. Ankle musculature was diffusely weak with paresthesias in the feet during dorsiflexion and eversion testing. Tinel sign was negative at the fibular head, anterior tarsal tunnel, and the medial tarsal tunnel bilaterally.

## DIFFERENTIAL DIAGNOSIS

Hamstring/Calf Strain, Exertional Compartment Syndrome, Popliteal Artery Entrapment, Medial Tibial Stress Reaction

## TESTS AND RESULTS

Arterial Dopplers: No popliteal entrapment. Small thrombus at the left distal superficial femoral artery at the adductor canal

CTA Left leg: Occlusion of the distal superficial femoral artery with associated thrombus. Multiple collaterals. With plantar flexion, narrowing of the popliteal artery due to displacement of the popliteal artery from hypertrophy of the medial gastrocnemius

CTA Right leg: Normal vasculature at rest. With plantar flexion, narrowing of the infrageniculate popliteal artery between the gastrocnemius heads. Displacement of the suprageniculate popliteal artery due to hypertrophy of the medial gastrocnemius

CT Knees: Hypertrophy of both medial gastrocnemius displacing the popliteal arteries. Occlusion of the proximal Right peroneal artery

Factor V Leiden, antithrombin, fibrinogen, prothrombin, thrombin, factor VIII, protein C/S WNL

D-dimer elevated; hexagonal lipid neutralization (LAC), anticardiolipin IgG/IgM POSITIVE  
 Pathology: Vascular tissue with organizing thrombus  
**TREATMENT AND OUTCOMES**  
 Left superficial femoral to popliteal artery bypass with transection of the Left adductor hiatus by Vascular Surgery  
 Release of the Right superficial femoral artery by division of the Right adductor magnus  
 Treated with daily aspirin  
 Returned to competitive soccer in 4 months  
**FINAL DIAGNOSIS**  
 Bilateral Exertional Compartment Syndrome due to Arterial Thrombus and Compression

2354 Board #8  
**A Rare Cause of Progressive Paresthesias, Cramps, Fasciculations and Weakness in a Collegiate Volleyball Player**

James Presley, Stephen Wisniewski. *Mayo Clinic, Rochester, MN.*  
*(No relationships reported)*

**HISTORY:**  
 A 21 year old female collegiate volleyball player presented with exertional paresthesias involving her cheeks, lips and chest. Her symptoms evolved to include twitching, stiffness and cramping of the thighs and calves, which forced discontinuation of participation in volleyball. She went on to develop upper extremity cramping and abnormal posturing of her hands, even at rest. She noticed symmetric hypertrophy of her calves and quadriceps muscles and increased sweating and salivation. Her cramping and leg stiffness worsened to the point that she needed aid of a walker for ambulation.

**PHYSICAL EXAMINATION:**  
 General medical exam was unremarkable. Her quadriceps and calves seemed abnormally muscular for body habitus. Movements of the upper and lower limbs were slow and stiff with visible cramping of calf and quadriceps muscles with activation. Neurological exam showed diminished reflexes. Strength testing was difficult due to non-painful muscle cramps with isolated testing of muscles. Sensation was normal.

- DIFFERENTIAL DIAGNOSIS:**  
 1) Myotonia (DM1, DM2)/ Neuromyotonia  
 2) Diffuse Myopathy  
 3) Multiple Sclerosis  
 4) Peripheral Neuropathy

**TEST AND RESULTS:**  
 MRI brain and cervical spine:  
 - No evidence of demyelination, inflammation, or infarction  
 EMG:  
 - Nearly persistent motor unit activity in upper and lower limb muscles with spontaneous, iterative, high frequency discharges consistent with neuromyotonia  
 Laboratory Testing:  
 - Blood tests for hereditary and acquired causes of myotonia/neuromyotonia were inconclusive  
 PET Scan/MRI:  
 - Showed focal, hypermetabolic activity in the thymus with two peripherally enhancing soft tissue nodules

**FINAL WORKING DIAGNOSIS:**  
 Hodgkin's Lymphoma with presentation of paraneoplastic neuromyotonia (Isaac's Syndrome)  
**TREATMENT AND OUTCOMES:**  
 1. Intravenous immunoglobulin was poorly tolerated with no clear benefit.  
 2. Gabapentin and mexiletine were started as membrane stabilizing agents with significant improvement in symptoms.  
 3. With imaging findings concerning for neoplasm, anterior mediastinal mass resection with total thymectomy was performed.  
 4. Surgical pathology showed interfollicular Hodgkin's lymphoma with no abnormality in the thymus.  
 5. The patient recovered well from surgery, reports 80% improvement in symptoms and is exercising consistently

2355 Board #9  
**Abdominal Pain in a Collegiate Football Player**  
 Wes Sohns, Scott Lynch, Scott Armen, Peter Seidenberg, FACSM. *Penn State University, University Park, PA.*  
*(No relationships reported)*

Hx: A 23 y/o NCAA football player who was unable to catch his breath after being hit in the abdomen at practice. He continued for 10 more plays prior to reporting the injury. He stated that he had increasing LUQ pain and shortness of breath.

PE: Pox 99%, HR 104, lungs CTAB but shallow. Abdomen: BS (+), TTP LUQ, no mass or rebound, Kehr's sign (+). Evaluated in ER and released.  
 Next morning: c/o LUQ and suprapubic pain, did not sleep well. Appetite and urination decreased, no N/V/D; afebrile; HR 90-100, BP 128/74, Pox 98%. Waves of diaphoresis; TTP suprapubic and LUQ areas. BS (+), no rebound. No rash or bruising. That afternoon: continued pain and urine retention; diaphoretic and intermittently pale with BP 148/94, HR 100, Pox 96%, afebrile, shallow breathing due to pain.

- DD:  
 1. Rib fracture  
 2. Splenic injury  
 3. Pancreatic injury  
 4. Small bowel injury  
 5. Traumatic ileus  
 6. Renal trauma  
 7. Left lung injury  
 8. Retroperitoneal hemorrhage

**TESTS/RESULTS:**  
 - US fast scan - WNL  
 - Istat - Hgb and Cr WNL  
 - Stat CT abd - only showed 12<sup>th</sup> rib fracture  
**FINAL/WORKING Dx:**  
 Jejunum perforation  
**Tx /OUTCOMES:**

- Transported to the ER. Fast scan US was normal. CT scan showed 12<sup>th</sup> rib fracture. Given IV dilaudid, toradol, Percocet for overnight pain.
- Next morning reported urinary retention and decreased appetite which he felt due to the medication. Had an US which showed full bladder and no splenic injury.
- D/c meds and gave IM toradol and PO tramadol for the pain.
- No improvement and was admitted to the hospital for IV hydration and pain control, further lab testing, observation.
- Pain continued into the night. Labs showed increased pancreatic enzymes and CPK. CXR and AAS showed B pleural effusion and possible free air under diaphragm.
- Local surgeon consulted did not think there was free air but concerned with pancreatic injury.
- Transferred to tertiary care center.
- Observed in the SICU for a day and started declining in status. An MR cholangiogram ordered to evaluate the pancreatic duct but stopped due to the presence of free air.
- Emergent exploratory laparotomy showed a jejunum perforation. Resected and repaired.
- Two days postop, taken back to OR for a leak at the repair site.
- Small abscess developed under the diaphragm; treated percutaneously.
- Currently doing great. Working out at pre-injury levels.

2356 Board #10  
**Decline Of Function And Weakness In A Special Olympian With Trisomy 21**

Brennan J. Boettcher, Jeffrey A. Strommen. *Mayo Clinic, Rochester, MN.* (Sponsor: Karen L. Newcomer-Aney, FACSM)  
*(No relationships reported)*

**HISTORY:** A 46 year-old gold medalist Special Olympian in softball, basketball and swimming presented in February 2013 to his local care provider with right leg weakness. He did not undergo any further diagnostics or treatment initially. In March he began to fall and became dependent on a walker for ambulation. Subsequent evaluation felt as if his decline in function was related to knee osteoarthritis which was symptomatically treated with injections of corticosteroid x 2 in the right knee. By June, the patient was requiring his arms to help pull himself up stairs to get into his apartment. He once again presented for further evaluation. :

**PHYSICAL EXAMINATION:** Muscle Strength (L/R, scale 0-5): Iliopsoas 3/4; Adductors 4/4; Abductors 4/4; Knee Extension 1/3; Knee Flexion 1/3; Dorsiflexion 1/3; Plantarflexion 5/5. Upper limb strength was normal. Reflexes (Scale 0-4) were hypoactive but symmetric in the upper extremities at +1; Patellar were +3; Ankle reflexes were +4 bilaterally with sustained clonus. Babinski upgoing bilaterally. Moderate vibration and proprioception deficits at the bilateral MTP joints.

Able to ambulate but locked his knees for stability.  
**DIFFERENTIAL DIAGNOSIS:** Extradurellary compression of cord (tumor or infection)

- Intradurellary tumor or infection  
 Spinal stenosis  
 Transverse Myelitis  
 Central Nervous System Demyelinating Syndrome  
 Paraneoplastic Syndrome  
 Vascular Malformation

**TEST AND RESULTS:** An MRI was obtained and an intradurellary T2-T3 spinal cord lesion was noted. He was transferred to Mayo Clinic after a short rehabilitation course locally for further treatment and workup. A short trial of IV

steroids decreased his weakness, but this returned quickly after discontinuation. Based on imaging findings and steroid responsiveness, neurosarcoidosis was felt to be the most likely diagnosis.

**FINAL WORKING DIAGNOSIS:** T2-3 neurosarcoidosis with myelopathy:

**TREATMENT AND OUTCOMES:** 1- Treatment with prednisone 60 mg daily

2- Inpatient rehabilitation- 3 hours of PT/OT 5 days/week

3- Continues on prednisone taper at 14 months following discharge, down to 6 mg daily.

4- He continues to attend physical therapy sessions regularly.

5- At his 1 year followup, patient is back to living independently with his wife.

Some weakness persists; he remains unable to participate in Special Olympics.

2357 Board #11

### **Quantification Of Physical Activity As An Exercise Vital Sign In A Pediatric Population**

Amy E. Valasek. *Nationwide Children's Hospital / The Ohio State University College of Medicine, Westerville, OH.* (Sponsor: James MacDonald, FACSM)

Email: amy.valasek@nationwidechildrens.org

(No relationships reported)

#### **PURPOSE**

Physical inactivity has become an increasing problem in our youth today and physical inactivity is an important independent factor in the development of chronic disease. Conversely, there is a rise in overuse injuries due to children specializing in sports earlier in their youth. The exercise recommendations by the American Academy of Pediatrics are 60 minutes of moderate to vigorous activity for all school aged youth daily, but research is limited to how many children actually meet these requirements. The goal of the survey was to quantify days, minutes, and exercise activity type of those presenting with an injury to a sports medicine clinic.

#### **METHODS**

All new patients presenting to outpatient sports medicine clinic were asked questions about their current exercise habits. Subjects self-reported the number of days per week, and minutes per day of moderate to vigorous activity. Moderate activity was described as sweating. Vigorous activity was described as breathlessness. Additionally subjects self-reported current activity participation in organized or unorganized activity.

#### **RESULTS**

120 subjects consisting of 50 males and 70 females responded to the survey. The mean age of respondents was 13.2 ±2.8 years. Mean days of exercise reported were 4 ±1.6 days. Mean minutes of daily exercise reported was 91.4±42.7 minutes. Mean minutes per week of exercise reported was 450.7±290.0 minutes. Mean activities responded per week was 2.35±1.2.

#### **CONCLUSION**

The questions provided a screening and quantified activity type, amount, and duration for children presenting to outpatient Sports Medicine clinic for a musculoskeletal complaint. The data gathered in this study demonstrate children are not meeting the daily exercise recommendation. Rather, this population exercised on fewer days with greater than 60 minutes of MVPA. 20% (24) of subjects reported greater than 150 minutes per day MVPA. The high volume training per session is a risk factor for musculoskeletal injury. 52% (63) of these subjects met the minutes per week recommended, and this cohort consists of organized sport participants. Currently, these screening questions serve as forum to discuss activity type, duration, and length as well as counsel patients on appropriate exercise habits.