

**C-06 Thematic Poster - Athlete Nutrition I**

Thursday, May 30, 2019, 9:30 AM - 11:30 AM  
Room: CC-101A

**1133 Chair: Nancy Clark, FACSM. Sports Nutritionist, West Newton, MA.**

(No relevant relationships reported)

**1134 Board #1 May 30 9:30 AM - 11:30 AM  
Examination of Low Energy Availability and Macronutrient Intake among Male and Female Recreational Athletes**

Stephanie A. McKeen<sup>1</sup>, Toni M. Torres-McGehee<sup>1</sup>, Erin M. Moore<sup>2</sup>, Dawn M. Emerson<sup>3</sup>, Kelly Pritchett<sup>4</sup>, Allison B. Smith<sup>1</sup>.  
<sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>University of South Florida, Tampa, FL. <sup>3</sup>University of Kansas, Lawrence, KS. <sup>4</sup>Central Washington University, Ellensburg, WA.  
(No relevant relationships reported)

Low energy availability (LEA) may be prevalent in both male and female recreational athletes and can be a catalyst for negative health consequences. **Purpose:** Examine the prevalence of LEA and macronutrient intakes (protein [PRO], carbohydrate [CHO], and fats) and differences between gender in recreational athletes. **Methods:** Data from a larger cross-sectional study was used to examine recreational athletes (n=103, age: 27.9±7.1 years; males: n=59, height: 175.3±9.5 cm, weight: 77.5±13.2 kg; female: n=44, height: 167.9±8.0 cm; weight: 71.4±15.2 kg). Athletes were moderately trained (exercised a minimum of 3-4 days/week. Data collection consisted of anthropometric data, surveys (eg, demographics, age, gender, etc.), resting metabolic rate, a 7-day online dietary log to measure energy intake (EI), and exercise logs to measure exercise energy expenditure (EEE). Basic descriptive stats, Chi-squares, and cross-tabulations were used to examine the proportion of participants classified as "at risk" for LEA (males: <20 kcal/kg/FFM; females: <30 kcal/kg/FFM) and met the micronutrient recommendation across gender. **Results:** Overall, 48.1% (n=50) of athletes demonstrated the following for males and females, respectively: LEA (26.0±10.4 vs. 28.4±14.9 kcal/kg/FFM; EI: 2287.9±943.4 vs. 1881.9±591.7 kcals, EEE: 589.8±399.1 vs. 423.1±199.8 kcals). Differences were found between LEA and gender (P<0.04), with females (28.8%) displaying higher risks than males (19.2%). No differences were found between LEA and PRO, CHO, or fat intake recommendations across gender. However, males overall consumed more than the recommendation for protein than females (15.5% vs. 11.7%; > 2 g/kg/day). Most recreational athletes (90.3%, n=93) reported low CHO intake (< 5 g/kg/day). Fat intake was adequately met by 64.1% (n=66) of athletes, however, 35.9% (n=37) of athletes with LEA consumed fats above the recommendation. **Conclusions:** Recreational athletes are moderately at risk for LEA. Most of these athletes demonstrated compromised low CHO intake compared to the recommendation, and despite LEA, over 1/3 of the athletes over consumed fat. Recreational athletes would benefit from proper nutritional education, specifically EI and macronutrient intake, which is necessary for proper nutritional fueling in recreational athletes.

**1135 Board #2 May 30 9:30 AM - 11:30 AM  
Examination of Low Energy Availability and Macronutrient Intake among Female Collegiate Athletes**

Morgan M. Larson<sup>1</sup>, Toni M. Torres-McGehee<sup>1</sup>, Erin M. Moore<sup>2</sup>, Kelly Pritchett<sup>3</sup>, Allison B. Smith<sup>1</sup>. <sup>1</sup>University of South Carolina, Columbia, SC. <sup>2</sup>University of South Florida, Tampa, FL. <sup>3</sup>Central Washington University, Ellensburg, WA.  
(No relevant relationships reported)

Low energy availability (LEA: ≤ 30kcal/kg/FFM) is one component of the Female Athlete Triad and is a catalyst for negative health consequence. Female athletes may be at increased risk for LEA due to a multitude of risks: individual judgments, body size expectations, uniforms, lack of nutrition knowledge or pathogenic behaviors. **Purpose:** Examine the prevalence of LEA and macronutrient intakes (protein [PRO], carbohydrate [CHO], and fats) and differences between sport type and academic status (e.g., freshman, sophomore, junior, senior) in female collegiate athletes. **Methods:** Data from a larger cross-sectional study was used to examine 75 Female collegiate athletes (age: 19.5 ± 1.3 years; height: 170.4 ± 6.8 cm; weight: 65.6 ± 8.8 kg) across various sports [beach volleyball (n=18), softball (n=17), equestrian (n=28), and indoor volleyball (n=12)]. Data collection consisted of anthropometric data, surveys (e.g., demographics, health history, etc.), resting metabolic rate, a 7 day online dietary to measure energy intake (EI) and exercise logs to measure exercise energy expenditure (EEE). Basic descriptive stats and Chi-squares and cross-tabulations were used to

examine the proportion of participants classified as "at risk" for LEA and across sport and academic status. **Results:** Overall, 92% (n=69) of athletes demonstrated LEA (13.3±11.9 kcal/kg/FFM, EI: 1490.2±437.3 kcals, EEE: 874.4±490.8 kcals). Differences were found between LEA and PRO intake for both sport type (p<0.04) and academic status (p=0.04), with most equestrian athletes and freshman not meeting protein recommendations (<1.2 g/kg/day). Most athletes (98.7%, n=74) reported low CHO intake (< 5 g/kg/day) with 90.7% (n=68) of athletes with LEA had inadequate CHO intake. Fat intake was adequately met by 64% (n=48) of athletes, however, 26.7% (n=20) of athletes with LEA consumed fats above the recommendation. **Conclusions:** Majority of female athletes demonstrated compromised LEA and macronutrient intake (CHO and PRO). Proper nutritional education, specifically EI and macronutrient intake, is essential for adequate health status and performance in athletes. Healthcare professionals should be aware of recommendations for proper dietary intake, be a resource for education, and implementation of proper nutritional fueling for female athletes.

**1136 Board #3 May 30 9:30 AM - 11:30 AM  
Athlete Iron Consumption: Timing Is Everything, But When Is Best?**

Rachel McCormick<sup>1</sup>, Diego Moretti<sup>2</sup>, Alannah McKay<sup>1</sup>, Dorine W. Swinkels<sup>3</sup>, Rachel vanSwelm<sup>3</sup>, Debbie Trinder<sup>4</sup>, Gregory Cox<sup>5</sup>, Michael Zimmerman<sup>6</sup>, Marc Sim<sup>7</sup>, Carmel Goodman<sup>8</sup>, Brian Dawson<sup>1</sup>, Peter Peeling<sup>1</sup>. <sup>1</sup>The University of Western Australia, Crawley, Western Australia, Australia. <sup>2</sup>Laboratory of Human Nutrition, Institute of Food Nutrition and Health, ETH, Zürich, Switzerland, Switzerland. <sup>3</sup>Radboud University, Nijmegen, Netherlands. <sup>4</sup>University of Western Australia, Fiona Stanley Hospital, Murdoch, Western Australia, Australia. <sup>5</sup>Bond University, Gold Coast, Queensland, Australia. <sup>6</sup>Laboratory of Human Nutrition, Institute of Food Nutrition and Health, ETH, Zürich, Switzerland. <sup>7</sup>Edith Cowan University, Joondalup, Western Australia, Australia. <sup>8</sup>The Western Australian Institute of Sport, Mt Claremont, Western Australia, Australia.  
Email: rmcormick@wais.org.au  
(No relevant relationships reported)

**PURPOSE:** The influence of exercise timing on the subsequent inflammatory, hepcidin and iron absorption responses in endurance athletes was examined. **METHODS:** Sixteen endurance-trained runners (10 male, 6 female) with serum ferritin (sFer) < 50 µg/L completed a 90 min running protocol (65% vVO<sub>2max</sub>) in the morning (AM), and the afternoon (PM), in a crossover design. An iron-fortified fluid labelled with stable iron isotopes (<sup>57</sup>Fe or <sup>58</sup>Fe) was administered with a standardized meal 30 min following the exercise and control conditions during each trial, serving as a breakfast and dinner meal. Venous blood samples were collected pre-, immediately post-, and 3 h post- the exercise and control conditions for measures of sFer, Interleukin-6 (IL-6), and hepcidin-25. A final venous blood sample was collected 14 d after each trial to determine the erythrocyte iron incorporation. **RESULTS:** The immediate post-run levels of IL-6 were significantly increased from pre-run in both the AM and PM condition (both p=0.004). Hepcidin-25 levels increased 3 h following the AM run (p=0.012), returning to baseline by 12.5 h post-run. During the PM trial, hepcidin levels exhibited diurnal tendency, increasing from baseline to pre-run (p=0.002), before further increasing from pre- to 3 h post-run (p<0.001). Fractional iron absorption was greater at breakfast following the AM run, compared with both the rested condition (p=0.016) and dinner in the AM run trial (p=0.037). **CONCLUSION:** While exercise resulted in increased levels of inflammation and hepcidin, iron was best absorbed in the morning following exercise, indicating there may be a transient mechanism during the acute post-exercise window to promote iron absorption before the homeostatic regulation of hepcidin elevations become more influential.

**1137 Board #4 May 30 9:30 AM - 11:30 AM  
Evaluation of a Method to Rapidly Assess Beverage Intake in Collegiate Athletes**

Samantha Kostelnik<sup>1</sup>, Brittany Thorpe<sup>1</sup>, Catherine Cockrill<sup>1</sup>, Michelle Rockwell<sup>1</sup>, Valisa Hedrick<sup>1</sup>, Travis Thomas<sup>2</sup>, Kevin Davy, FACSM<sup>1</sup>, Brenda Davy, FACSM<sup>1</sup>. <sup>1</sup>Virginia Tech, Blacksburg, VA. <sup>2</sup>University of Kentucky, Lexington, KY.  
(Sponsor: Brenda Davy, FACSM)  
(No relevant relationships reported)

Fluid intake recommendations have been established for both general and athletic populations in order to promote adequate hydration. The Beverage Intake Questionnaire (BEVQ-15) is a food frequency questionnaire that rapidly measures habitual beverage intake and has been validated in children and adults. However, there is no beverage consumption questionnaire that has been validated in athletic populations.

**PURPOSE:** The purpose of this investigation is to evaluate the validity and reproducibility of the BEVQ-15 for determining habitual beverage intake in collegiate athletes.

**METHODS:** National Collegiate Athletic Association (NCAA) Division 1 collegiate athletes from a variety of sports from two universities in Virginia were recruited to participate. The study consisted of three sessions on nonconsecutive days within 2 weeks. At each session, the participants completed a 24-hr dietary recall, which was analyzed via NDSR. At the first and third sessions, participants completed the BEVQ-15. Validity was assessed using by comparing reported beverage intake determined by the BEVQ-15 to the average of three 24-hour recalls, using a Spearman's correlational analysis; reproducibility was assessed by comparing BEVQ-15 results from the two administrations, using a Pearson's correlational analysis.

**RESULTS:** Eighty-five collegiate athletes (60% female) participated in the study. Mean water and total beverage intake were 80.9±89.5 fl oz and 112.9±95.4 fl oz, respectively. Total beverage intake (fl oz, kcal) between the average BEVQ-15 administration and the recalls was associated (fl oz:  $r=0.51$ ; kcal:  $r=0.36$ , both  $p<0.01$ ). Correlations between the two BEVQ-15 administrations were significantly associated for water (fl oz:  $r=0.80$ ;  $p<0.01$ ) and total beverage intake (fl oz, kcal:  $r=0.74$  and  $0.77$ , respectively;  $p<0.01$ ).

**CONCLUSIONS:** These results suggest that the BEVQ-15 is a valid and reproducible method to assess water and total beverage intake in collegiate athletes. The BEVQ-15 is a practical tool (<5 minute completion time) which may be used to measure collegiate athletes' beverage intake. Additional research is needed to determine if the BEVQ-15 is sensitive to detect changes in athlete's beverage intake over time.

**1138 Board #5 May 30 9:30 AM - 11:30 AM**  
**Dietary Intake Of Calcium, Magnesium, And Zinc In Female And Male Athletes**

Maria S. Terry, Joseph R. Stanzione, Stella L. Volpe, FACSM.  
*Drexel University, Philadelphia, PA.* (Sponsor: Stella L. Volpe, FACSM)  
 Email: mst83@drexel.edu  
 (No relevant relationships reported)

There are limited data on the micronutrient intake of athletes from various sports. Of particular interest are calcium (Ca), magnesium (Mg), and zinc (Zn) intakes among athletes due to their role in metabolic and physiological processes. **PURPOSE:** To determine differences in dietary Ca, Mg, and Zn intake among female and male runners (RN), triathletes (TA), CrossFit athletes (CF), rowers (CW), and general athletes (GA), 18 years of age and older. **METHODS:** This was a cross-sectional study, where 246 athletes (119 women, 127 men; 35±11 years of age) completed a food frequency questionnaire (FFQ) to determine average daily dietary micronutrient intake. We utilized one-sample t-test to compare dietary intake of Ca, Mg, and Zn in athletes with the Recommended Dietary Allowance (RDA) for each micronutrient. **RESULTS:** The results are shown in Table 1 below.

Sex	Sport	n	Ca (mg)	Mg (mg)	Zn (mg)
F	All	119	815.5±401.4 ( $p<0.00001$ )	349.3±123.2 ( $p<0.05$ )	10.1±4.1 ( $p<0.00001$ )
F	RN	50	920±578.3	384.3±137.6 ( $p<0.01$ )	11.3±5.3 ( $p<0.001$ )
F	TA	19	845.7±317.7	345.6±156.0	10.8±4.5 ( $p<0.05$ )
F	CF	10	809.2±151.4 ( $p<0.05$ )	372.6±107.2	9.6±1.4 ( $p<0.05$ )
F	CW	16	699.2±209.1 ( $p<0.001$ )	320.1±97.9	7.9±2.2
F	GA	37	764.2±264.4 ( $p<0.0001$ )	338.4±97.8	10.0±3.0 ( $p<0.001$ )
M	All	127	971.9±429.3	405.8±173.3	13.4±6.0 ( $p<0.0001$ )
M	RN	38	917.5±344.0	383.8±151.0	12.2±5.0
M	TA	27	1055±505.0	441.3±216.6	14.2±5.8 ( $p<0.01$ )
M	CF	6	1015.5±691.6	336.7±124.3	13.2±5.9
M	CW	16	1154.0±474.2	477.9±179.7	16.6±7.0 ( $p=0.01$ )
M	GA	23	802.8±297.1 ( $p<0.05$ )	379.6±129.5	10.8±4.1

**CONCLUSIONS:** All female athletes combined reported Ca intakes significantly below the RDA, while Mg and Zn intakes were significantly higher than the RDA. Significantly low dietary Ca was revealed in female CF, CW, and GA. All male athletes combined reported Zn intakes significantly higher than the RDA. Male GA reported Ca intakes significantly lower than the RDA. Further research is needed to explore the effect of low Ca intake on athletic performance in female and male athletes. This study was not funded.

**1139 Board #6 May 30 9:30 AM - 11:30 AM**  
**The Effect of Different Post-Exercise Beverages with Food on Voluntary Dietary Intake and Subsequent Performance**

Danielle McCartney<sup>1</sup>, Christopher Irwin<sup>1</sup>, Gregory R. Cox<sup>2</sup>, Ben Desbrow<sup>1</sup>. <sup>1</sup>Griffith University, Gold Coast, Australia. <sup>2</sup>Bond University, Gold Coast, Australia. (Sponsor: Louise Burke, FACSM)  
 Email: danielle.mccartney@griffithuni.edu.au  
 (No relevant relationships reported)

**PURPOSE:** Recent evidence suggests that different beverages promote similar fluid recovery but alter nutrient provision when consumed voluntarily with food post-exercise (Campagnolo et al., 2017; McCartney et al., In Press). However, when preparing to undertake another bout of exercise, individuals may exhibit different dietary behavior (e.g. to reduce gastrointestinal distress, optimize performance). This study investigated the effect of consuming water or a carbohydrate (CHO)-electrolyte sports beverage ('Sports Drink') *ad libitum* with food during a 4h post-exercise recovery period on fluid restoration, nutrient provision, and subsequent endurance cycling performance.

**METHODS:** On two occasions, 16 trained cyclists, 8 male (M) (age: 31±9y;  $VO_{2max}$ : 54±6mL·kg<sup>-1</sup>·min<sup>-1</sup>) and 8 female (F) (age: 33±8y;  $VO_{2max}$ : 50±7mL·kg<sup>-1</sup>·min<sup>-1</sup>), lost 2.3±0.3% and 1.6±0.3% of their body mass (BM) (respectively) during 1h of fixed-intensity cycling. Participants then had *ad libitum* access to either Water or Sports Drink (103kJ·dL<sup>-1</sup>; 5.8g CHO·dL<sup>-1</sup>) and food for the first 195 min of a 4h recovery period. At the end of the recovery period, participants completed a cycling performance test (45 min fixed-intensity pre-load and an incremental test to exhaustion [peak power output, PPO]). Beverage intake; water/nutrient intake; and indicators of fluid recovery (BM, urine output, plasma osmolality [ $P_{osm}$ ]) were assessed throughout trials. **RESULTS:** Participants returned to a similar state of positive fluid balance prior to recommencing exercise, regardless of the beverage provided (Water: +0.4±0.5 L; Sports Drink: +0.3±0.3 L,  $p=0.529$ ). While Sports Drink increased post-exercise energy (M: +1.8±1.0MJ; F: +1.3±0.5MJ) and CHO (M: +114±31g; F: +84±25g) intake ( $p$ 's<0.001), this did not affect subsequent endurance cycling performance (Water: 337±40W [M] and 252±50W [F]; Sports Drink: 340±40W [M] and 258±47W [F],  $p=0.242$ ).

**CONCLUSIONS:** Recovery beverage recommendations should consider the post-exercise environment (i.e. availability of food), an individual's tolerance for food/fluid, the immediate requirements for refueling (e.g. CHO demands of subsequent activity) and the athlete's overall dietary goals.  
 Campagnolo, N. et al. (2017) *Physiol. Behav* 171, 228-235. McCartney, D. et al. (In Press). *Appl Physiol Nutr Metab*.

**1140 Board #7 May 30 9:30 AM - 11:30 AM**  
**A Pilot Nutrition Education Intervention with Division I Women's Basketball Players**

Emily N. Werner, Alyssa Guadagni, James M. Pivarnik, FACSM.  
*Michigan State University, East Lansing, MI.* (Sponsor: James M. Pivarnik, FACSM)  
 Email: enwerner34@gmail.com  
 (No relevant relationships reported)

Appropriate nutrition is important for both health and optimization of sport performance; however, many athletes do not have sufficient nutrition knowledge to engage in ideal nutrition practices. Few studies have been conducted to investigate the efficacy of a nutrition education intervention on athletes' nutrition knowledge, and even fewer have done so using a validated assessment tool. **PURPOSE:** To evaluate changes in nutrition knowledge of NCAA Division I women's basketball players after a sport-focused nutrition education intervention using a validated nutrition knowledge survey. **METHODS:** NCAA Division I women basketball players (N=8) completed a validated nutrition knowledge survey (Callella et al., 2017) that evaluated both general and sport nutrition. Athletes then participated in six, once weekly, 20-minute nutrition education sessions led by a Registered Dietitian. Topics included: hydration, carbohydrates, protein, fats, meal planning, and micronutrients/supplements. At the end of six weeks, the survey was re-administered. Scores were summed as +1 for a correct answer and +0 for no answer, an incorrect answer, a double-answer, or the "I don't know" option. Maximum possible score was 97. A paired-samples t-test was conducted to evaluate baseline versus follow-up scores. **RESULTS:** At baseline, athletes scored 40.5±18.0 out of 97 possible, 27.0±12.7 out of 64 possible, and 13.9±6.2 out of 33 possible for the total survey, general nutrition and sport nutrition sections, respectively. Significant average score increases were found for the total survey overall (62.2±11.7,  $p=0.004$ ), within the general nutrition section (40.4±7.7,  $p=0.015$ ), and within the sport nutrition section (21.9±5.9,  $p<0.001$ ). **CONCLUSION:** The education intervention used in this pilot study succeeded in increasing nutrition knowledge of Division I women's basketball players. Future research should include intake assessments to determine whether eating habits improve after nutrition education.

This research was funded by the MSU College of Education via a Summer Research Fellowship.

**1141** Board #8 May 30 9:30 AM - 11:30 AM  
**The Importance of Iron Testing for D3 Cross Country Runners**

Preston Kauder, Nathan Goslin-Klemme, Jake Till, Elaina Biechler. *Loras College, Dubuque, IA.* (Sponsor: Vincent Paolone, FACSM)

Email: pkaud24@gmail.com

(No relevant relationships reported)

**PURPOSE:** Iron is an important mineral carried throughout the body, which helps carry oxygen rich molecules via hemoglobin. For endurance athletes, blood iron levels may be an important predictor of performance. Previous research has shown that iron absorption rates are lower in athletes in comparison to sedentary individuals. The purpose of the current investigation was twofold: first, to measure pre-season blood iron levels in division III collegiate cross country runners to determine if iron deficiency existed, and secondly, improve blood iron levels with a five week nutrition intervention for subjects classified as low.

**METHODS:** Capillary puncture was utilized to measure blood iron levels during the week of pre-season practice in division III male (N=26) & female (N=20) cross country runners. Athletes were classified as low iron if the males were below 13.0mg/dL, and 12.0mg/dL for the females. If subjects were classified as low, they received a nutritional pamphlet as an intervention, and were retested five weeks later.

**RESULTS:** The researchers classified 26.92% of males as iron deficient, and 5.00% of females as deficient. After retesting the deficient subjects, a paired t-test was utilized to determine if significant improvements in blood iron occurred following the five week intervention. A p-value of 0.002 (2-tail) was yielded showing a significant improvement in hemoglobin levels from pre-season in comparison to 5 weeks following the intervention (12.28 +/- 1.09, 13.94 +/- 0.25 respectively).

**CONCLUSIONS:** After a five week intervention, iron levels in those previously deficient, were significantly improved. Iron is a significant mineral for athletes, especially runners who are greatly dependent on oxygen for their performance. Thus, making sure cross country runners are educated on good nutritional habits, allowing them to maintain the said desirable blood iron levels is key to optimize their performance. Lastly, meeting the recommended guidelines for iron is vastly important, and educating athletes can result in a substantial improvement in blood iron levels.

**C-07** Thematic Poster - Clinical Exercise  
**Physiology: Exercise and Type 2 Diabetes**

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

**1142** Chair: R. Scott Rector, FACSM. *University of Missouri, Columbia, MO.*

(No relevant relationships reported)

**1143** Board #1 May 30 9:30 AM - 11:30 AM  
**Impact Of A Clinical Exercise Program On Trajectories Of Hba1c And Weight In Older Veterans**

Jamie Giffuni, Rebecca Melvin, Bethany Lyons, Odessa Addison, Alyssa Stookey, Leslie Katzel. *Baltimore Veterans Affairs Medical Center, Baltimore, MD.*

Email: jamie.giffuni@va.gov

(No relevant relationships reported)

**Purpose** Gerofit is a clinical exercise program for Veterans  $\geq 65$  years, originally developed at the Durham VA Medical Center and offered at the Baltimore VA Medical Center (BVAMC) since 2013. Veterans receive individualized exercise programs and participation in the program is voluntary. We assessed hemoglobin A1C (A1C) and weight changes in Veterans with a diagnosis of diabetes who completed one year of exercise training in Gerofit. **Methods** Older Veterans with primary care at the BVAMC were referred to Gerofit. Functional assessments included measures of weight and were used in conjunction with patients' personally identified exercise goals to develop comprehensive exercise programs including cardiorespiratory, strength, and flexibility training. Clinical chart reviews were conducted to determine A1C and weight one year prior to starting Gerofit, time of enrollment, and one year into participation. Initial program enrollment eligibility did not exclude for elevated A1C, but was later modified to include pre-program A1C  $\leq 10\%$ . Veterans could attend Gerofit exercise sessions up to 3 days per week. **Results** Forty-four Veterans with diabetes (43 male, 73.5  $\pm$  5.6 years, 89% African American, BMI 32.9  $\pm$  5.0 kg/m<sup>2</sup>) completed 1 year

of Gerofit. On average, both weight and A1C increased in the year prior to initiating Gerofit (A1C 7.2  $\pm$  1.2 to 7.4  $\pm$  1.5%, weight +1.2 lbs.). Overall A1C declined to 7  $\pm$  1.1% (p < 0.05) and weight by -.04  $\pm$  41.5 (p = 0.73) 1 year into the program. Half the group (22/44) experienced a decrease in A1C, 2/44 had no change, and 17/44 increased A1C. The group that decreased A1C at 1 year started with a significantly higher A1C at time of enrollment compared to those that increased A1C at 1 year (7.8  $\pm$  1.6% vs. 6.8  $\pm$  1.2%). **Conclusion** Diabetic Veterans who participated in one year of Gerofit overall demonstrated a reversed trajectory of rising A1C and weight. Overall, the decline in A1C approached the clinically significant reduction of 0.5%. Those Veterans with a higher A1C at time of enrollment demonstrated a statistically and clinically significant reduction; reducing potential diabetes complications. Results demonstrate the importance of advocating for participation in a low level, multi-component exercise program for weight and diabetes management.

**1144** Board #2 May 30 9:30 AM - 11:30 AM  
**Long-term Changes On Bdnf And Igf-1 In Patients With T2dm - Training At Different Intensities**

João P. Magalhães, Pedro B. Júdice, Megan Hetherington-Rauth, Duarte neto, Catarina Matias, Luís B. Sardinha. *Faculdade de Motricidade Humana, Universidade de Lisboa, Lisbon, Portugal.*

(No relevant relationships reported)

A growing body of evidence suggests that exercise can influence the central nervous system through circulating growth factors that can cross the blood-brain barrier. Among these factors are the brain-derived neurotrophic factor (BDNF) and insulin-like growth factor-1 (IGF-1), which work simultaneously to improve brain plasticity and functioning. However, the long-term effects of different exercise intensities on BDNF and IGF-1 in patients with type 2 diabetes mellitus (T2DM) have never been examined. **PURPOSE:** Examine the impact of a 12-month randomized controlled trial of combined high-intensity interval training (HIIT) with resistance training (RT) vs. a combined moderate continuous training (MCT) with RT, on circulating levels of BDNF and IGF-1, in patients with T2DM. **METHODS:** Patients with T2DM (n=80) were randomized into three groups (Control, HIIT with RT, and MCT with RT). Exercise training was performed 3 days per week for 12 months, while supervised by exercise physiologists. Resting serum BDNF and IGF-1 levels were measured at baseline and 12-months. Within- and between-group changes in BDNF and IGF-1 were assessed using generalized estimating equations were used.

**RESULTS:** After adjustment for sex and baseline moderate-to-vigorous physical activity, there was no significant between-group changes for both HIIT and MCT on BDNF (MCT:  $\beta = -0.05$ , p=0.474; HIIT  $\beta = -0.01$ , p=0.950) and IGF-1 (MCT:  $\beta = 1.73$ , p=0.358; HIIT  $\beta = 2.75$ , p=0.173) in the intention-to-treat analyses. With similar results, the per protocol analysis (>70% adherence to prescribed sessions) showed no significant changes for both MCT and HIIT on BDNF (MCT:  $\beta = -0.03$ , p=0.723; HIIT  $\beta = 0.03$ , p=0.602) and IGF-1 (MCT:  $\beta = 0.52$ , p=0.829; HIIT  $\beta = 1.84$ , p=0.455).

**CONCLUSIONS:** These findings indicate that a 12-month intervention using a combination of HIIT with RT or MCT with RT had no significant impact on serum levels of both BDNF and IGF-1 in patients with T2DM. There is a heterogeneous and wide response to exercise on BDNF and IGF-1, especially when considering long-term interventions. Thus, future studies on the long-term effects of exercise are warranted to better understand the influence of these specific growth factors on brain health.

**1145** Board #3 May 30 9:30 AM - 11:30 AM  
**Vascular Changes In Patients With T2DM Following 1-year Of Exercise, Irrespective Of Cardiorespiratory Fitness Improvement**

Megan Hetherington-Rauth<sup>1</sup>, João P. Magalhães<sup>1</sup>, Pedro B. Júdice<sup>1</sup>, Xavier Melo<sup>2</sup>, Luís B. Sardinha<sup>1</sup>. <sup>1</sup>Faculty of Human Kinetics, University of Lisbon, Lisbon, Portugal. <sup>2</sup>Ginásio Clube Português, Lisbon, Portugal.

(No relevant relationships reported)

Micro- and macro-vascular changes occurring in patients with type 2 diabetes mellitus (T2DM) are major contributors to the development of cardiovascular disease, a leading cause of morbidity and mortality for these individuals. Increased cardiorespiratory fitness (CRF) from exercise training has been associated with improvements in metabolic and vascular health outcomes. Despite mean improvements in CRF from exercise training there remains a portion of participants having little or no improvement. **PURPOSE:** Given the importance of vascular function in people with T2DM, we assessed whether non-responders to CRF also failed to improve structural and functional arterial indices following a 1-year exercise intervention. **METHODS:** We assessed patients with T2DM (n=63) who participated in a three arm 1-year randomized controlled exercise intervention involving a control group, moderate continuous training or high intensity interval training combined with resistance training. Exercise responders were classified based on changes in CRF ( $\Delta VO_{2max} \geq 5\%$ ). Vascular structural and functional indices were measured using ultrasound imaging and applanation tonometry. Changes in vascular measures were compared

across control (n=22), exercise responders (n=15), and exercise non-responders (n=26) using generalized estimating equations. **RESULTS:** Compared to controls, both responders and non-responders had significant improvements in carotid intima-media thickness (responders:  $\beta=-3.54$  [CI -6.40, -0.68], non-responders:  $\beta=-5.59$  [CI -9.18, -2.01]) and peripheral arterial stiffness indices, such as carotid to distal posterior tibial artery pulse wave velocity (responders:  $\beta=-0.16$  [CI -0.28, -0.04], non-responders:  $\beta=-0.13$  [CI -0.24, -0.03]) and on the distensibility coefficient (responders:  $\beta=0.00$  [CI 3.01e-5, 0.00], non-responders:  $\beta=0.00$  [CI 1.41e-6, 0.00]), while only responders improved central arterial stiffness (carotid pulse wave velocity,  $\beta=-0.06$  [CI -0.11, -0.01]). No improvements in the remaining vascular indices and hemodynamic variables were observed. **CONCLUSIONS:** Regardless of increasing CRF, a 1-year exercise intervention entails significant benefits for vascular function in patients with T2DM.

**1146 Board #4 May 30 9:30 AM - 11:30 AM**  
**Influence of High Intensity Body-Weight Circuit Training in Adults with Type II Diabetes.**

Brian Kliszczewicz, FACSM, Robert Buresh, FACSM, Emily Bechke. *Kennesaw State University, Kennesaw, GA.*  
 Email: bkliszcz@kennesaw.edu

(No relevant relationships reported)

**PURPOSE:** To determine the effectiveness of a 15-week intervention of a minimal dose high-intensity bodyweight circuit (HIBC) program in persons with type 2 diabetes (T2D) on markers of metabolic function, autonomic balance, and body composition. **METHODS:** Three females (55±4yrs) and two males (64±1yrs) with T2D underwent assessments of glycosylated hemoglobin (HbA1c) and fasting plasma glucose (FG), insulin (INS), and lipids. Body composition was determined using dual-energy x-ray absorptiometry, aerobic fitness (submaximal treadmill test), blood pressure (SBP/DBP), and resting heart rate (RHR) were assessed. Participants completed 15-weeks of bodyweight circuit training (10 banded bodyweight squats, 5 modified pull-ups, 5 modified push-ups, 10 abdominal crunches). Participants completed as many cycles as possible in each session. Session duration progressed from 5-10 minutes, as tolerated, and session frequency progressed from 3-4 sessions per week. All assessments were repeated after 15 weeks of training.

**RESULTS:** Body composition: Pre and Post changes in mean weight ( $p = 0.395$ ), body fat % ( $p = 0.632$ ), lean mass ( $p = 0.372$ ). Aerobic fitness: estimated  $VO_{2max}$  ( $p = 0.232$ ), SBP ( $p = 0.062$ ), DBP ( $p = 0.90$ ), RHR ( $p = 0.727$ ). Metabolic biomarkers: FG ( $p = 0.942$ ), HDL ( $p = 0.271$ ), LDL ( $p = 0.671$ ), HbA1c ( $p = 0.810$ ), INS ( $p = 0.762$ ). **CONCLUSIONS:** The HIBC did not appear to be effective in improving markers of metabolic function or health-related physical fitness in the five participants. However, when removing a singular outlying participant, several factors demonstrate substantial improvements in several outcome measures. HIBC may be an appropriate and appealing intervention for those with T2D.

**1147 Board #5 May 30 9:30 AM - 11:30 AM**  
**Effects of Novel Compression Exercise Technology on Glycohemoglobin Levels and Weight in Type II Diabetics**

Chloe Wernecke<sup>1</sup>, Richard Henderson<sup>2</sup>, Cristian Torres<sup>1</sup>. <sup>1</sup>Vaspar Systems, Moffett Field, CA. <sup>2</sup>Covenant Medical, Lubbock, TX.  
 Reported Relationships: C. Wernecke: Salary; Vaspar Systems.

The most potent lifestyle intervention for treatment of Type II Diabetes (T2D) is consistent exercise. However, for many patients with the condition, other comorbidities such as osteoarthritis, hypertension, and high body mass indexes prevent them from being able to exercise intensively and consistently enough to experience optimal metabolic benefits. Recent research has supported the use of compression exercise in physically limited populations and demonstrated physiologic responses at lower intensities (10-20% one repetition maximum vs. 70% for hypertrophic response in conventional resistance exercise). The combination of compression technology with core cooling further lowers the exertional requirements and has been used in cardiopulmonary rehabilitation populations to provide a safe and reliable exercise intervention. Compression exercise has also been shown to significantly increase muscle hypertrophy, with a greater growth in type II fibers (higher expressors of GLUT4). Therefore, this technology could directly address basal metabolism through increasing muscle protein turnover, increasing glucose storage in skeletal muscle mass, and improving glycemic control. This capacity to attenuate the insulin response combined with the accessibility of the platform suggests a clinical implication for diabetes management.

**PURPOSE:** To establish safe use of cooled compressive exercise in Type II Diabetics and to examine the effect of 6 months of training on biometabolic markers, especially Glycohemoglobin levels and weight.

**METHODS:** Thirty Type II Diabetics agreed to 3 training sessions a week for 6 months. Biometabolic markers via blood draw were analyzed at 0, 3, and 6 months.

**RESULTS:** Midpoint data from 16 participants at 0 and 3 months were analyzed with a two-tailed T-test, revealing significant differences in Glycohemoglobin and weight. There was an 8% average decrease in Glycohemoglobin levels (8.5±2.2 vs. 7.8±1.8 mg/dl,  $p = 0.002$ ) and an average weight loss of 3.6 lbs (211±50 vs. 208±48 lbs,  $p = 0.032$ ). **CONCLUSION:** The preliminary results of this study suggest exercise with compression and cooling contributes to a reduction in biometabolic markers of diabetes. This intervention has promise in contributing to effective management of T2D with a low physical burden.

**1148 Board #6 May 30 9:30 AM - 11:30 AM**  
**Impact Of Short-term Exercise Training And Diet On Glucose Effectiveness Between Prediabetes Phenotypes**

Kara C. Anderson, Natalie Z.M. Eichner, Nicole M. Gilbertson, Emily M. Heiston, Steven K. Malin, FACSM. *University of Virginia, Charlottesville, VA.* (Sponsor: Steven K. Malin, FACSM)

(No relevant relationships reported)

**PURPOSE:** Although exercise improves glucose effectiveness (GE) in adults with type 2 diabetes, the influence of exercise on GE across the prediabetes phenotypes is unknown. Additionally, the impact of dietary intake on GE after an exercise intervention is limited. The purpose of this study was to examine the effect of short-term exercise training and habitual dietary intake on GE in adults with impaired fasting glucose (IFG) compared with IFG plus impaired glucose tolerance (IFG+IGT). **METHODS:** Female subjects (Age 59.4±7.2 yrs.; BMI 34.4±1.4 kg/m<sup>2</sup>) were screened for IFG (n=7, FPG: 103.9±2.3 mg/dl; 2-hr glc: 116.7±7.2 mg/dl) and IFG+IGT (n=10 FPG: 99.1±3.5 mg/dl; 2-hr glc: 152.9±11.0 mg/dl) using ADA criteria (120 min 75g OGTT). Subjects underwent 12 bouts of exercise at ~70% of HR<sub>peak</sub> for 60 min/d over 2-weeks. A 180 min, 75g OGTT was used to collect glucose and insulin to determine GE via a validated minimal model before and after training.  $VO_{2peak}$  and body composition (BIA) were also tested. Energy expenditure during training was calculated using a linear regression equation based on  $VO_{2}$  and heart rate. Subjects were also asked to record their diet before and after the intervention using 3-d food logs.

**RESULTS:** Exercise training reduced BMI ( $P < 0.05$ ), but had no effect on lean body mass (LBM) or  $VO_{2peak}$ ; and there was no difference in exercise energy expenditure in either group (all,  $P > 0.72$ ). However, adults with IFG+IGT increased GE post-training (within effect;  $P = 0.02$ ), and this rise in GE tended to be greater in IFG+IGT than IFG (0.23±0.08 vs. 0.00±0.08 mg/dl per min;  $P = 0.059$ ). Increased GE correlated with elevated LBM ( $r = 0.42$ ,  $P = 0.09$ ), but not reduced BMI ( $r = -0.08$ ,  $P = 0.75$ ) or increased fitness ( $r = 0.02$ ,  $P = 0.95$ ). While dietary protein reduction was linked with increased GE ( $r = -0.49$ ,  $P = 0.05$ ), no association was seen between GE and carbohydrates ( $r = -0.24$ ,  $P = 0.37$ ), fat ( $r = -0.17$ ,  $P = 0.53$ ) or total kcal ( $r = -0.23$ ,  $P = 0.40$ ). **CONCLUSION:** Independent of weight loss and fitness, short-term exercise training increased GE in adult women with IFG+IGT but not those with IFG. The results also suggest dietary protein may modulate the exercise effect on GE. Future work is needed to examine how nutrition can optimize exercise induced glucose regulation in individuals with prediabetes.

**1149 Board #7 May 30 9:30 AM - 11:30 AM**  
**Effect of Weight Loss on Physical Function in Overweight and Obese Individuals**

Jason M. Brown<sup>1</sup>, Gary D. Miller<sup>2</sup>. <sup>1</sup>Wake Forest Baptist Health, WINSTON SALEM, NC. <sup>2</sup>Wake Forest University, Winston Salem, NC.

(No relevant relationships reported)

Impaired physical function is a major health concern in obesity across the adult lifespan. Reducing weight and improving body composition may be critical for improving physical function in overweight and obese adults. **Purpose:** Investigate physical function before and during weight loss and study the relationships of body composition with changes in physical function. **Methods:** Data were obtained from women (n=127, age 49.3±12.8 years; weight 101.8±17.9 kg; BMI 37.8±6.6 kg/m<sup>2</sup>) and men (n=17, age 54.4±10.1 years; weight 131.9±31.9 kg; BMI 40.5±9.9 kg/m<sup>2</sup>) enrolled in a medical supervised comprehensive weight loss program at Wake Forest Baptist Health Weight Management Center. Mean follow up was 6.7 months. Body composition, grip strength, gait speed, chair rise time, and submaximal  $VO_{2max}$  were determined before and at the end of follow-up. Paired samples t-tests analyzed changes between baseline and follow-up. Pearson correlations examined relationships between pre-and-post functional performance tests and fat free mass (FFM), and fat mass (FM). **Results:** Mean weight loss was 11.8±9.8 kg. Approximately 74.9% of weight loss was from fat mass: [FM (48.3±18.5 kg at baseline and 38.9±12.7 kg at follow-up,  $p < .001$ ) and FFM (57.9±10.6 kg at baseline and 55.7±10.9 kg at follow-up,  $p < .001$ )]. Grip strength (29.3±8.1 to 32.9±11.2 kg,  $p < .001$ ), chair rise time (9.1±2.9 to 7.8±2.7 s,  $p = .018$ ), gait speed (1.2±0.2 to 1.3±0.2 m/s,  $p = .001$ ), and submaximal  $VO_{2max}$  (32.7±3.9 to 34.7±4.5 ml/kg/min,  $p < .001$ ) all improved from baseline to follow-up, respectively. Gait speed

( $r = -.292, p = .005$ ) grip strength ( $r = -.215, p = .041$ ) and chair rise ( $r = -.273, p = .009$ ) changes were correlated with FM changes but not FFM changes. **Conclusions:** A comprehensive weight loss generally improves physical function. This improvement is possibly mediated by FM losses rather than FFM changes.

**1150 Board #8 May 30 9:30 AM - 11:30 AM**  
**Sex-Specific HbA1c Responses to Structured Exercise Among Patients with Type 2 Diabetes**

Diana Devitskaya<sup>1</sup>, Cynthia Villalobos<sup>1</sup>, J. Mark VanNess<sup>1</sup>, Paul D. Vosti<sup>2</sup>, Alexis C. King<sup>3</sup>, Courtney D. Jensen<sup>1</sup>. <sup>1</sup>University of the Pacific, Stockton, CA. <sup>2</sup>St. Joseph's Medical Center, Stockton, CA. <sup>3</sup>University of Illinois at Urbana-Champaign, Champaign, IL.

(No relevant relationships reported)

In the United States, 1 in every 9 adult women and 1 in every 8 adult men have diabetes; 95% of these cases are Type 2 diabetes. The efficacy of exercise training as an intervention for treatment is likely attributed to a combination of biological and environmental factors, including age, physical fitness, and sex. Despite the large number of exercise trials observing the effects of physical activity on Type 2 diabetics, few studies compare the benefits of the intervention exclusive to the participants' sex. **PURPOSE:** To evaluate sex-specific glycated hemoglobin (HbA1c) changes to structured exercise among males and females with Type 2 diabetes. **METHODS:** 24 males and 40 females with Type 2 diabetes were enrolled in an exercise program involving aerobic activity, resistance exercise, and flexibility training. At the initial evaluation, subjects underwent a health history exam, multiple assessments of physical fitness, cardiometabolic testing, and an assessment of HbA1c. Following 10 weeks of bi-weekly exercise sessions, participants that remained active in the program were reassessed. A repeated measures ANOVA with Greenhouse-Geisser correction compared HbA1c levels at baseline and follow-up between sexes. **RESULTS:** Subjects were assigned to "completers" (N=39) or "non-completers" (N=28) based on adherence to the exercise program. At baseline, HbA1c levels did not differ between completers and non-completers ( $p = 0.234$ ). Sex was not related to completion of the trial ( $p = 0.660$ ) or baseline HbA1c ( $p = 0.117$ ). The repeated measures ANOVA found HbA1c to improve with exercise ( $F = 7.878, p = 0.008$ ) and an interaction effect with sex ( $F = 6.734, p = 0.014$ ) whereby males decreased more than females (0.61 compared to 0.02). **CONCLUSION:** In our sample, a structured exercise program induced greater reductions in HbA1c among male participants versus female participants. These findings help illustrate clinical importance for personalizing sex-specific exercise programs for persons at risk for or diagnosed with Type 2 diabetes.

**C-08 Thematic Poster - Oxygen Uptake Kinetics**

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

**1151 Chair: John M. Kowalchuk. University of Western Ontario, London, ON, Canada.**

(No relevant relationships reported)

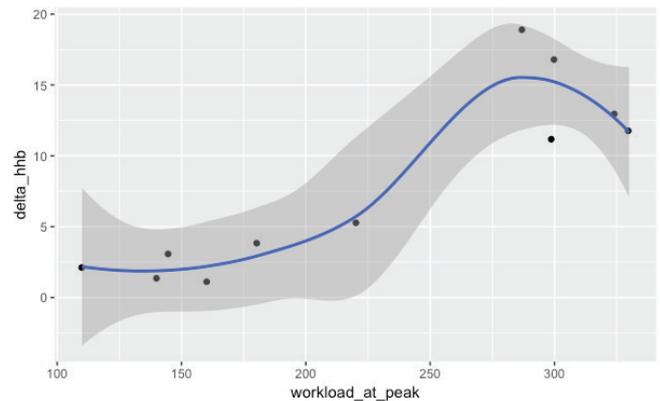
**1152 Board #1 May 30 9:30 AM - 11:30 AM**  
**Relationship Between Muscle Deoxygenation And Workload At Peak Exercise In Healthy Adults Using Near-infrared Spectroscopy**

Ashley M. Goodwin<sup>1</sup>, Jacqueline Montes<sup>1</sup>, Ipek Ensari<sup>2</sup>, Feliz Marie Hernandez<sup>1</sup>, Kayla Coutts<sup>1</sup>, Ashwini K. Rao<sup>1</sup>, Carol Ewing Garber, FACSM<sup>3</sup>. <sup>1</sup>Columbia University Irving Medical Center, New York, NY. <sup>2</sup>Columbia University Data Science Institute, New York, NY. <sup>3</sup>Teachers College, Columbia University, New York, NY. (Sponsor: Dr. Carol Ewing Garber, FACSM)  
 Email: amg2310@cumc.columbia.edu

(No relevant relationships reported)

Near-infrared spectroscopy (NIRS) is used to investigate muscle oxygenation, but the association of muscle deoxygenation (deoxygenated hemoglobin, deoxy[Hb+Mb]; ΔHHb) to workload during exercise needs further study. **PURPOSE:** To characterize the relationship between the change in muscle deoxygenation (ΔHHb) and maximal workload (MW) achieved during maximal cardiopulmonary exercise test (CPET). **METHODS:** 6 men and 5 women (mean ± SD: 39.09 ± 17.2 years [age]) underwent CPET on a recumbent cycle ergometer. ΔHHb in the vastus lateralis muscle was measured using NIRS, and MW as recorded in Watts. A polynomial model ( $\Delta HHb \sim MW + MW^2 + \text{peak oxygen uptake; } VO_{2peak}$ ) was compared to a semi-linear regression model (with an added interaction term between  $VO_{2peak}$  and MW) to

characterize the relationship. **RESULTS:** ΔHHb during CPET was strongly correlated with peak workload (0.881,  $p = 0.0003$ ) and  $VO_{2peak}$  (0.934,  $p = 0.0001$ ). The polynomial model explaining the relationship was significant (Adj.R<sup>2</sup>: 0.821,  $F(4,7) = 7.853, p = 0.009$ ); however, the point estimates were not. The semi-linear regression model was better able to characterize the overall trend (Adj.R<sup>2</sup>: 0.90,  $p = 0.0002$ ) and the drop in ΔHHb at the higher ends of MW, and indicated that  $VO_{2peak}$  had a significant effect ( $B = 54.9, p = 0.019$ ), and interacted with MW ( $B = -0.157, p = 0.04$ ). **CONCLUSION:** These preliminary results show that the linear increase in ΔHHb with incremental workload appears to attenuate and slightly decrease at greater MW, especially for those with higher exercise capacity. Supported by NIH Grant K01HD084690-01A1.



**1153 Board #2 May 30 9:30 AM - 11:30 AM**  
**The Oxygen Mean Response Time At Different Ramp-Incremental Cycling Slopes.**

Rafael de Almeida Azevedo<sup>1</sup>, Danilo Iannetta<sup>1</sup>, Daniel Keir<sup>2</sup>, Juan Murias<sup>1</sup>. <sup>1</sup>University of Calgary, Calgary, AB, Canada. <sup>2</sup>University of Health Network, Toronto, ON, Canada.

(No relevant relationships reported)

During a ramp-incremental (RI) cycling exercise, the measurement of oxygen uptake ( $\dot{V}O_2$ ) at the level of the mouth has a time delay from the onset of exercise, which is defined as the mean response time (MRT). It has been shown that the MRT is best calculated using the steady-state  $\dot{V}O_2$  from a bout of moderate-intensity exercise prior to the RI test, and then matching this  $\dot{V}O_2$  to the time at which this metabolic rate occurs during the RI test. Previous research has used RI slopes of 25 and 30  $W \cdot \text{min}^{-1}$  to measure the MRT. In this context, it is known that the  $\dot{V}O_2$  to work rate relationship is affected by the slopes of the ramp, which might affect the duration of the MRT. However, there is no empirical data to support this assumption. **PURPOSE:** To determine the influence of different RI slopes on the MRT. **METHODS:** Six healthy young men (age:  $28 \pm 10$  years; height:  $179 \pm 6$  cm; weight:  $72 \pm 5$  kg;  $\dot{V}O_{2max}$ :  $4.0 \pm 0.3$   $L \cdot \text{min}^{-1}$ ) performed six RI cycling tests with slopes of 5, 10, 15, 25, 30 and 100 ( $W \cdot \text{min}^{-1}$ ). The ramp-incremental test was preceded by a moderate-intensity step-transition (i.e., 6 min at 20 followed by 6 min at 100 W), from which the steady-state  $\dot{V}O_2$  could be determined before the ramp  $\dot{V}O_2$  vs power output relationship was established. The difference between the power output at the steady-state  $\dot{V}O_2$  and the ramp-specific power output at a similar  $\dot{V}O_2$  was transformed into time to calculate the MRT. **RESULTS:** The MRT for 5 ( $11 \pm 6$  s), 10 ( $16 \pm 11$  s), 15 ( $22 \pm 12$  s), 25 ( $26 \pm 11$  s), 30 ( $32 \pm 13$  s) and 100 ( $25 \pm 10$  s)  $W \cdot \text{min}^{-1}$  showed a significant main effect ( $P = 0.001$ ). Post-hoc comparisons showed shorter MRT for 5 compared to 25 ( $P = 0.025$ ) and 30 ( $P = 0.001$ )  $W \cdot \text{min}^{-1}$ , and for 10 compared to 30 ( $P = 0.015$ )  $W \cdot \text{min}^{-1}$ . **CONCLUSION:** Different ramp-incremental slopes directly influences the MRT, where it appears that MRT progressively becomes greater with steeper ramp slopes, until a certain level is reached (i.e.,  $\sim 25$   $W \cdot \text{min}^{-1}$ ) where there was no further lengthening of the MRT. From a practical perspective, less steep RI slopes will result in smaller adjustments in power output due to the shorter MRT. Thus, in RI slopes of 5 and 100  $W \cdot \text{min}^{-1}$  the power output adjustment would be  $\sim 1$  and  $\sim 40$  W, respectively.

THURSDAY, MAY 30, 2019

**1154** Board #3 May 30 9:30 AM - 11:30 AM  
**Skeletal Muscle Oxygen Kinetics During Exercise In Adults With Obstructive Sleep Apnea.**  
 Jeffrey E. Herrick<sup>1</sup>, Shirpa Puri<sup>2</sup>, Monira Aldhahi<sup>2</sup>, Vivek Jain<sup>3</sup>, Lisa MK Chin<sup>4</sup>. <sup>1</sup>University of Lynchburg, Lynchburg, VA. <sup>2</sup>George Mason University, Fairfax, VA. <sup>3</sup>George Washington University, Washington DC, DC. <sup>4</sup>National Institutes of Health Clinical Research Center, Bethesda, MD.  
 Email: herrick\_je@lynchburg.edu  
 (No relevant relationships reported)

Obstructive sleep apnea (OSA) is associated with persistent and progressive nighttime sympathetic nervous system (SNS) arousal strain in response to both hypopnea and apnea events. This repetitive strain of nighttime activation of the SNS may promote daytime hyperactivity, possibly limiting microvascular reactivity.

**PURPOSE:** The purpose of this study was to examine the on-kinetic profile of muscle deoxygenation during sub-maximal walking in adults with OSA.

**METHODS:** Twelve adults with OSA (age=48±10years, BMI=29±5kg/m<sup>2</sup>, Apnea-hypopnea index (AHI)=50±24) and 12 healthy non-OSA (NO) adults (42±8years, BMI=24±3kg/m<sup>2</sup>) completed two 6-minute bouts of submaximal exercise on a motorized treadmill, corresponding to 85% of anaerobic threshold. Using near-infrared spectroscopy (NIRS), concentration changes in deoxygenated hemoglobin-myoglobin ( $\Delta$ [HHb]) was measured continuously from the left lateral gastrocnemius muscle. The two bouts were averaged to form a single  $\Delta$ [HHb] response profile per subject. Indices of  $\Delta$ [HHb] on-kinetics include the time constant ( $\tau$ ),  $\Delta$ [HHb] amplitude ( $\Delta$ [HHb]amp), and mean response time (MRT=time delay+ $\tau$ ). In addition, the transition constant ( $K_t = \Delta$ [HHb]amp/MRT) reflects the overall normalized rate of  $\Delta$ [HHb] on-kinetics. Data were compared using age, BMI, gender, race, total physical activity and sleep duration as covariates for ANCOVA.

**RESULTS:** Both  $\tau$  and MRT did not differ between the groups (OSA:19.8±8.2s, NO:19.4±4.4s,  $p=0.835$ ; and OSA:28.9±7.2s, NO:24.4±5.9s,  $p=0.515$  respectively). However,  $\Delta$ [HHb]amp and  $K_t$  were lower in OSA compared to NO (OSA:2.8 ±2a.u., NO:8.7±5.3a.u.,  $p=0.011$ ; and OSA:0.101±0.07a.u./s, NO:0.354±0.17a.u./s,  $p=0.002$ , respectively). Further, the multivariate regression analysis showed that AHI was a strong predictor of and was negatively associated with  $\Delta$ [HHb]amp as well as  $K_t$  ( $p=0.015$  and  $p=0.019$  respectively).

**CONCLUSION:** The lower normalized response rate of muscle deoxygenation may be reflective of impaired capability of the muscle to extract/utilize oxygen, which may contribute towards a decreased ability to sustain physical activity. Disease severity was also directly related to the normalized  $\Delta$ [HHb] response rate, which has implications for physical activity participation in persons with OSA.

**1155** Board #4 May 30 9:30 AM - 11:30 AM  
**Gemfibrozil And Oxygen-hemoglobin Binding Affinity In Humans**  
 Chad C. Wiggins, Paolo B. Dominelli, Sarah E. Baker, John-Rodger A. Shepherd, Koji Uchida, Michael J. Joyner, FACSM. Mayo Clinic, Rochester, MN. (Sponsor: Michael J. Joyner, M.D., FACSM)  
 Email: wiggins.chad@mayo.edu  
 (No relevant relationships reported)

Exercise tolerance, in humans, is determined primarily by the diffusive and convective components of oxygen transport. Each of these can be acutely altered by changing the oxygen binding affinity for hemoglobin (right-shifting the oxygen-hemoglobin dissociation curve (ODC)). The tradeoffs associated with any acute shift in the ODC and the associated effects on O<sub>2</sub> transport are very context-dependent. Lipid-lowering drugs such as fibrates directly permeate the erythrocyte membrane and alter the hemoglobin molecule effectively lowering (right-shifting) the oxygen binding affinity to hemoglobin, in vitro. **PURPOSE:** To determine if fibrates (gemfibrozil) are effective in therapeutic doses, in vivo, at altering O<sub>2</sub> binding affinity for hemoglobin, and oxygen uptake kinetics during moderate intensity exercise. **METHODS:** Five volunteers (3M/2W, age= 32.3 ± 2.3 years, BMI = 23.5 ± 1.6 kg/m<sup>2</sup>,  $\dot{V}O_{2max}$  = 42.5 ± 4.2 ml/kg/min) completed a single study visit in which we measured oxygen binding affinity ( $P_{50}$  and Hill's n), and oxygen uptake kinetics during moderate intensity exercise (power output that elicited 40%  $\dot{V}O_{2max}$ ) at rest and following two separate 1,200mg doses of gemfibrozil (administered approximately 2h apart). **RESULTS:** Gemfibrozil did not alter oxygen-hemoglobin binding affinity with either dose (Baseline  $P_{50}$  = 26.8 ± 1.4, Hill's n = 2.5 ± 0.1; Dose #1  $P_{50}$  = 27.0 ± 0.7, Hill's n = 2.5 ± 0.0; Dose #2  $P_{50}$  = 27.5 ± 1.1 Hill's n = 2.5 ± 0.0). Oxygen uptake kinetics during exercise at a power output eliciting 40%  $\dot{V}O_{2max}$  were not different following the administration of either dose of gemfibrozil (Baseline  $\Delta\dot{V}O_2$  = 0.88 ± 0.32 L/min,  $\tau$  = 22.1 ± 9.7s; Dose #1  $\Delta\dot{V}O_2$  = 0.88 ± 0.31 L/min,  $\tau$  = 21.5 ± 9.7s; Dose #2  $\Delta\dot{V}O_2$  = 0.90 ± 0.31 L/min,  $\tau$  = 19.7 ± 8.2s). **CONCLUSION:** Therapeutic doses of gemfibrozil administered acutely are not an effective allosteric modifier of oxygen binding affinity for hemoglobin, in vivo, therefore, there were no changes in the O<sub>2</sub> kinetics during moderate intensity exercise.

**1156** Board #5 May 30 9:30 AM - 11:30 AM  
**Comparison of Oxygen Uptake Kinetics Between Kidney Transplant Recipients and Healthy Subjects**  
 Alessandro Patti, Daniel Neunhaeuserer, Sara Ortolan, Fausto Roman, Lucrezia Furian, Veronica Baiocco, Sara Rovai, Andrea Gasperetti, Andrea Ermolao. Padua University-Hospital, Italy, Padua, Italy.  
 Email: alessandro.patti@studenti.unipd.it  
 (No relevant relationships reported)

Aerobic exercise capacity is reduced in kidney transplant recipients (KTRs), with a progressive improvement after transplantation. KTRs show central exercise limiting factors such as chronotropic incompetence, anemia, heart or vascular diseases. Moreover, peripheral alterations at a muscular level are present in this population. It has been reported that slower oxygen uptake ( $\dot{V}O_2$ )-kinetics during a moderate constant load exercise, expressed as an increased time constant ( $\tau$ ), may reflect an impaired muscular oxidative metabolism.

**PURPOSE:** To analyze the  $\dot{V}O_2$ -kinetics in a population of KTRs.

**METHODS:** two groups of KTRs enrolled 3 and 12 months (n=21 and 14, respectively) after transplantation and a control group of healthy young adults (n=16) underwent cardiopulmonary exercise testing at cycle-ergometer. The protocol consisted in two subsequent constant, moderate-load exercise phases with a final incremental test until exhaustion.

**RESULTS:** The  $\tau$  was increased in KTRs compared to controls (50.4±13.11 s at 3 and 43.84±11.57 s at 12 months vs 28.91±8.37 s in controls; both  $P<0.01$ ) while  $\dot{V}O_{2peak}$  was reduced, but significantly higher in the group evaluated at 12 months (21.30±4.34 vs 26.36±7.96 ml/kg/min ( $P=0.04$ ), vs 41.7±7.82 ml/kg/min in controls (both  $P<0.01$ ). Consistently with this result, an increased hemoglobin (Hb) concentration was found 12 months after transplantation (12.77±1.67 vs 14.55±1.74 g/dL ( $P<0.01$ )). Also, lower peak heart rate (HR) might affect KTRs' exercise capacity (79.67±12.16% of predicted at 3 and 84.29±11.49% at 12 months vs 93.38±5.21% in controls; both  $P<0.01$ ). Among KTRs, the  $\tau$  showed a moderate negative correlation with  $\dot{V}O_{2peak}$  and oxygen uptake efficiency slope ( $R=-0.51$  and  $R=-0.57$ , respectively), less depending on Hb and particularly on peak HR ( $R=-0.33$  and  $R=-0.13$ , respectively). **CONCLUSION:** KTRs show slower  $\dot{V}O_2$ -kinetics, reduced peak  $\dot{V}O_2$  and HR when compared to a population of healthy young adults.  $\dot{V}O_{2peak}$  and Hb seem to improve during the first year after transplantation. The reduced aerobic capacity of KTRs was associated with slower  $\dot{V}O_2$ -kinetics, which seem to be less affected by the oxygen transport. These findings suggest that an impaired oxidative muscle metabolism could be a peripheral limiting factor contributing to decreased exercise capacity in KTRs.

**1157** Board #6 May 30 9:30 AM - 11:30 AM  
**The Effect of Passive Stretch on Vascular Control during Exercise**  
 Lillie M. Huckaby, Andrew M. Alexander, Kaylin D. Didier, Shane M. Hammer, Camryn N. Webster, Thomas J. Barstow, FACSM. Kansas State University, Manhattan, KS.  
 (No relevant relationships reported)

It has been demonstrated that daily stretching leads to an increase in blood flow to the skeletal muscle during exercise in rats; however, little is known about the effects of daily muscle stretching on adaptations of muscle blood flow in humans. **Purpose:** Therefore, the purpose of this study was to investigate the effect of passive stretch on vascular control (VC) during exercise. We tested the hypothesis that acute static stretch would not elicit changes in deoxygenated or total heme (deoxy-[heme], total-[heme] respectively) during exercise. Furthermore, we hypothesized that chronic stretch would elicit a decrease in oxygen extraction (deoxy-[heme]) through an increase in blood volume (total-[heme]). **Methods:** 4 healthy males (24.8 ± 3.6 yr, 179 ± 2.2 cm, 92.1 ± 7.8 kg) completed a controlled passive stretch of the plantar flexors. 2 subjects completed 2 days of a 30 min stretching protocol, while the other 2 subjects completed 2 days of a 10 min stretching protocol. Following the first two days of stretching, all subjects completed a moderate intensity (40%  $P_{peak}$ ) plantar flexion constant load test to determine acute effects of stretching on VC. All subjects then continued with the 10 min stretching protocol for the remaining 5 days, resulting in 7 consecutive days of stretch. Following the 7<sup>th</sup> day of stretch, subjects completed another moderate intensity (40%  $P_{peak}$ ) constant load test to determine the chronic effects of stretching on VC. Near-infrared spectroscopy was used to continuously measure deoxy-[heme] and total-[heme] during exercise. **Results:** Although no statistical differences were found, the 2 subjects who had completed the 30 min acute stretching protocol showed a marked decrease in deoxy-[heme] following acute stretching (5.13 ± 2.98  $\mu$ M to 1.40 ± 1.83  $\mu$ M), however no differences were observed in the 2 subjects who completed the 10 min acute stretching protocol. Following exercise in both the acute and chronic stretch protocols, no differences were observed in total-[heme]. **Conclusions:** The observed decrease in deoxy-[heme] lead us to believe that an acute static stretch of 30 minutes improves VC through better matching in the oxygen perfusion to extraction ratio during exercise. This VC enhancement was lost with chronic stretch, which could have been due to an insufficient stimulus on the microvasculature.

1158 Board #7 May 30 9:30 AM - 11:30 AM

**Oxygen Utilization During The Contraction-relaxation Of Isometric Knee Extension Exercise**Camryn N. Webster, Shane M. Hammer, Andrew M. Alexander, Kaylin D. Didier, Lillie M. Huckaby, Thomas J. Barstow, FACSM. *Kansas State University, Manhattan, KS.**(No relevant relationships reported)*

**PURPOSE:** Sufficiently high intramuscular pressures during contraction can lead to increased resistance to perfusive oxygen delivery and therefore increased fractional oxygen extraction in order to maintain muscle  $\text{VO}_2$ . Near-infrared spectroscopy (NIRS) has been used to estimate fractional oxygen extraction via deoxygenated heme concentrations (deoxy-[heme]) and changes in microvascular hematocrit via changes in total heme concentrations (total-[heme]). We tested the hypotheses that during severe and extreme intensities 1) deoxy-[heme] would decrease during contraction compared to relaxation and 2) total-[heme] would be unchanged during the contraction-relaxation cycle.

**METHODS:** Four subjects (2 men, 24.0  $\pm$  3.7 yrs, 81.9  $\pm$  27.4 kg, 168.9  $\pm$  10.2 cm) completed two isometric knee extension tests to failure at 40% (severe) and 70% (extreme) MVC. NIRS was placed on the right vastus lateralis to continuously measure deoxy-[heme] and total-[heme] during relaxation and contraction. Deoxy-[heme] and total-[heme] were averaged during the final 5 contraction-relaxation cycles and compared using paired t-tests.

**RESULTS:** Average deoxy-[heme] during contraction and relaxation at 40% was 44.8  $\pm$  31.8  $\mu\text{M}$  and 44.4  $\pm$  31.6  $\mu\text{M}$ , respectively. Average deoxy-[heme] during contraction and relaxation at 70% was 41.9  $\pm$  24.5  $\mu\text{M}$  and 40.1  $\pm$  23.6  $\mu\text{M}$ , respectively. Average total-[heme] during contraction and relaxation at 40% was 127.0  $\pm$  106.4  $\mu\text{M}$  and 124.2  $\pm$  105.2  $\mu\text{M}$ , respectively. Average total-[heme] during contraction and relaxation at 70% was 116.0  $\pm$  89.4  $\mu\text{M}$  and 115.0  $\pm$  90.5  $\mu\text{M}$ , respectively. Although statistical significance was not detected ( $p=0.06$ ), all four subjects demonstrated an increase in deoxy-[heme] at 70% MVC, but not at 40%.

**CONCLUSIONS:** These data suggest that the contraction-relaxation cycle may result in fluctuations in fractional oxygen extraction during extreme but not severe isometric exercise. Furthermore, the contraction-relaxation cycle does not appear to alter microvascular hematocrit.

**C-09 Thematic Poster - Taking Steps to Improve Walking and Walkability**Thursday, May 30, 2019, 9:30 AM - 11:30 AM  
Room: CC-102B1159 **Chair:** Susan A. Carlson. *CDC / Division of Nutrition, Physical Activity, and Obesity, Atlanta, GA.**(No relevant relationships reported)*

1160 Board #1 May 30 9:30 AM - 11:30 AM

**Step It Up! Prioritizing Community Supports for Walking in the United States**Eric T. Hyde, John D. Omura, Kathleen B. Watson, Janet E. Fulton, FACSM, Susan A. Carlson. *Centers for Disease Control and Prevention, Atlanta, GA.* (Sponsor: Janet E. Fulton, FACSM)

Email: mme7@cdc.gov

*(No relevant relationships reported)*

**PURPOSE:** *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities* (Call to Action) calls on Americans to be physically active and for the nation to better support walking and walkability. The Call to Action presents five goals, along with related strategies and actions, to support walkability in the U.S. Our study assessed U.S. adults' perceived presence and prioritization of four community supports for walking related to the goals of the Call to Action.

**METHODS:** Data from a nationwide sample of U.S. adults who completed the 2016 *SummerStyles* survey were analyzed ( $N = 4,043$ ). Participants were asked to identify which of the following four supports that encourage residents to walk were present in their community: walking groups, safe streets, access to walkable locations, and promotional campaigns. Participants were also asked which of these supports should be of highest priority for their community to encourage walking. We calculated prevalence of the presence and prioritization of supports overall and by demographic factors. Adjusted logistic regression analyses were conducted to examine the association between presence and prioritization of each support.

**RESULTS:** Overall, 46.5% of adults reported access to walkable locations, 29.2% reported safe streets, 12.9% reported walking groups, and 9.6% reported promotional

campaigns. The prevalence of these supports varied by sex, age, education, income level, and physical activity level. Access to walkable locations and safe streets were the two supports most often reported together (13.6%). Access to walkable locations (60.0%) and safe streets (50.6%) were most often selected as highest priority for communities, followed by promotional campaigns (23.6%) and walking groups (18.8%). For all supports, positive associations were observed between having the support and rating it as highest priority (range of adjusted prevalence ratios: 1.57-2.53).

**CONCLUSIONS:** The most commonly reported community supports for walking in the U.S. are access to walkable locations and safe streets. In addition, these two supports are most often selected as the highest priorities to encourage walking in communities. Establishing community supports for walking and improving resident awareness of them may help promote walking among U.S. adults.

1161 Board #2 May 30 9:30 AM - 11:30 AM

**Do Older Adults Achieve Moderate Intensity When Walking At Their Self-selected Pace?**Scott W. Ducharme<sup>1</sup>, Elroy J. Aguiar<sup>1</sup>, Aston K. McCullough<sup>1</sup>, Christopher C. Moore<sup>1</sup>, Colleen J. Sands<sup>1</sup>, Marcos A. Amalbert-Birriel<sup>1</sup>, Zachary R. Gould<sup>1</sup>, John M. Schuna, Jr<sup>2</sup>, Tiago V. Barreira<sup>3</sup>, Stuart R. Chipkin<sup>1</sup>, Catrine Tudor-Locke, FACSM<sup>1</sup>.<sup>1</sup>University of Massachusetts, Amherst, Amherst, MA. <sup>2</sup>Oregon State University, Corvallis, OR. <sup>3</sup>Syracuse University, Syracuse, NY. (Sponsor: Catrine Tudor-Locke, FACSM)*(No relevant relationships reported)*

Walking at a cadence of  $\geq 100$  steps/min consistently corresponds to minimally moderate intensity physical activity (PA). While current PA guidelines emphasize the importance of PA intensity for positive health outcomes, most young adults already naturally walk at cadences  $\geq 100$  steps/min. It is unknown whether older adults select these same cadences and intensities when they freely select their walking pace.

**PURPOSE:** To determine cadence and intensity of self-paced walking in older adults, and to evaluate the accuracy of using  $\geq 100$  steps/min to indicate moderate intensity in this population. **METHODS:** Twenty-six healthy, ambulatory older adults (10M, 16W; mean  $\pm$  SD; age = 68.3  $\pm$  4.8 years; height = 1.67  $\pm$  0.08 m; mass = 73.4  $\pm$  12.3 kg) walked continuously for 5 min at their self-selected pace back and forth along a 13m pathway that included a 7m gait mat. Oxygen uptake ( $\text{VO}_2$ ; mL/kg/min) was determined using indirect calorimetry and converted to absolutely-defined metabolic equivalents (METs;  $\text{VO}_2/3.5$ ). Average cadence was quantified using the gait mat. Prevalence of cadences  $\geq 100$  and METs  $\geq 3$  was calculated as the number of participants above the respective thresholds divided by total participants ( $n=26$ ). Classification Accuracy (ACC; true positive + true negative / total participants) determined the accuracy of  $\geq 100$  steps/min indicating  $\geq 3$  METs. **RESULTS:** The majority of participants (23/26, 83.3%) walked at a cadence  $\geq 100$  steps/min (cadence = 113  $\pm$  9 steps/min), and many (20/26, 76.9%) achieved moderate intensity (METs = 3.43  $\pm$  0.59). A cadence of  $\geq 100$  steps/min was a strong indicator of moderate intensity during self-paced walking (i.e.,  $\geq 3$  to  $< 6$  METs, ACC = 80.8%). **CONCLUSION:** Most healthy older adults attain at least moderate metabolic intensity during self-paced walking. These findings further suggest that "going for a walk" can be recommended, even in the absence of specific PA intensity guidelines. However, these results are preliminary and include only healthy, ambulatory, and relatively young (i.e., only one participant  $> 75$  years old) older adults. Future studies should continue to explore self-paced walking in a more representative sample of older adults, and include more of the oldest adults (i.e.,  $> 75$  years), or those with disease or ambulatory limitations. **FUNDING:** NIH-NIA-5R01AG049024

1162 Board #3 May 30 9:30 AM - 11:30 AM

**Association between the National Walkability Index and Walking Among U.S. Adults**Kathleen B. Watson<sup>1</sup>, Geoffrey P. Whitfield<sup>1</sup>, John V. Thomas<sup>2</sup>, David Berrigan<sup>3</sup>, Janet E. Fulton, FACSM<sup>1</sup>, Susan A. Carlson<sup>1</sup>.<sup>1</sup>Centers for Disease Control and Prevention, Atlanta, GA.<sup>2</sup>Environmental Protection Agency, Washington D.C., DC.<sup>3</sup>National Cancer Institute, Washington D.C., DC. (Sponsor: Janet E. Fulton, FACSM)

Email: iyr4@cdc.gov

*(No relevant relationships reported)*

*Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities* calls on Americans to work together to increase walking and improve walkability. No universal tool exists to measure community walkability; therefore, the Environmental Protection Agency created the National Walkability Index (NWI), a measure based on environmental features that affect the likelihood of whether people will walk as a mode of transportation. It is unknown, however, how strongly NWI is associated with transportation and leisure walking.

**PURPOSE**

To describe the association between the NWI and transportation and leisure walking among U.S. adults.

**METHODS**

We used data from the 2015 Cancer Control Supplement of the National Health Interview Survey (NHIS) to assess adults' past week participation in transportation and leisure walking for ≥10 minutes (n=33,672). NWI scores were linked to HIS data based on the block group of the respondent's residence. NWI scores were categorized into national level quartiles. Logistic regression analyses were used to describe the association between NWI quartiles and transportation and leisure walking.

**RESULTS**

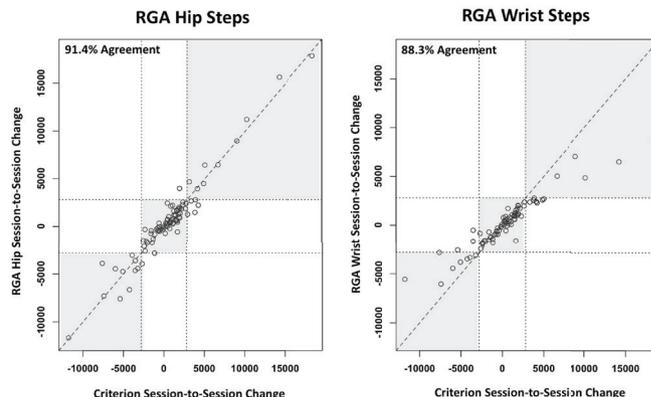
NWI quartiles exhibited significant linear and quadratic trends (p<0.05) with transportation walking and a significant linear trend (p<0.05) with leisure walking. Prevalence of transportation walking increased 23 percentage points and leisure walking increased 5 percentage points from least to most walkable communities (see Table).

	National Walkability Index (NWI)			
	Least walkable	Below average walkable	Above average walkable	Most walkable
NWI range	(1.00-5.75)	(>5.75-10.50)	(>10.50-15.25)	(>15.25-20.00)
Transportation walking (%; 95% CI)	24.5 (22.7, 26.5)	27.7 (26.4, 29.0)	38.0 (36.2, 39.9)	47.7 (44.6, 50.7)
Leisure walking (%; 95% CI)	49.5 (47.2, 51.9)	52.5 (51.1, 53.9)	52.3 (50.6, 54.0)	54.9 (52.3, 57.4)

<sup>1</sup>Prevalence adjusted for sex, age, race/ethnicity, education, region, and rural/urban status  
<sup>2</sup>NWI encompasses density, land use mix, and proximity to transit

**CONCLUSIONS**

NWI is a free and publicly available standardized tool to measure community walkability. Our findings suggest NWI is positively associated with transportation and leisure walking, although, the association was stronger for transportation walking. These findings may be useful to researchers and to public health, transportation, and planning professionals and other relevant stakeholders, as they promote transportation-related walking and walkability in communities.



**CONCLUSIONS:** These data show that RGA's worn on the wrist and hip are sensitive in detecting change in steps in free living settings and both detect changes in steps in free-living settings. This device can be employed for interventions designed to increase walking behavior.

Funded by: NIH: F31HL129802

**1163** Board #4 May 30 9:30 AM - 11:30 AM

**A Research-grade Accelerometer Is Sensitive In Detecting Step Changes In Free-living Settings**

Albert R. Mendoza<sup>1</sup>, John Staudenmayer<sup>2</sup>, Patty S. Freedson, FACSM<sup>2</sup>. <sup>1</sup>California State University, East Bay, Hayward, CA. <sup>2</sup>University of Massachusetts-Amherst, Amherst, MA. (Sponsor: Patty S. Freedson, FACSM)  
 (No relevant relationships reported)

Research-grade wearable accelerometers (RGA) are valuable tools to monitor steps. Despite the broad appeal of such devices, there is limited evidence as to how well RGA detect change in steps in free-living settings. **PURPOSE:** To determine the sensitivity of RGA in detecting change in steps compared to changes in directly observed steps (criterion) in free-living settings.

**METHODS:** Thirty-two participants were directly observed and video-recorded on three separate days for 2-hours each day in free-living settings. Participants wore commonly used hip- and wrist-worn RGA's. Criterion steps were assessed using a validated direct observation (DO) method applied to the video recordings. Session-to-session step differences (session 1 - session 2, session 2 - session 3, session 1 - session 3) were calculated. Linear-mixed models were used to determine within-subject standard deviation of criterion measured session-to-session changes in steps and to identify significant changes in steps (greater than ±1 SD of within-subject SD). DO classified pairs of sessions for each participant based on whether steps changed (i.e., greater than ±1 SD of within-subject SD). The same classification method was applied to the RGA's and percent agreement between the two methods was then calculated.

**RESULTS:**

**1164** Board #5 May 30 9:30 AM - 11:30 AM

**Assessing Walkability By Questionnaires: Construct, Validity, And Reliability**

Jingyuan Zhu, Zezhao Chen, Weimo Zhu, FACSM. *University of Illinois at Urbana-Champaign, Urbana, IL.*  
 Email: jz5@illinois.edu  
 (No relevant relationships reported)

**PURPOSE:** To determine the psychometrics of the walkability questionnaires, including their construct, validity, and reliability. **METHODS:** Using keywords "walkability," "measurements," "scales," "NEWS," etc., a comprehensive literature search was conducted, and identified questionnaires were reviewed and analyzed. **RESULTS:** Over 200 research publications were found and 27 questionnaires, including 14 different versions of Neighborhood Environment Walkability Scales (NEWS), focusing mostly on urban settings, were used for the final analysis. Ten key components were found in forming the construct of walkability, including residential density, land use mix-density, land use mix-access, street connectivity, walking/cycling facilities, aesthetics. Furthermore, 209 subcomponents were nested within the key components; e.g., "Residential Density" is consist of subcomponents of detached single-family residences, townhouses, apartments with different floors and so on. For validity, about 80% of questionnaires have reported it. The most used validation method (about 70%) was the "contracted groups", in which various levels of walkability and conditions neighborhoods were compared, with an effect size ranging from -0.65 to 3.81, followed by the correlational (with objective environmental attributes) approach (20%), with the validity coefficients ranging from 0.45 to 0.87. Finally, intra-rater/test-retest reliability was often (about 75%) computed for the reliability of the questionnaire, with a range from 0.25 to 0.99. **CONCLUSION:** A set of questionnaires with sound psychometric quality has been developed to assess the walkability in urban settings and more tools to evaluate walkability in a small community, rural settings are urgently needed.

**1165** Board #6 May 30 9:30 AM - 11:30 AM

**The Effect of Environmental Changes on Hospital Employee Walking Duration**

Ryan Doyel, Joseph Dadabo, Prakash Jayabalan. *Northwestern University Feinberg School of Medicine / Shirley Ryan AbilityLab, Chicago, IL.*  
 (No relevant relationships reported)

**Purpose**

Employee health is known to be associated with work-related physical exertion. The objectives of this study were to assess the effect on employee daily steps taken by transitioning a free-standing rehabilitation hospital to a larger facility and to compare step count differences across age, sex, and occupations.

**Methods**

Data from personal fitness devices linked to an employer-sponsored wellness program assessed the number of steps taken in two specific months (July and November) in the year prior to and in the year following the move to a rehabilitation facility three-times

THURSDAY, MAY 30, 2019

the size of the original. Participant data were only included for those enrolled in the program in these specific months pre- and post-move. Daily step counts accounted for activity both during and outside of work.

**Results**

Participants (n=70) had significantly less average daily steps for both July (9708 steps vs. 8008 p=0.02) and November (8839 vs. 7779 p=0.006) following the move to the new rehabilitation facility. Groups with significant step reduction included women compared to men (p=0.03), those aged 21-35 years (p=0.03), and the occupations of health care assistants (HCAs) and nursing (p=0.01), for both months. However, medical providers (physicians and nurse practitioners) had a trend towards increased step counts, regardless of age group or sex.

**Conclusion**

Transitioning a rehabilitation facility to a larger building does not necessarily lead to increased employee work-related physical activity. In our study, the transition to a larger facility was associated with a reduction in employee daily steps taken with relation to age, gender, and occupation. These findings may reflect strategic planning within the new workspace, which optimizes efficiency specifically for nurses and HCAs, allowing occupational duties to be confined to a smaller area. This could lead to employees having less daily work-related physical exertion, although this will be investigated further in future studies.

**1166 Board #7 May 30 9:30 AM - 11:30 AM  
Perceived Neighbourhood Walkability and Different Types of Physical Activity in Canadian Men and Women**

Vikram Nichani<sup>1</sup>, Chelsea Christie<sup>1</sup>, Jennifer Vena<sup>2</sup>, Christine Friedenreich<sup>1</sup>, Gavin McCormack<sup>1</sup>. <sup>1</sup>University of Calgary, Calgary, AB, Canada. <sup>2</sup>Alberta Health Services, Calgary, AB, Canada.  
Email: Gavin.McCormack@ucalgary.ca  
(No relevant relationships reported)

**Purpose:**

Few Canadian studies have examined whether associations between neighbourhood walkability and physical activity differ by gender. We estimated associations between perceived neighbourhood walkability and physical activity among urban Canadian men and women.

**Methods:**

This study included cross-sectional survey data from the 'Alberta's Tomorrow Project' (2008; n=9101), in which the International Physical Activity Questionnaire captured weekly physical activity and the Neighbourhood Environment Walkability Scale abbreviated version (NEWS-A) captured self-reported neighbourhood characteristics. NEWS-A subscale scores were standardized and overall walkability scores computed. Sociodemographic characteristics were also captured. Covariate-adjusted generalized linear models estimated the associations between physical activity participation and minutes (transportation walking: TW, recreational walking: RW, moderate-intensity: MPA, and vigorous-intensity: VPA) and walkability scores. Odds ratios (ORs) were estimated for participation and beta coefficients (Bs) were estimated for minutes of physical activity, with 95% confidence intervals (95CIs).

**Results:**

Overall walkability was positively associated with participation in TW (OR 1.05; 95CI 1.04, 1.06), RW (OR 1.02; 95CI 1.01, 1.03), MVPA (OR 1.02; 95CI 1.01, 1.03) and VPA (OR 1.02; 95CI 1.01, 1.03) and minutes of TW (B 1.14; 95CI 0.59, 1.69). In men, positive associations were found between lack of parking and MPA participation (OR 1.14; 95CI 1.06, 1.23) and residential density and TW minutes (B 8.31; 95CI 2.85, 13.78). In women, RW participation was associated with land use mix diversity (OR 1.11; 95CI 1.04, 1.17) and infrastructure and safety for walking (OR 1.15; 95CI 1.09, 1.21) and MPA participation associated with traffic safety (OR 0.91; 95CI 0.86, 0.96). Notably, residential density was negatively associated with RW minutes among women only (B -3.69; 95CI -6.62, -0.76).

**Conclusions:**

Neighbourhood walkability is associated with participation and time spent in different physical activities for men and women. Modifying perceptions, possibly via improving neighbourhood urban design, has the potential to increase physical activity in Canadian adults.

**1167 Board #8 May 30 9:30 AM - 11:30 AM  
US Vision Zero Plans: Opportunity to Support Safer Walking and Bicycling**

Kelly R. Evenson, FACSM<sup>1</sup>, Carmen C. Cuthbertson<sup>1</sup>, Rebecca B. Naumann<sup>1</sup>, Samantha Schilsky<sup>1</sup>, Camden Spade<sup>1</sup>, Seth LaJeunesse<sup>2</sup>. <sup>1</sup>UNC-Chapel Hill, Chapel Hill, NC. <sup>2</sup>Highway Safety Research Center, Chapel Hill, NC.  
(No relevant relationships reported)

Vision Zero is defined by a systems perspective to equitably reduce fatalities and serious injuries from road traffic crashes to zero. Recently, United States' (US) cities

began developing Vision Zero plans to address safety for all road users, including pedestrians/bicyclists. **PURPOSE:** We described the content of these plans to identify areas for improvement and facilitate creation of new plans. **METHODS:** We identified, collected, and analyzed 14 US Vision Zero plans published from 2014-2017. An extensive quantitative and qualitative coding tool was developed to identify elements of high quality plans. **RESULTS:** In total, 13 municipal and 1 county plan were abstracted. Nine of 14 plans described public participation in plan development, with 6 holding public meetings, 5 using surveys, 5 using map mark-ups, and 1 using social media. Most (n=13) plans had a vision statement and included goals/objectives to achieve the vision (n=12), but few included timelines to accomplish the goals (n=3). The goals to reach zero fatalities/serious injuries targeted the year 2020 (n=1), 2025 (n=3), 2028 (n=1), and 2030 (n=6), while 3 plans did not set a target date. All plans described the number of local-area crashes, but only half (n=7) reported the crash type, including involvement of a pedestrian/bicyclist. Plans included policy (11 traffic calming, 10 walking/bicycling to school, 9 Complete Streets, 5 no right turn on red), engineering (9 slow zones, 3 shared space for all road users), and educational (12 school education on pedestrian/bicyclist safety, 11 mass media/educational campaign on safety/speeding, 2 crosswalk ambassadors) strategies to address safety of pedestrians/bicyclists. Three of 14 plans proposed funding strategies for their implementation activities. Nine plans mentioned an evaluation plan for measuring progress, but most evaluation descriptions were brief. **CONCLUSION:** The assessment of US Vision Zero plans indicates that improvements could be made by involving the public more deliberately in plan development, including a clearer vision statement with connection to a target goal date and evaluation plan, and identifying funding sources for implementation activities. A number of target strategies could improve safety for pedestrians/bicyclists and should eventually be evaluated for their impacts.

**C-10 Thematic Poster - The Spine and Spinal Cord Injury**

Thursday, May 30, 2019, 9:30 AM - 11:30 AM  
Room: CC-104B

**1168 Chair: Joshua F. Yarrow. VA Medical Center, Gainesville, FL.**

(No relevant relationships reported)

**1169 Board #1 May 30 9:30 AM - 11:30 AM  
Neuromuscular Impairment Following Chronic Moderate-Severe Contusion in Spinal Cord Injured Rats**

Hui Jean Kok<sup>1</sup>, Jacob C. Oster<sup>2</sup>, Christine F. Conover<sup>3</sup>, Drew B. Fletcher<sup>2</sup>, Elisabeth R. Barton<sup>2</sup>, Joshua F. Yarrow<sup>1</sup>. <sup>1</sup>University of Florida; North Florida/South Georgia Veterans Health System, Gainesville, FL. <sup>2</sup>University of Florida, Gainesville, FL. <sup>3</sup>North Florida/South Georgia Veterans Health System, Gainesville, FL.  
Email: jean.kok@ufl.edu  
(No relevant relationships reported)

Muscle atrophy and neuromuscular impairment are consequences of spinal cord injury (SCI) that impede quality of life and functional recovery.

**PURPOSE:** To examine time course changes in muscle fiber type distribution, fiber cross-sectional area (fCSA), and other histologic characteristics of muscle pathology occurring in rats in response to moderate-severe contusion SCI.

**METHODS:** Twenty-four 4-month old male Sprague-Dawley rats received SHAM surgery or T9 laminectomy plus moderate-severe (250 kilodyne) contusion SCI by a computer-guided impactor. Body weight and Basso-Beattie-Bresnahan (BBB) hindlimb locomotor rating scores were measured weekly. Animals were euthanized and soleus were harvested at 2-weeks, 1-month, 2-months, or 3-months post-surgery. Soleus fiber-type distribution, fCSA, and muscle-nerve bundle morphology were assessed by immunofluorescent staining, imaged using an epifluorescent microscope, and quantified with semi-automatic muscle analysis using segmentation of histology (SMASH).

**RESULTS:** At 1-week post-surgery, SCI animals exhibited near-complete hindlimb paralysis (indicated by BBB scores <3), with minimal improvement in voluntary hindlimb locomotor function thereafter. Body weight, soleus mass, and median fCSA were significantly lower in SCI vs SHAM animals (p<0.01 at all timepoints). A slow-to-fast fiber-type shift was observed in SCI animals, with a progressive ~20% decrease in the number of type I fibers, ~8% increase in type IIa fibers, and ~5% increase in hybrid type I/IIa fibers at each consecutive timepoint, along with the emergence of unstained type IIx/b muscle fibers (~30% of total) at 3-months. In addition, muscle fiber splitting was present in SCI animals at 2-months, as well as reduced

neurofilament staining in SCI muscle-nerve bundles. Furthermore, evidence of growth related remodeling occurred in SHAM muscles from increased centrally nucleated fibers across timepoints but not in SCI.

**CONCLUSION:** Deterioration in motor ability accompanying SCI produced muscle atrophy and progressive impairments in muscle oxidative capacity that may have resulted from repetitive denervation-reinnervation cycles. These factors may have contributed to muscle pathology resulting in limited capacity for muscle growth and remodeling.

**1170 Board #2 May 30 9:30 AM - 11:30 AM**  
**Does Reduced Blood Flow Affect the Rate of Muscle Loss in Rats Post Spinal Cord Injury**

Michael C. Reynolds, Christine F. Conover, Dana M. Otzel, Russell D. Wnek, Kinley H. Buckley, Micah Flores, Ean G. Phillips, Darren T. Beck, Danielle McCullough, Joshua F. Yarrow. *North Florida/South Georgia Veterans Healthcare System, Gainesville, FL.*

(No relevant relationships reported)

Muscle atrophy is a major sequela occurring after spinal cord injury (SCI) that results from disuse. Additionally, other secondary complications of SCI (e.g., alterations in muscle blood flow) may contribute to muscle loss. **PURPOSE:** To determine the time course of muscle blood flow changes in relation to muscle atrophy in a rodent severe contusion SCI model. **METHODS:** Sixty-three 4-month-old (skeletal-mature) male Sprague-Dawley rats received SHAM surgery (T9 laminectomy) or severe (250 kdynes) contusion SCI using a computer-guided impactor. At 1-, 2-, and 4-weeks (wk) post-surgery, an intravenous catheter was implanted into the tail vein of SHAM and SCI animals. Colored microspheres (15µm diameter) were then infused into the circulation, allowing for the measurement of regional blood flow (ml/min/g tissue mass). Subsequently, the animals were euthanized and the mass of the dissected right and left soleus, gastrocnemius, and plantaris were taken. Concentrations of the colored microspheres within each muscle were determined via spectrophotometry, following chemical digestion of the muscle. Muscle blood flow calculations were then averaged across the contralateral hindlimbs for the aforementioned muscles. SCI vs SHAM comparisons were made at each time point using independent samples t-tests and Pearson's correlation coefficients. **RESULTS:** SCI animals exhibited 23-41% lower soleus mass, 17-27% lower gastrocnemius mass, and 16-29% lower plantaris mass vs SHAM, at all time points ( $p < 0.001$ ). Soleus and gastrocnemius blood flow (corrected for tissue mass, ml/min/g) was 51% lower ( $p < 0.001$ ) and 25% lower ( $p < 0.05$ ) after SCI, respectively, at 1-wk only. Additionally, a positive relationship between soleus mass and blood flow (corrected for mass) was identified at 1-wk ( $r = 0.687$ ,  $p < 0.01$ ). No significant alterations in plantaris blood flow were identified at any time point. **CONCLUSION:** Hindlimb muscle atrophy and reduced muscle blood flow occurred within 1-wk of severe contusion SCI. Thereafter, muscle blood renormalized in comparison with SHAM animals. Further research is needed to determine whether the reductions in muscle blood flow occurring after SCI contribute to muscle loss and/or whether prevention of blood flow deficits preserves muscle mass.

**1171 Board #3 May 30 9:30 AM - 11:30 AM**  
**Effects of Activity-Based Rehabilitation on Cancellous Bone Loss Following Contusion Spinal Cord Injury in Rats**

Russell D. Wnek, Christine F. Conover, Dana M. Otzel, Michael C. Reynolds, Kinley H. Buckley, Micah Flores, Ean G. Phillips, Joshua F. Yarrow. *North Florida/South Georgia Veterans Health System, Gainesville, FL.*

Email: rw\_nek@yahoo.com

(No relevant relationships reported)

Severe cancellous bone loss occurs after spinal cord injury (SCI), which increases fracture risk. Bodyweight-supported treadmill training (TM) and passive Cycle training are activity-based rehabilitation therapies that improve neuromuscular plasticity after SCI. However, the skeletal adaptations to these therapies remain unknown.

**PURPOSE:** Determine whether TM or Cycle training alter the rate of cancellous bone loss in a rodent severe contusion SCI model. **METHODS:** 16-wk old male Sprague-Dawley rats received: 1) SHAM surgery (T9 laminectomy) ( $n = 9$ ), 2) T9 laminectomy plus severe contusion SCI ( $n = 8$ ), 3) SCI+TM ( $n = 14$ ), or 4) SCI+Cycle ( $n = 7$ ). TM and Cycle were initiated 1-wk post-SCI and consisted of two 20 min bouts/day for 3 wks. For TM, 40% bodyweight support was provided and the paralyzed hindlimbs were manually positioned into plantar stepping (3.5 m/min, increasing 0.1 m/min/day). For Cycle, the paralyzed hindlimbs were secured to pedals on a motor-driven bike and moved passively through a cycling motion that mimicked normal gait patterning (12 rotations/min). Distal femur cancellous bone was quantified before surgery (baseline), and at 2- and 4-wk post-surgery via *in vivo* microCT. Outcomes are reported as percent change from baseline. **RESULTS:** Across all groups, cancellous bone volume (cBV/TV) was reduced 52-75% at 2-wk and 54-84% at 4-wk, compared with baseline ( $p < 0.01$ ). cBV/TV loss was 22% greater in SCI at 2-wk and 29% greater at 4-wk vs

SHAM ( $p < 0.01$ ), characterized by 28% lower trabecular number (Tb.N) and 90% higher trabecular separation (Tb.Sp) ( $p < 0.01$ ) and a higher trabecular pattern factor (Tb.Pf) ( $p < 0.05$ ) that indicates a less connected trabecular network. At 2-wk, neither TM nor Cycle prevented SCI-induced bone deficits. However, at 4-wk SCI+Cycle displayed 25-30% higher cBV/TV, 23-24% higher trabecular thickness (Tb.Th), 17-22% higher Tb.N, and lower Tb.Pf vs SCI and SCI+TM ( $p < 0.01$ ). Ultimately, no differences in cancellous bone outcomes were present between SCI+Cycle and SHAM at 4-wk, except for 16% higher Tb.Th in SCI+Cycle ( $p < 0.01$ ). **CONCLUSION:** Our data indicate Cycle better attenuated cancellous bone loss in rodents after severe SCI. The higher cBV/TV and Tb.Th in SCI+Cycle at 4-wk also suggests that this modality stimulated bone formation; although, further investigation is needed.

**1172 Board #4 May 30 9:30 AM - 11:30 AM**  
**Trabecular Bone Integrity at the Proximal Tibia Following a Contusion Spinal Cord Injury in Rats**

Aaron S. Gomez, Christine F. Conover, Ean G. Phillips, Taylor E. Bassett, Micah Flores, Russell D. Wnek, Joshua F. Yarrow. *Malcom Randall VA Medical Center, Gainesville, FL.*

(No relevant relationships reported)

Bone loss following spinal cord injury (SCI) is a major contributor to bone fracture risk, particularly at the proximal tibia. **PURPOSE:** To determine longitudinal changes in trabecular bone integrity at the proximal tibia in a rodent contusion SCI model. **METHODS:** 16-week old male Sprague-Dawley rats ( $n = 28$ ) were randomized to receive no surgery (Non-Surgical Controls), T9 laminectomy (SHAM), or T9 laminectomy plus severe (250 kdynes) contusion SCI using a computer-guided impactor and were euthanized 2- or 4-weeks (w) post-surgery. Hindlimb locomotion was assessed weekly using the BBB locomotor scale and trabecular bone integrity at the proximal tibia was assessed weekly using *in vivo* microCT. Comparisons were made using one-way ANOVAs and post-hoc analyses were done when appropriate. **RESULTS:** SCI animals exhibited significant losses in hindlimb locomotor function [BBB score  $< 6$  (0-21 scale);  $p < 0.01$  vs SHAM at all time points]. Percent cancellous bone volume (cBV/TV) was 32% lower at 2-w and 42% lower at 4-w in SCI vs SHAM animals ( $p < 0.01$ ). This bone loss was exemplified by progressively lower trabecular thickness (Tb.Th) and trabecular number (Tb.N) at 2- and 4-w ( $p < 0.01$ ) and higher trabecular separation (Tb.Sp) ( $p < 0.01$  at 4-w only). No differences in trabecular pattern factor (Tb.Pf), an inverse indicator of trabecular network connectedness, were present at 1-w. However, Tb.Pf was higher at 2- and 4-w in SCI vs SHAM ( $p < 0.01$ ). Structure model index (SMI) was higher at 2- and 4-w in SCI vs SHAM ( $p < 0.01$ ), indicating transition from rod- to plate-shaped trabecular spicules. Similarly, in SCI animals, cBV/TV was 48-75% lower, Tb.Th was 15-27% lower, Tb.N was 36-62% lower across the 4-w period in comparison with Non-Surgical Controls ( $p < 0.01$  for all), while Tb.Sp was progressively higher in SCI animals ( $p < 0.05$  for 2- and 4-w). Higher Tb.Pf and SMI were also found in SCI vs Non-Surgical Controls at all timepoints ( $p < 0.05$ ). Only cBV/TV was lower in SHAM vs Non-Surgical Controls across the 4-w period ( $p < 0.01$ ). **CONCLUSION:** Our findings indicate that trabecular bone integrity at the proximal tibia was significantly impaired in rats following a severe contusion SCI due to both bone loss and diminished bone quality. As such, our rodent model may be useful to examine effectiveness of strategies intended to prevent SCI-induced bone loss.

**1173 Board #5 May 30 9:30 AM - 11:30 AM**  
**Testosterone and Resistance Training Improves Muscle Quality Following Spinal Cord Injury**

Matthew E. Holman, Ashraf S. Gorgey, FACSM. *Hunter Holmes McGuire VA Medical Center, Richmond, VA.* (Sponsor: Ashraf S. Gorgey, FACSM)

Email: holmanme@vcu.edu

(No relevant relationships reported)

Spinal cord injury (SCI) adversely affects muscle quality and testosterone levels. Following SCI, resistance training (RT) has been shown to increase muscle cross-sectional area (CSA). Testosterone replacement therapy (TRT) in other populations has also been shown to improve muscle quality. **PURPOSE:** To examine if the combination of RT and TRT (TRT+RT) can maximize the beneficial effects to muscle quality following SCI. **METHODS:** Twenty-two SCI subjects were randomized into two intervention groups for 16-weeks: TRT+RT ( $n = 11$ ), or TRT ( $n = 11$ ). Muscle quality was assessed by measuring peak torque at speeds of 0, 60, 90, and 180°/sec (PT-0°, PT-60°, PT-90°, PT-180°), knee extensor CSA (KE-CSA), specific tension (ST), and contractile speeds (rise time [RTi], and half-time to relaxation [ $\frac{1}{2}$ TiR]) for each limb prior to testing and following the intervention. 2x2 mixed models with subject identifiers added as random effects and post-hoc Tukey-Kramer HSD tests identified pairwise differences within interactions ( $P < 0.05$ ). **RESULTS:** Following the intervention period, participants in the TRT+RT group increased PT-0° (48.4%,  $P = 0.017$ ), KE-CSA (30.8%,  $P < 0.001$ ), ST (8%,  $NS$ ), and RTi (17.7%,  $P = 0.012$ ). PT-0° decreased (17%,  $NS$ ), KE-CSA slightly increased (10%,  $NS$ ), ST decreased (20%,  $NS$ ), and RTi also slightly decreased (9%,  $NS$ ) in the TRT group. Changes to

PT-60°, PT-90°, PT-180°, and ½TIR for each group were similar following the 16-week intervention. **CONCLUSION:** Mechanical stress induced via RT combined with TRT maximizes enhancements of muscle quality when compared to TRT interventions alone in men with complete SCI. Our study shows that TRT+RT increases both muscle size, strength, and also improves muscle contractile properties.

**1174** Board #6 May 30 9:30 AM - 11:30 AM  
**Intervertebral Disc And Vertebral Health In Long-term Runners**

Ulrike H. Mitchell, Robert E. Larson, Jennifer A. Bowden, Bruce Bailey. *Brigham Young University, Provo, UT.* (Sponsor: Allen Parcell, FACSM)  
Email: rike\_mitchell@byu.edu  
(No relevant relationships reported)

Intervertebral disc (IVD) and bone health is strongly associated with nutrient flow and loading. Running places repeated substantial axial forces on the lower back, which likely influence its tissue health. Two theories exist: 1) cyclic loading is correlated to improved IVD and vertebral health parameters, because it brings about hypertrophic changes that make the tissue stronger, and 2) mechanical overload produces localized trauma and tissue damage, which outpaces the tissue's ability to repair itself and leads to accelerated degradation. Both theories are based on sound research, but the implications contradict. **PURPOSE:** To determine if long-term runners exhibit different IVD and bone health parameters compared to matched sedentary controls. **METHODS:** 10 male runners with an average of 25 year history of running (average 84km/week) and 5 age and sex-matched sedentary controls received Magnetic Resonance Imaging (MRI) and DXA scans. MRI T1 and T2 imaging techniques were used to obtain morphological characteristics, including the level of disc degeneration (Pfirrmann grading system). Diffusion-weighted imaging was used to calculate the apparent diffusion coefficient (ADC), which represents a mean estimate of water diffusion. The DXA scan was used to obtain bone mineral density (BMD) of the lumbar spine and femoral neck. **RESULTS:** The groups were not different in age, height or weight, but in BMI ( $p=0.03$ ) and total fat mass ( $p=0.005$ ). On average the sedentary controls demonstrated significantly greater L5 vertebral heights ( $p=0.009$ ). The runners exhibited greater L5/S1 mid-IVD height ( $p=0.03$ ) and less disc degeneration, but this difference was not significant. There was no difference in ADC. There was no difference in BMD. There was no difference in Z-scores, but on average the runners' Z-score was below 0 in the lower spine and above 0 in the femoral neck, while this was reversed in the sedentary subjects. **CONCLUSIONS:** This small sample seems to indicate that long term running is correlated with better IVD morphology, but smaller lumbar vertebral height. Running is not correlated with significantly higher BMD. The latter might change with an increased subject number, as all the runners' BMD numbers are consistently higher in respect to femoral neck and shaft and consistently lower in respect to L1-L4 vertebrae.

**1175** Board #7 May 30 9:30 AM - 11:30 AM  
**Thorax and Spine Abnormalities in Health Sciences Students**

Sergio Márquez-Gamiño, Karla S. Vera-Delgado, Cipriana Caudillo-Cisneros, Fernando Sotelo-Barroso, Montserrat G. Vera-Delgado. *Universidad de Guanajuato, León, Mexico.*  
Email: smgamino@fisica.ugto.mx  
(No relevant relationships reported)

**PURPOSE:** To evaluate trunk and thorax alterations prevalence in health sciences students.

**METHODS:** 293 recently admitted students to the Health Sciences Division of the University of Guanajuato, in Central Mexico, were clinically assessed for scapular girdle, spine alignment and thorax deformities.

**RESULTS:** In 208 women, and 85 men no previous diagnostic, symptomatology nor orthosis use were detected. Two of the participants had thorax asymmetry, corresponding to 0.7%. By contrast, 14.0% (41) presented dorsal hump. Also, the scapular girdle exhibited higher alterations indexes. For example, the shoulder blades were asymmetric in 19.5 (57) and 3.1% (9) for the right and left sides, respectively. Shoulders descended occurred in 23.5 (69), 4.4 (13), and 0.7% (2) (right, left, and both, in such order). Lumbar hump was observed in 45 (15.4%) students. No scoliosis was detected.

**CONCLUSIONS:** The structural problems detected involved the upper body and are quite important due to its implications for low back pain development. In fact, they can progressively evolve to cause nerve compression and its derived musculoskeletal conditions (MEC). In their practice, health professionals are exposed to risk behaviors for MEC, between others long standing periods, abnormal postures, patient's mobilization, etc. The information obtained can support new ways to train and physically fit the health sciences students as preventive measures for MEC development.

**C-11** Free Communication/Slide - Mental Health, Affect and Pain

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

**1176** Chair: Debra A. Stroiney. *George Mason University, Fairfax, VA.*

(No relevant relationships reported)

**1177** May 30 9:30 AM - 9:45 AM  
**The Effectiveness of Acute Resistance Exercise Training among Young Adults with Analogue Generalized Anxiety Disorder**

Brett R. Gordon, Mark Lyons, Matthew P. Herring. *University of Limerick, Limerick, Ireland.*  
Email: brett.gordon@ul.ie  
(No relevant relationships reported)

Evidence has supported positive effects of acute aerobic exercise and exercise training among adults with analogue and clinical Generalized Anxiety Disorder (GAD). However, the effects of acute resistance exercise (RE) are untested. **Purpose:** This study investigated the effects of acute RE, compared to quiet rest (QR), on worry among young adults with analogue GAD (AGAD) and otherwise healthy young adults (OH). **Methods:** Twenty-three young adults ( $25.3 \pm 4.5$  years; 15 female, 8 male) were block randomized by AGAD status (Psychiatric Diagnostic Screening Questionnaire GAD subscale score  $\geq 6$ , and Penn State Worry Questionnaire (PSWQ)  $\geq 45$ ) to acute RE or 30-min QR. RE consisted of two sets of 8-12 repetitions of eight exercises performed at moderate intensity in a laboratory, supervised by a researcher. Appropriate resistance for each exercise was determined following three weekly familiarization sessions prior to the acute RE. Worry was assessed at baseline and pre-post condition with the PSWQ. Two AGAD status X two Condition X two Time RM-ANOVA examined differences between RE and QR. Significant interactions were decomposed with simple effects analysis. Hedges' *d* effect sizes quantified magnitude of change. Potential moderation by sex, depression status, and sleep quality was also explored. **Results:** As expected, baseline worry was significantly greater among AGAD participants ( $p \leq 0.001$ ). There were no baseline differences between conditions. The three-way interaction for worry was statistically significant ( $F_{(1,19)}=18.50$ ,  $p \leq 0.001$ ). Decomposition of the interaction showed a significant reduction in worry from pre- to post-RE for AGAD (mean difference = -2.86,  $p \leq 0.04$ ), and a significant increase in worry from pre- to post-QR for AGAD (mean difference = 4.17,  $p \leq 0.01$ ). Compared to QR, RE resulted in a large magnitude improvement ( $d=0.98$ ) among AGAD participants. Among OH participants, there were no significant changes in worry in either condition. Worry response to RE was not significantly moderated by sex, depression status, or sleep quality (all  $p > 0.05$ ). **Conclusion:** Preliminary findings support both positive effects of acute RE on worry, the hallmark symptom of GAD, and the need for future investigations of the acute and chronic effects of RE among participants with analogue GAD.

**1178** May 30 9:45 AM - 10:00 AM  
**State Anxiety and Worry Responses to a Single Sprint Before and After Sprint Interval Training**

Matthew P. Herring, Courtney Fregopoulos, Chloe Forte, Tom P. Aird, Brian P. Carson. *University of Limerick, Limerick, Ireland.*  
Email: matthew.herring@ul.ie  
(No relevant relationships reported)

There has been continued interest in the anxiolytic effects of diverse and non-traditional exercise modes. However, the acute and chronic effects of sprint interval training (SIT) on anxiety and worry are not well known, and the degree to which chronic SIT changes the acute response to a single sprint is untested.

**PURPOSE:** This study quantified state anxiety and worry responses to a single sprint (Wingate), state anxiety and worry responses to three weeks of SIT, and, the extent to which chronic SIT changed acute responses to a single sprint.

**METHODS:** Eighteen healthy young adult males ( $25.2 \pm 3.6$  y) completed a single 30s Wingate at 7.5% body mass before and after a 3-wk SIT intervention comprised of nine sessions of 4-6 sprints. Acute and chronic effects of SIT on state anxiety, worry, and worry engagement were assessed with the State subscale of the State-Trait Anxiety Inventory and the Penn State Worry Questionnaire, respectively. Paired *t*-tests quantified pre-training acute responses and training responses (i.e., baseline to post-SIT); magnitude of change was quantified with standardized mean difference (*d*). RM-ANOVA examined differences between pre-training and post-training acute responses. The magnitude of change in acute responses was quantified with Hedges' *d* effect sizes.

**RESULTS:** At pre-training, state anxiety was significantly increased ( $t_{17}=-2.34$ ,  $p\leq 0.032$ ) and worry engagement was significantly decreased ( $t_{17}=3.14$ ,  $p\leq 0.006$ ) following a single sprint. Small-to-moderate magnitude reductions were found for worry engagement ( $d=0.37$ ) and worry ( $d=0.18$ ), and a small-to-moderate magnitude increase was found for state anxiety ( $d=0.36$ ). No statistically significant changes were found for state anxiety, worry, or worry engagement following SIT (all  $p>0.23$ ); however, small magnitude reductions were found for state anxiety ( $d=0.11$ ), worry ( $d=0.26$ ), and worry engagement ( $d=0.21$ ). Following SIT, a statistically non-significant small magnitude attenuation ( $d=0.14$ ) of state anxiety response to a single sprint was found.

**CONCLUSION:** Findings provide proof of principle that even a single high-intensity sprint can acutely perturb state anxiety and improve worry. Short-term SIT may elicit improved resting levels of anxiety and worry and response to a single high-intensity sprint in healthy young men.

1179 May 30 10:00 AM - 10:15 AM

### The Effects of a Physical Activity Program on Mood States in College Students

Lisa D. Powell<sup>1</sup>, Erin J. Reifsteck<sup>2</sup>, Pam K. Brown<sup>2</sup>, Diane L. Gill, FACSM<sup>2</sup>. <sup>1</sup>University of North Carolina, Greensboro, NC. <sup>2</sup>University of North Carolina at Greensboro, Greensboro, NC. Email: lisa.powell@cnu.edu

(No relevant relationships reported)

College students are at risk for adverse mental and physical health. Physical activity (PA) can reduce risks and promote positive mental health; however, less than half (49.9%) of college students meet the ACSM recommendations for PA (American College Health Association, 2017), reporting barriers such as lack of motivation, energy and time. Evidence-based, person-centered PA programs can overcome such barriers to enhance mood states and overall health. **PURPOSE:** To implement and evaluate a PA program (#cnubwell) designed to enhance mood states and promote continued PA in college students. **METHODS:** College students ( $n=10$ ) participated in #cnubwell for 5 wks. Students completed pre and post measures of perceived health, PA (Godin), intrinsic motivation (IMI), and mood states (POMS2), and a post program evaluation. Additionally, participants recorded Feeling Scale (FS) and Felt Arousal Scale (FAS) ratings before, during and after each weekly PA session. **RESULTS:** Participants experienced significant ( $p<0.05$ ) increases in positive feelings (FS) and energy levels (FAS) during each of the #cnubwell PA sessions. Intrinsic motivation increased from pre ( $M=34.8$ ) to post ( $M=37.4$ ), but the difference was not significant ( $p>0.05$ ). Ratings of perceived health and mood states remained unchanged from pre to post. On the evaluations, participants reported feeling more autonomous, confident and connected; and that they enjoyed learning new workouts, exercising at their own pace/abilities (i.e., modifications provided), engaging in structured activities, and connecting with new people. **CONCLUSION:** While notable positive feelings and energy levels were experienced by the participants during the PA sessions, pre and post measures of perceived health and mood states did not differ. Confounding factors such as participant illness and campus mourning (i.e., deaths of two students the week before) may influence results. Also, the study was conducted from beginning to mid-semester, which is likely a more stressful time for students. Possibly, PA provided a coping strategy during those stressful times. Additional research with larger samples may provide greater insight into benefits of the program on mental health and wellness.

1180 May 30 10:15 AM - 10:30 AM

### The Relationship Between Self-reported Lifestyle Habits and Depressive Symptoms in Older Adults 'At Risk' for Dementia

Bonnie A. Tran, Loren Mowszowski, Haley M. LaMonica, Sharon L. Naismith, Shantel L. Duffy. *The University of Sydney, Sydney, Australia.*

Email: bonnie.tran@sydney.edu.au

(No relevant relationships reported)

**PURPOSE:** Depressive symptoms are now well-established as an independent risk factor for dementia, however the association between health-related lifestyle habits and depressive symptom severity remains unclear. As such, this study aimed to investigate the relationship between self-reported physical activity levels, sleep behaviour and diet quality, and self-reported depressive symptoms in older adults 'at risk' for dementia.

**METHODS:** Participants aged  $\geq 50$  years were recruited from the Healthy Brain Ageing Clinic at the Brain and Mind Centre, The University of Sydney, and underwent comprehensive psychiatric, medical and neuropsychological assessments. Self-reported symptoms of depression were assessed via the 15-item Geriatric Depression Scale. Participants completed questionnaires to quantify volume of physical activity, and to characterise sleep behaviour and diet quality. **RESULTS:** A total of 90 participants (mean age=66yrs) with subjective and/or objective cognitive impairment were recruited. Depressive symptoms were correlated with somnolence ( $r=0.342$ ,  $p=0.001$ ), greater symptoms of insomnia ( $r=0.270$ ,  $p=0.010$ ), larger meal portion size ( $r=0.232$ ,  $p=0.029$ ), and a lower intake of protective foods ( $r=-0.355$ ,  $p=0.001$ ).

Of note, a trend between a higher number of bouts of moderate intensity physical activity and lower depressive symptoms was observed but did not reach significance ( $r=-0.208$ ,  $p=0.052$ ). Based on significant univariate correlations and age, a stepwise multiple regression analysis was performed. The regression model was statistically significant [ $R^2=0.286$ ,  $F(3,86)=11.483$ ,  $p<0.001$ ], and showed that age, somnolence and frequency of protective foods consumed each contributed 4%, 12% and 8% to the variance in depressive symptom severity, respectively. **CONCLUSIONS:** Outcomes of this study demonstrate that age, somnolence and the intake of protective foods account for a considerable proportion (28.6%) of depressive symptom severity in older adults 'at risk' for dementia. These results support recent research highlighting the benefit of non-pharmacological interventions for depressive symptom management. Further research looking at the longitudinal relationship, underlying mechanisms and the possibility of a bidirectional relationship is now warranted.

1181 May 30 10:30 AM - 10:45 AM

### Active Older Women Differentiated RPE while Affective Responses Remained Stable During Spontaneous or Prescribed Walking

Maressa P. Krause<sup>1</sup>, Sergio G. da Silva<sup>2</sup>, André L. Peres<sup>1</sup>, Liézer L. Cardoso<sup>1</sup>, Fredric L. Goss, FACSM<sup>3</sup>, Robert J. Robertson, FACSM<sup>3</sup>. <sup>1</sup>Universidade Tecnológica Federal do Paraná, Curitiba-PR, Brazil. <sup>2</sup>Universidade Federal do Paraná, Curitiba-PR, Brazil. <sup>3</sup>University of Pittsburgh, Pittsburgh, PA. Email: maressakrause@hotmail.com

(No relevant relationships reported)

**Purpose:** To compare psychophysiological responses and walking speeds between spontaneous, self-selected and prescribed conditions in elderly active women. **Methods:** Seventeen older active women participated in this investigation (66.9 $\pm$ 5.0 yrs). The study consisted of six experimental sessions of 20-min walking: 1. spontaneous (S) where subjects performed their usual walking speed unaware that research data were being collected; 2. self-selected (SS) where subjects were instructed to walk at their "preferred intensity"; 3. self-selected reproduction (SR) where subjects used the same instructions as SS; 4. Prescribed Exertion (PE) where subjects walked at easy (PEE), moderate (PEM) and hard (PEH) exertion. The last three sessions were counterbalanced. Psychophysiological (RPE - OMNI scale, and affective valence (AV) - Feeling Scale) and heart rate (HR) were measured immediately after exercise, and distance was recorded to calculate average walking speed. One way ANOVA examined differences in dependent variables between conditions and post-hoc Tukey tests were used to decompose significant main effects ( $p<0.05$ ). **RESULTS:**

Psychophysiological and WS across the different walking conditions (mean; SD)						
	S	SS	SR	PEE	PEM	PEH
HR (bpm)	130.5 $\pm$ 14.6	136.2 $\pm$ 7.7	138.9 $\pm$ 6.0	114.8 $\pm$ 7.3abc	138.6 $\pm$ 4.4d	147.7 $\pm$ 4.9abde
AV (FS -5 - +5)	4.6 $\pm$ 0.6	4.8 $\pm$ 0.3	4.6 $\pm$ 0.5	4.6 $\pm$ 0.5	4.5 $\pm$ 0.5	4.8 $\pm$ 0.4
RPE (0 - 10)	6.2 $\pm$ 1.7	6.2 $\pm$ 0.8	6.5 $\pm$ 0.8	4.3 $\pm$ 0.7abc	6.1 $\pm$ 0.8d	8.4 $\pm$ 0.6abede
WS (m/s)	1.42 $\pm$ 0.15	1.43 $\pm$ 0.12	1.43 $\pm$ 0.10	1.14 $\pm$ 0.09abc	1.40 $\pm$ 0.07d	1.61 $\pm$ 0.07abede

S: spontaneous; SS: self-selected; SR: self-selected reproduction; PEE: prescribed exertion-easy; PEM: prescribed exertion-moderate; PEH: prescribed exertion-hard. <sup>a</sup>Differ from S; <sup>b</sup>Differ from SS; <sup>c</sup>Differ from SR; <sup>d</sup>Differ from PEE; <sup>e</sup>Differ from PEM (all  $p<0.05$ ).

**Conclusion:** Active older women were able to discriminate between different prescription instructions designed to produce low, moderate and hard exertion. Interestingly, the spontaneous and self-selected intensities elicited similar walking speeds as the prescribed moderate exertion session. Public health strategies may use simple exertional cues to help guide individuals in producing moderate intensity exercise, which may lead to health-fitness benefits. The pleasurable feeling associated with this intensity may in turn improve exercise adherence.

1182 May 30 10:45 AM - 11:00 AM

### Bodily Pain in U.S. Navy Explosive Ordnance Disposal Technicians: Exploring Biobehavioral Relationships

Trevor B. Viboch, D. Christine Laver, Lisa M. Hernández, Marcus K. Taylor, FACSM. *Naval Health Research Center, San Diego, CA.* (Sponsor: Marcus K Taylor, FACSM)

Email: trevor.b.viboch.ctr@mail.mil

(No relevant relationships reported)

Pain is a complex experience which may interact with biological, psychological, and social factors. Evidence supports a relationship between bodily pain and depression in which one may augment the other. This connection was shown in U.S. Marines

but not yet studied in U.S. Navy Explosive Ordnance Disposal (EOD) Technicians. Characterizing EOD and understanding these interactions is a key aspect of managing warfighter health and performance.

**PURPOSE:** The primary purpose is to assess bodily pain and medication (med) use in EOD Technicians. The secondary purpose is to evaluate associations between bodily pain and biobehavioral correlates, such as depression, anxiety, and posttraumatic stress disorder (PTSD). **METHODS:** Eighty-four EOD Technicians self-reported bodily pain (0–10 scale), pain med use, and symptoms of depression, anxiety, and PTSD. One-way analysis of variance evaluated the relationship between med type and bodily pain. Pearson product-moment correlations examined associations between pain and biobehavioral measures. **RESULTS:** Self-reported bodily pain: none = 6.9%, mild = 69.4%, moderate = 22.2%, severe = 1.4%;  $\bar{x}$  = 2.4/10 for bodily pain. Of those reporting pain, 67.4% were taking meds, which represents 36.9% of all participants. Higher pain was reported in those taking prescription meds compared to over-the-counter meds or no meds [ $F(4, 7) = 8.72, p < .001$ ]. Positive relationships were found between pain and depression ( $r = .34$ ), anxiety ( $r = .33$ ), and PTSD ( $r = .53$ ) symptoms (all  $p < .01$ ). **CONCLUSION:** Most EOD Technicians reported some level of pain contrasted with roughly half the general population (55.7%). Compared to U.S. Marines, pain ratings were similar; however, EOD Technicians reported over twice the prevalence of pain med use. Additionally, findings indicate that EOD Technicians using prescription meds reported higher pain. With respect to biobehavioral correlates, the relationship between pain and depression in EOD Technicians was similar to reports in Marines. Combined with the associations observed between pain, anxiety, and PTSD, this reinforces the premise that pain and behavioral health are interrelated. These findings may be useful for clinicians when evaluating military members for potential comorbidities, particularly following trauma when symptoms may be most severe.

1183 May 30 11:00 AM - 11:15 AM

#### Pain Sensitivity And Psychological Variables Affect Delayed Onset Muscle Soreness (DOMS)

Einat Kodesh, Anat Sirkis-Gork, Simone Shamay-Tsoory, Tsipora Mankovsky-Arnold, Irit Weissman-Fogel, *University of Haifa, Haifa, Israel.* (Sponsor: Bareket Falk, FACSM)  
Email: ekodesh@univ.haifa.ac.il  
(No relevant relationships reported)

Delayed onset muscle soreness (DOMS) is an acute muscle pain condition occurring after eccentric muscular activity in some but not all people. Physiological and psychological factors may affect DOMS. **PURPOSE:** To investigate whether individual pain sensitivity and psychological variables predict DOMS. **METHODS:** Thirty two participants completed pain-related psychological questionnaires and quantitative sensory testing (QST) and thereafter the DOMS protocol was carried out for the upper extremity. The second session was held 24 h later, participants completed the DOMS-related interference questionnaire and QST was then reapplied. To compare QST parameters and psychological variables between those developing DOMS and those who did not, independent sample t-tests were conducted. Multiple regression analyses were used to determine the predictive role of QST and psychological variables on DOMS intensity. **RESULTS:** Out of the 32 participants, 17 showed a DOMS response. Participants who developed DOMS had higher trait anxiety ( $p=0.010$ ), depression ( $p=0.025$ ), and stress ( $p=0.034$ ) scores, compared to those who did not develop DOMS. Trait anxiety predicted the intensity of DOMS ( $r=0.63, P<0.000$ ). Additionally, those who developed DOMS demonstrated a higher systemic pain sensitivity at baseline, expressed by a lower pressure pain threshold in the muscle that was exercised and in a remote muscle, and by a lower pain inhibition efficiency ( $P<0.02$ ). No correlation was found between the level of pain sensitivity at baseline and the intensity of DOMS. **CONCLUSIONS:** The endogenous ability to regulate pain has a significant impact on pain development in DOMS. Development of DOMS is affected by baseline systemic pain sensitivity as well as psychological and personality traits. Our findings highlight the contribution of physiological and psychological factors to the development of DOMS.

1184 May 30 11:15 AM - 11:30 AM

#### Acute Pain And Fatigue Responses To Resistance Exercise Among Gulf War Veterans With Chronic Pain

Jacob Lindheimer<sup>1</sup>, Aaron J. Stegner<sup>1</sup>, Ryan J. Dougherty<sup>2</sup>, Stephanie M. VanRiper<sup>2</sup>, Neda E. Almassi<sup>2</sup>, Jacob V. Ninneman<sup>2</sup>, Laura D. Ellingson-Sayen, FACSM<sup>3</sup>, Patrick J. O'Connor, FACSM<sup>4</sup>, Dane B. Cook, FACSM<sup>1</sup>. <sup>1</sup>US Department of Veterans Affairs, Madison, WI. <sup>2</sup>University of Wisconsin-Madison, Madison, WI. <sup>3</sup>Iowa State University, Ames, IA. <sup>4</sup>University of Georgia, Athens, GA. (Sponsor: Dane B. Cook, FACSM)  
(No relevant relationships reported)

The chronic effects of exercise training have previously been explored in Persian Gulf War Veterans (GV) with chronic musculoskeletal pain (CMP). However, the

effect of a single bout of resistance exercise on pain and fatigue has not been reported. The magnitude and direction of those effects over several months of a progressive resistance exercise training (RET) program is also unknown.

**PURPOSE:** To examine changes in pain and fatigue in response to acute bouts of resistance exercise across 16 wks of RET among GV with CMP. It was hypothesized that perceived pain and fatigue would decrease after each training session and the magnitude of this change would increase over the course of the intervention.

**METHODS:** GV who met criteria for widespread CMP ( $n=22; 50\pm 7$  years) completed 16 wks of RET. Training intensity started at 25% and 35% of estimated one-repetition maximum (1RM) and systematically progressed over the course of the intervention. Pre and post exercise pain and fatigue scores on a 0-100 visual analog scale were examined for the first RET session of each training wk. Data gathered during 1RM testing (baseline, mid-program, and end-program) were excluded, resulting in analysis of 13 training wks. Hypotheses were tested with separate 2 (time: pre, post) x 13 (program length: wk 1-13) repeated measures ANOVA models.

**RESULTS:** Average pre-exercise pain and fatigue were  $27.8\pm 2$  and  $21.8\pm 3$ , respectively. Pre-exercise trend line slopes were 0.04 and 0.02 for pain and fatigue, respectively. Significant interaction effects for pain,  $F = 2.80, p = .006$ , partial eta squared = 0.12, and fatigue,  $F = 2.23, p = .03$ , partial eta squared = 0.10, models were found. Relative to pre-exercise, post-exercise scores were lower following earlier training sessions (e.g., wks 1-5) and higher following later training sessions (e.g., wks 10-13).

**CONCLUSION:** Contrary to our hypothesis, post-exercise pain and fatigue appeared to increase across wks 1-13, which could be related to the progression of exercise intensity over the course of the program. However, the stability of the pre-exercise scores across wks 1-13 suggests that weekly pre-exercise pain and fatigue were not exacerbated by acute responses to RET.

Project supported by Dept. of Veterans Affairs grant: IO1-CX000383. Jacob Lindheimer was supported by Dept. of Veterans Affairs grant: IK2-CX001679.

#### C-12 Free Communication/Slide - Older Adults

Thursday, May 30, 2019, 9:30 AM - 11:30 AM  
Room: CC-202C

1185 Chair: Melissa A. Whidden, FACSM. *West Chester University, West Chester, PA.*

(No relevant relationships reported)

1186 May 30 9:30 AM - 9:45 AM

#### Breaking3: Performance Characteristics Of A Sub-three-hour Septuagenarian Marathoner

Austin T. Robinson<sup>1</sup>, Joseph C. Watson<sup>1</sup>, Matthew C. Babcock<sup>1</sup>, Michael J. Joyner, FACSM<sup>2</sup>, William B. Farquhar, FACSM<sup>1</sup>. <sup>1</sup>University of Delaware, Newark, DE. <sup>2</sup>Mayo Clinic, Rochester, MN. (Sponsor: William B. Farquhar, PhD, FACSM)  
Email: ausrobin@udel.edu  
(No relevant relationships reported)

**Purpose:** In this case study we characterize the physiological profile of an elite 70-year old endurance runner who ran 2:55:18 at the Scotiabank Toronto Marathon on Oct 21, 2018, breaking his own American record for a 70-year old male by over two-minutes. **Methods:** The athlete underwent a familiarization visit, health screening, and performance-testing. During the screening visit, a resting electrocardiogram and a fasted venous blood sample for biochemical analysis were obtained, and dual energy X-ray absorptiometry was performed to assess body composition. Performance testing consisted of graded treadmill running and indirect calorimetry for determination of maximum oxygen uptake ( $\dot{V}O_{2max}$ ), running economy testing (RE; 12-16 km/hr, 0% grade, 5 minutes each), and lactate threshold (LT; blood draws during running via venous catheter). **Results:** Height was 176.5 cm, weight was 64.2 kg, and he exhibited exceptional cardiometabolic health for his age (body fat: 19.1%, blood pressure: 122/75 mmHg, blood glucose: 86 mg/dL, total cholesterol: 173 mg/dL, LDL: 84 mg/dL, HDL: 66 mg/dL, and triglycerides: 135 mg/dL). The only medication he reported taking was daily low-dose aspirin. His  $\dot{V}O_{2max}$  was 46.9 mL/kg/min (max heart rate: 156, 104% age-predicted  $HR_{max}$ , RPE 19 out of 20). This  $\dot{V}O_{2max}$  is exceptional for a 70-year old, but lower than what is expected for a performance-matched younger runner. He reached his LT at ~14 km/hr, which corresponded, to a  $\dot{V}O_2$  of 44.0 mL/kg/min or 93.8% of his  $\dot{V}O_{2max}$ , and a heart rate of 147, or 94% of  $HR_{max}$ . Near  $\dot{V}O_{2max}$  levels of oxygen consumption were reached during the final stage of RE testing (16 km/hr, 46.0 mL/kg/min) and blood lactate also plateaued at 14.4 mmol/L. Running economy at the submaximal speeds was comparable to elite younger runners.

**Conclusion:** Running a marathon in 2:55:18 requires a running speed of ~14.5 km/hr, a speed which is faster than this elite masters athlete's laboratory-measured LT speed

(14km/hr). Our data indicate that his ability to maintain a remarkably high percentage of his measured  $\text{VO}_{2\text{max}}$  (>90%) enable him to compete with performance-matched younger runners who have much higher  $\text{VO}_{2\text{max}}$  values.

1187 May 30 9:45 AM - 10:00 AM

### Body Fat Is More Strongly Associated Than Lean Mass With Physical Function In Middle-aged Women

Christie L. Ward-Ritacco, Ashley L. Meyer, Walker Grace, Natalie J. Sabik, Deb Riebe, FACSM. *University of Rhode Island, Kingston, RI.* (Sponsor: Deb Riebe, FACSM)  
Email: CHRISTIEWARD@URI.EDU  
(No relevant relationships reported)

**PURPOSE:** Research in older adults suggests that percent body fat is more strongly associated with physical function compared to lean mass when examining relationships between body composition and functional performance. Poor physical function has been associated with increased risk for disability and loss of independence in older women; however, the component of body composition most strongly associated with physical function in middle-aged females is incompletely characterized. Poorer physical function earlier in the lifespan may predispose people to decreased quality of life in older age. The purpose of this study was to examine the strength of the associations between lean mass and percent fat on objectively measured physical function performance in middle-aged females.

**METHODS:** Eighty females (ages  $52.58 \pm 6.10$  yrs) were assessed for body composition (lean mass, percent fat) via dual-energy x-ray absorptiometry, physical activity and sedentary time via accelerometer (steps per day, minutes per day), and physical function via Timed Up-And-Go, 30-Second Chair Stand, Transfer Task, Six-Minute Walk, and Lift and Carry.

**RESULTS:** Measures of lean mass (total lean mass, lean mass index) were not related to any measures of physical function (all  $p > 0.05$ ), while percent fat was related to Timed Up-And-Go ( $r = .32$ ), 30-Second Chair Stand ( $r = -.35$ ), Transfer Task ( $r = .53$ ), and Six-Minute Walk ( $r = -.48$ ) performance (all  $p \leq 0.05$ ) but not Lift and Carry performance ( $r = .22$ ,  $p = .06$ ). Hierarchical linear regression analyses revealed: (1) age, steps per day, and percent fat were related to Transfer Task, 30-Second Chair Stand, and Six-Minute Walk performance, explaining 40%, 25%, 25% of the variance, respectively (all  $p \leq 0.05$ ); (2) age, sedentary minutes per day, and percent fat were related to Timed Up-And-Go, explaining 18% of the variance,  $p \leq 0.01$ ; (3) age, and average steps per day, but not percent fat, were associated with Lift and Carry performance, explaining 11% of the variance.

**CONCLUSIONS:** In middle-aged women, percent fat was more strongly associated with physical function performance compared to total mass, lean mass, or lean mass index. This suggests that reducing percent fat via intervention may be an effective method for improving functional performance among women in this age group.

1188 May 30 10:00 AM - 10:15 AM

### Age-related Differences in Rectus Femoris Muscle Size and Hip Flexion Maximal and Rapid Torque Characteristics

Ty B. Palmer, Bailey M. Palmer. *Texas Tech University, Lubbock, TX.* (Sponsor: C. Roger James, FACSM)  
(No relevant relationships reported)

Previous studies have reported that decreases in muscle size of the rectus femoris (RF) may contribute to age-related deficits in leg extension strength. However, we are aware of no studies that have examined the contribution of RF muscle size to age-related differences in hip flexion strength, and more specifically, the age-related differences in maximal and rapid torque characteristics. **PURPOSE:** To determine the effects of age on RF muscle size (cross-sectional area [CSA]) and hip flexion maximal and rapid torque characteristics in young and old men. **METHODS:** Fifteen young (age =  $25 \pm 3$  yr; body mass =  $86 \pm 17$  kg; height =  $176 \pm 5$  cm) and 15 old ( $73 \pm 4$  yr;  $83 \pm 10$  kg;  $173 \pm 6$  cm) men underwent two diagnostic ultrasound assessments followed by two isometric maximal voluntary contractions (MVCs) of the hip flexors on an isokinetic dynamometer. RF CSA ( $\text{cm}^2$ ) was measured on the right leg using a portable B-mode ultrasound imaging device and linear-array probe. For each MVC, participants laid supine with the knee- and ankle-joints immobilized using custom-built stabilizing apparatuses. All MVCs were performed on the right leg at a hip joint angle of  $20^\circ$  above the horizontal plane. Participants were instructed during each MVC to flex the thigh at the hip "as hard and fast as possible" for 3-4 s. Isometric MVC peak torque (PT; Nm) was calculated as the highest mean 500 ms epoch during the entire 3-4 s MVC plateau. Rate of torque development (RTD;  $\text{Nm}\cdot\text{s}^{-1}$ ) was calculated as the peak of the first derivative of the torque signal. **RESULTS:** There were no differences between the young and old men for body mass ( $P = 0.624$ ) and height ( $P = 0.156$ ). The old men exhibited lower CSA (old =  $10.05 \pm 1.82$   $\text{cm}^2$ ; young =  $12.16 \pm 2.59$   $\text{cm}^2$ ;  $P = 0.015$ ), PT (old =  $117.22 \pm 17.42$  Nm; young =  $144.16 \pm 29.72$  Nm;  $P = 0.005$ ), and RTD (old =  $1129.62 \pm 374.77$   $\text{Nm}\cdot\text{s}^{-1}$ ; young =  $1718.26 \pm 633.04$   $\text{Nm}\cdot\text{s}^{-1}$ ;  $P = 0.005$ ) than the young men. Significant relationships were observed between CSA and PT ( $r = 0.520$ ;  $P = 0.003$ ) and RTD ( $r = 0.534$ ;  $P = 0.002$ ). **CONCLUSION:** These findings

demonstrated that RF muscle size and hip flexion PT and RTD decrease in old age. The significant relationships observed between CSA and PT and RTD in the young and old men perhaps suggest that these age-related declines in RF muscle size may play an important role in the lower hip flexion maximal and rapid torque values observed in older adults.

1189 May 30 10:15 AM - 10:30 AM

### The Effects Of 5-week Cup-tap Or Lower-limb-strength Exercise On Proprioception And Mobility In Community-dwelling Elderly

Xiaochun Tian<sup>1</sup>, Yujie Tong<sup>1</sup>, Yejun Wang<sup>1</sup>, Jia Han<sup>1</sup>, Gordon Waddington<sup>2</sup>, Roger Adams<sup>2</sup>, Jeremy Witchalls<sup>2</sup>, Doa El-Ansary<sup>3</sup>. <sup>1</sup>Shanghai University of Sport, Shanghai, China. <sup>2</sup>University of Canberra, Canberra, Australia. <sup>3</sup>Swinburne University of Technology, Melbourne, Australia.  
(No relevant relationships reported)

There is strong evidence to support strength or balance training for a duration of 6 to 12 weeks as an exercise intervention to improve proprioception and mobility in community-dwelling elderly. However, it is unknown if a shorter duration of exercise can be effective in improving proprioception and mobility in this population. **PURPOSE:** To determine whether a 5-week program of cup-tap balance control or lower limb strength exercise can improve proprioception and mobility in healthy community-dwelling older people. **METHODS:** Sixty-eight healthy community-dwelling elderly (19M, 49F,  $70.91 \pm 6.61$  yrs old, range 55-90 yrs old) were randomly allocated into 3 groups: cup-tap balance control exercise group (CTE), lower limb strength exercise group (LSE) or education group (EC). A 60 minutes per session, twice weekly cup-tap or strength exercise program was delivered for 5 weeks duration. Key outcome measures included ankle proprioception measured by using the active movement extent discrimination apparatus (AMEDA), and mobility assessed by using the Timed Up and Go test (TUG) and the 30-second Sit to Stand test (30STS). **RESULTS:** ANOVA analysis showed that there was no significant difference in baseline measures: ankle proprioception ( $F = 1.605$ ,  $p = 0.209$ ), TUG ( $F = 0.473$ ,  $p = 0.625$ ), and 30STS ( $F = 1.201$ ,  $p = 0.307$ ) among the 3 groups. Paired t-tests used for examining pre- and post-intervention differences indicated that 1) for the CTE group, the performance of 30STS and the ankle proprioception were significantly improved ( $p = 0.005$ ,  $p = 0.016$  respectively); 2) for the LSE group, both TUG and 30STS were significantly improved ( $p = 0.023$ ,  $p = 0.03$  respectively); and 3) no significant changes were observed for the EC group. In addition, Pearson's correlation analysis showed that 30STS and TUG performances were moderately correlated ( $r = -0.598$ ,  $p < 0.001$ ) and TUG was significantly correlated with age ( $r = 0.416$ ,  $p < 0.001$ ). **CONCLUSION:** The current findings suggest that the proprioception and mobility of older people can be improved by a short duration of balance control or strength training exercise. However, we suggest that the exercise program must be target-specific with respect to different impairments associated with the aging process for optimal results.

1190 May 30 10:30 AM - 10:45 AM

### Lower-Extremity Torque Capacity and Physical Function in Mobility-Limited Older Adults

Gregory J. Grosicki<sup>1</sup>, Davis A. Englund<sup>2</sup>, Lori Lyn Price<sup>3</sup>, Megumi Iwai<sup>4</sup>, Makoto Kashiwa<sup>4</sup>, Kieran F. Reid<sup>2</sup>, Roger A. Fielding<sup>2</sup>. <sup>1</sup>Georgia Southern University, Savannah, GA. <sup>2</sup>Tufts University, Boston, MA. <sup>3</sup>Tufts Medical Center, Boston, MA. <sup>4</sup>Astellas Pharma Inc, Osaka, Japan.  
Email: ggrosicki@georgiasouthern.edu  
(No relevant relationships reported)

Skeletal muscle weakness and an increase in fatigability independently contribute to age-related functional decline. **PURPOSE:** The objective of this study was to examine the combined contribution of these deficiencies (i.e., torque capacity) to physical function, and then to assess the functional implications of progressive resistance training (PRT) mediated-torque capacity improvements in mobility-limited older adults. **METHODS:** Seventy mobility-limited (Short Physical Performance Battery (SPPB)  $\leq 9$ ) older adults (~79 yrs) were recruited and randomized to either PRT or home-based flexibility 3 days/week for 12 weeks. Torque capacity was defined as the sum of peak torques from an isokinetic knee extension fatigue test. Relationships between torque capacity and performance-based and patient-reported functional measures were examined using partial correlations adjusted for age, sex, and body mass index. **RESULTS:** Skeletal muscle torque capacity explained ( $P < 0.05$ ) 10 and 28% of the variance in six-minute walk distance and stair climb time, respectively. PRT-mediated torque capacity improvements were paralleled by increases ( $P < 0.05$ ) in self-reported activity participation (+20%) and advanced lower extremity function (+7%), and associated ( $P < 0.05$ ) with a reduction in activity limitations ( $r = 0.44$ ) and an improved SPPB score ( $r = 0.32$ ). **CONCLUSION:** Skeletal muscle torque capacity, a composite of strength and fatigue, may be a proximal determinant of physical function in mobility-limited older individuals. To more closely replicate the musculoskeletal

demands of real-life tasks, future studies are encouraged to consider the combined interaction of distinct skeletal muscle faculties to overall functional ability in older adults.  
Supported by a grant from Astellas Pharma Inc.

**1191** May 30 10:45 AM - 11:00 AM  
**Muscularity Of Non Sedentary Elderly Over Three Decades Trends**

Rafael Benito Mancini<sup>1</sup>, João Pedro Da Silva Junior<sup>1</sup>, Carolina Gonzalez Beltran<sup>1</sup>, Tatiane Kosimenko Ferrari<sup>2</sup>, Timoteo Leandro Araujo<sup>3</sup>, Sandra Mahecha Matsudo<sup>4</sup>, Victor Keihan Rodrigues Matsudo<sup>1</sup>, José da Silva Guedes<sup>5</sup>. <sup>1</sup>Center of Studies of the Physical Fitness Research Laboratory from São Caetano do Sul (CELAFISCS), São Caetano do Sul - SP, Brazil. <sup>2</sup>Universidade de São Paulo- USP, São Paulo, Brazil. <sup>3</sup>Faculdades Metropolitanas Unidas - UNIFMU, São Paulo - SP, Brazil. <sup>4</sup>School of Medicine – Universidad Mayor, Santiago, Chile. <sup>5</sup>Santa Casa, São Paulo - SP, Brazil.  
Email: mancini.rafael@gmail.com  
(No relevant relationships reported)

**Purpose:** To describe and analyze the muscular trend, related to circumferences of non-sedentary women over three different decades **Methods:** The present study is part of the Mixed Longitudinal Project of Physical Fitness and Aging. Sample composed only women's, 50 years-old and older and participated in at least one evaluation between 1998 and 2017, totalizing a sample of 6367 individuals. The circumferences (cm) analyzed were: contracted and relaxed leg and arm. To analyze the trend, the sample was divided into age groups: 50 to 59 years, 60 to 69 years and 70 years old and over. Polynomial regression models were estimated. In the modeling process, the mean of each one of the anthropometric variables was considered as dependent variable and the years of evaluation as independent variable. For each variable, the model with the highest statistical significance and the best accuracy measure (r<sup>2</sup>) was selected. **Results:** Leg circum. (cm) presented a positive trend in the age group of 50 to 59 years, and a negative trend in the age groups of 60 to 69 years, and in the 70 years and over group. The contracted arm circum. (cm) presented a positive tendency in the age groups of 50 to 59 years and 60 to 69 years. On the other hand, the circum. of the relaxed arm (cm) presented a positive tendency only in the 50 to 59 years-old group. In the age group of 50 to 59 years, the mean leg circum. was 35.77 cm, the mean arm circum. contracted was 30.68 cm and the mean arm circum. relaxed was 30.43 cm. In both cases, there was an increase of 0.01 cm every year. In the age group of 60 to 69 years, mean leg circum. was 35.11 cm, and there was a decrease of 0.01 cm in every year; the mean of the contracted arm circum. was 29.97 cm, with an increase of 0.01 cm every year. In the age group of 70 years and over, mean leg circum. was 34.81 cm, with a decrease of 0.01 cm every year. **Conclusion:** Over the three decades analyzed, the younger elderly showed a positive tendency for the muscularity indices; while older groups presented mixed results.

Table. Trend analysis of circumference among non-sedentary elderly according to age group.

	50 to 59 years			60 to 69 years			70 years and over		
	Model	r <sup>2</sup>	β	Model	r <sup>2</sup>	β	Model	r <sup>2</sup>	β
Leg Circumference (cm)	y = 35.77 + 0.01x	0.50	0.0011	y = 35.11 - 0.01x	0.53	0.0006	y = 34.81 - 0.01x	0.53	0.0007
Arm contracted circumference (cm)	y = 30.68 + 0.01x	0.35	0.0081	y = 29.97 + 0.01x	0.25	0.0325	y = 29.29 - 0.03x	0.19	0.0683
Arm relaxed circumference (cm)	y = 30.43 + 0.01x	0.66	0.0007	y = 29.79 + 0.01x	0.01	0.9710	y = 28.97 - 0.04x	0.20	0.1275

a. first-order regression model; b. second-order regression model; c. third-order regression model.

**1192** May 30 11:00 AM - 11:15 AM  
**Health and Lifestyle Behaviors of U.S. Master's World Cup Field Hockey Players**

Karen A. Croteau, FACSM<sup>1</sup>, Nina Eduljee<sup>1</sup>, Laurie Murphy<sup>1</sup>, Lisa Ahearn<sup>2</sup>. <sup>1</sup>Saint Joseph's College of Maine, Standish, ME. <sup>2</sup>Plymouth State University, Plymouth, NH.  
Email: kcroteau@sjcme.edu  
(No relevant relationships reported)

**PURPOSE:** The purpose of this study was to examine health status and lifestyle behaviors of U.S. master's field hockey athletes. **METHODS:** Participants were 122 athletes (72 females, 50 males) who competed for the U.S. in the Master's Field Hockey World Cup in 2018. Mean age was 50.12±8.28 (range = 35-71). Participants completed the 42-item Health and Wellbeing of Master's Field Hockey Athletes Survey. **RESULTS:** Mean BMI was 24.9±3.1 (range = 15.6-35.5). Participants rated their health as very good/excellent (86.9%), had no major health conditions (61.5%) or medication use (70.5%), and had at least one injury (53.3%). Perceived stress was rated as rare or not at all by 56.6% of participants. Participants consumed ≥2 fruits (68.9%) and ≥2 vegetables per day (83.6%), daily breakfast (68%), ≤1 sugar-sweetened beverages (86.9%) and ≥7 cups of water (54.0%) per day, and ≤2 alcoholic beverages per week (59.8%). Participants reported ≥7 hours of sleep per night (65.5%) and no/little restless sleep (52.4%). Just under half of participants reported sitting ≥5

hours per day (46.7%). Exercise frequency at ≥3 days per week and ≥30 minutes was cited by 95.9% and 98.4% of the sample. **CONCLUSION:** Master's field hockey athletes practice lifestyle behaviors conducive to positive health.

**1193** May 30 11:15 AM - 11:30 AM  
**Effects of Tai Chi Exercise Versus BINGO on Fine Motor Functions in Older Adults**

Saira Talwar<sup>1</sup>, Chih-Chia Chen<sup>2</sup>, John Lamberth<sup>2</sup>, Yonjoong Ryuh<sup>2</sup>, Poram Choi<sup>2</sup>, Morgan Hommel<sup>2</sup>, Zhujun Pan<sup>2</sup>. <sup>1</sup>University of Wisconsin - Milwaukee, Milwaukee, WI. <sup>2</sup>Mississippi State University, Mississippi State, MS. (Sponsor: Scott Strath, FACSM)  
Email: talwar@uwm.edu  
(No relevant relationships reported)

Tai Chi exercise (TC) improves gross motor skills in older adults; however, fine motor skills, which enhance performance of daily living activities (ADLs), have not been thoroughly examined. **PURPOSE:** The purpose of this study was to investigate the effects of TC versus BINGO on fine motor skills in older adults. **METHODS:** Twenty-seven self-ambulatory older adults (age: 76 ±9.00; female: N = 26) with no restrictive health conditions and MMSE score ≥ 21, completed this study. Participants engaged in 1-hour, twice-per-week TC or BINGO sessions for 8 weeks (wk). Fine motor skills were assessed using the unilateral Jebsen Taylor Hand Function Test (JTHFT), including 7 ADL-like tasks; less time (s) to complete a task reflected better performance. Repeated measures 2x4 [2(TC x BINGO) x 4(Baseline x Intra-intervention x Post x Retention)] ANOVA was used with alpha of 0.05; data was analyzed separately for each hand. **RESULTS:** There were no significant group differences (p > 0.05). Significant time main effects were found for 6 tasks using the dominant hand (DH) and 7 tasks using the nondominant hand (NH) (Table 1). Significant time x group interaction was found for simulated feeding using the DH (p = 0.001). TC improved by 1.69 s across the 8-wk intervention, with a 1.23 s improvement after 4 wk. BINGO improved by 0.07 s across the 8 wk. Significant time x group interaction was also found for lifting large, heavy objects using the NH (p = 0.039). TC improved by 0.65 s across the 8 wk intervention, with a 0.50 s improvement after 4 wk. BINGO improved by 0.09 s across 8 wk. **CONCLUSION:** This study was one of the first to explore the effects of TC on fine motor functions. TC does not demand precise finger movements such as those required for BINGO; however, improvements specific to tasks requiring eye-hand coordination, manual dexterity, wrist range of motion, and hand grip strength were noted 4 wk into the TC intervention. TC may improve fine motor functions in older adults. Supported by MSU College of Education.

	Group	Time		Group*Time			
		F-value	P-value	F-value	P-value		
1. Writing	Dominant Hand	0.764	0.390	1.963	0.127	1.364	0.260
	Nondominant Hand	0.010	0.919	3.182	0.029*	0.849	0.472
2. Simulated Page Turning	Dominant Hand	1.256	0.273	21.993	< 0.001*	1.181	0.313
	Nondominant Hand	1.423	0.244	27.764	< 0.001*	0.700	0.517
3. Small Objects	Dominant Hand	0.259	0.615	10.510	< 0.001*	0.645	0.547
	Nondominant Hand	2.356	0.137	7.144	0.006*	1.028	0.345
4. Simulated Feeding	Dominant Hand	3.539	0.072	10.346	< 0.001*	6.250	0.001*
	Nondominant Hand	4.004	0.056	6.174	0.009*	2.738	0.093
5. Stacking Checkers	Dominant Hand	0.370	0.549	2.928	0.039*	0.701	0.554
	Nondominant Hand	0.239	0.629	6.147	0.009*	0.357	0.646
6. Large, Light Objects	Dominant Hand	2.145	0.155	6.597	0.001*	2.072	0.124
	Nondominant Hand	1.385	0.250	7.295	< 0.001*	0.883	0.454
7. Large, Heavy Objects	Dominant Hand	2.895	0.101	4.240	0.021*	1.741	0.187
	Nondominant Hand	3.828	0.062	14.508	< 0.001*	3.498	0.039*

Table 1. Main effect F-values (Group: F(1,25); Time and Group\*Time: F(3,25)) and P-values of Jebsen-Taylor Hand Function Test for dominant and nondominant hand; \*p < 0.05.

**C-13 Clinical Case Slide - Leg and Tibia**

Thursday, May 30, 2019, 9:30 AM - 10:50 AM  
Room: CC-305

**1194 Chair:** Mark R. Hutchinson, FACSM. *University of Illinois at Chicago, Chicago, IL.*  
(No relevant relationships reported)

**1195 Discussant**  
Jay Hertel, FACSM. *University of Virginia, Charlottesville, VA.*  
(No relevant relationships reported)

**1196 Discussant**  
Sean Engel. *University of Minnesota, Minneapolis, MN.*  
(No relevant relationships reported)

**1197** May 30 9:30 AM - 9:50 AM  
**Leg Pain in a 23 Year Old Football Player**  
Kyle H. Yost, Valerie Cothran, Ralph F. Henn. *University of Maryland Medical System, Baltimore, MD.*  
Email: kyleyost08@gmail.com  
(No relevant relationships reported)

**HISTORY**

A 23 year old male reported getting kicked in the leg during a collegiate football game. He noted immediate pain in his lateral calf after attempting a tackle. He did not feel or hear a pop. He had a noticeable limp walking off the field. There was no pain in the ankle or foot, but he noted pain with ankle movement. He had pain with weight-bearing but denied any numbness or tingling.

The next day, he developed worsening pain that was unbearable with any change of position or movement. The pain was greatest along the mid-lateral leg but extended along the entire leg anterior and laterally. He had limited ability to move his toes and foot which was a new symptom.

**PHYSICAL EXAMINATION**

General: Alert and oriented in mild distress at rest.

Left leg

Edema: Anterior and lateral leg without pitting.

Compartments: Diffusely tender but not tense.

Tenderness: Diffuse, anterior and lateral compartments more than fibula and posterolateral.

Range of motion: DF 0 degrees, PF 30 degrees. Pain was worse with initiation. He tolerated gradual passive stretch of the anterior, more than the lateral.

Pain with inversion and eversion .

Strength: 1/5 anterior tibialis, EHL, EDL, Peroneals with pain, 2/5 GS/PT with pain.

Neurovascular: Intact, 2+ PT/DP pulses, cap refill < 2 sec.

**DIFFERENTIAL DIAGNOSIS**

1. Gastrocnemius Strain
2. Compartment Syndrome
3. Popliteus Strain
4. Fibular Fracture
5. High Ankle Sprain

**TESTS AND RESULTS**

XRays

1. Fluoroscopic imaging of the tib-fib and ankle were negative.
2. Tib-fib and Ankle xrays were negative for fracture and stress view demonstrated stable joint.

Compartment Testing

Diastolic pressure: 74

Left lower leg anterior compartment: 20

Left lower leg lateral compartment: 28

Left lower leg posterior superficial compartment: 27

Left lower leg posterior deep compartment: 26

MRI

1. Nondisplaced fracture of the middle third of the fibula.
2. Acute grade 1 muscular injury of the peroneal muscles of the lateral compartment.

**FINAL WORKING DIAGNOSIS**

Midshaft fibular stress fracture

**TREATMENT AND OUTCOMES**

1. Patient was admitted to the hospital for observation for one night.
2. Patient was discharged and allowed to weight bear as tolerated in the tall CAM boot for two weeks.

3. At two weeks, he was weaned out of the boot and allowed to progress into activities.
4. At six weeks, he was participating in football without any limitations.

**1198** May 30 9:50 AM - 10:10 AM  
**Lower Extremity Pain - Field Hockey**

Jessica Traver, Lyle Micheli, FACSM. *Boston Children's Hospital, Boston, MA.* (Sponsor: Lyle Micheli, MD, FACSM)  
Email: jessica.traver@childrens.harvard.edu  
(No relevant relationships reported)

Lower Leg Pain – Field Hockey

**HISTORY:** A 20-year-old collegiate field hockey player 1 year, 2 months out from bilateral anterior/lateral/deep posterior compartment fasciotomies for chronic exertional compartment syndrome, recurrence of pain along her bilateral medial legs and medial/plantar foot numbness. Worsening over previous 6 months. Pain is daily, constant. Had MRI/MRA arterial duplex performed at onset of symptoms and was told it was negative. No improvement with neuropathic pain medication, physical therapy, hydrodissection.

**PHYSICAL EXAMINATION:** Examination revealed healed surgical incisions. Mild scar hypertrophy along medial incisions with moderate tenderness to palpation. Full knee/ankle ROM. Pain reproduced with resisted ankle plantar flexion after 30 seconds, numbness along medial/plantar aspect of foot in tibial nerve distribution. Easily palpable dorsalis pedis/posterior tibialis pulses.

**DIFFERENTIAL DIAGNOSIS:**

1. Recurrent chronic exertional compartment syndrome
2. Saphenous nerve compression neuropathy
3. Popliteal Artery Entrapment Syndrome

**TEST AND RESULTS:**

1. Repeating compartment pressure testing: normal compartment pressures
2. EMG/NCS: normal without evidence of compression neuropathy
3. MRA (PRISMA 3T) study: forced plantarflexion demonstrates bilateral compression of the popliteal arteries at the popliteal fossa between the medial and lateral heads of the gastrocnemius muscle.

**FINAL/WORKING DIAGNOSIS:**

Popliteal Artery Entrapment Syndrome

**TREATMENT AND OUTCOMES:**

1. Referred to plastic surgery colleagues.
2. Underwent bilateral popliteal artery releases 1 year, 8 months after index surgery.
3. Improvement of both pain and numbness along medial aspect of foot.
4. Last seen at 3 months post-operatively. Full, painless ROM. No pain with resisted plantarflexion. Normal sensation. Anticipate return to sport over the next 6 weeks.

**1199** May 30 10:10 AM - 10:30 AM  
**Pain And Function: A Ten(din)uous Link In The Runner**

Peter Francis, Isobel Thornley, Ashley Jones. *Leeds Beckett University, Leeds, United Kingdom.*  
Email: peter.francis@leedsbeckett.ac.uk  
(No relevant relationships reported)

**HISTORY:** A male runner (30-years, 10-km time: 33-min 46-sec) had been running with suspected insertional achilles tendinopathy (AT) for 2.5 years when the pain reached a threshold that prevented running.

**PHYSICAL EXAMINATION:** Diagnostic ultrasound (US), prior to a high volume stripping injection, confirmed right sided medial insertional AT.

**DIFFERENTIAL DIAGNOSIS:** Right sided medial insertional AT.

**TEST AND RESULTS:** The athlete failed to respond to the injection and ceased running for a period of 5-weeks. At the beginning of this period, the runner completed the Victoria institute of sports assessment-achilles questionnaire (VISA-A) and the foot and ankle disability index (FADI), prior to undergoing an assessment of bilateral gastrocnemius medialis (GM) muscle architecture (muscle thickness (MT) and pennation angle (PA); US), muscle contractile properties (maximal muscle displacement (Dm) and contraction time (Tc); Tensiomyography (TMG)) and calf endurance (40 raises/min). VISA-A and FADI scores were 59%/100% and 102/136 respectively. Compared to the left leg, the right GM had a lower MT (1.60 cm vs. 1.74 cm), a similar PA (22.0° vs. 21.0°), a lower Dm (1.2 mm vs. 2.0 mm) and Tc (16.5 ms vs. 17.7 ms). Calf endurance was higher in the right leg compared to the left (48 vs. 43 raises).

**FINAL/WORKING DIAGNOSIS:** Right sided medial insertional AT.

**TREATMENT AND OUTCOMES:** The athlete began a metronome guided (15-BPM), 12-week progressive eccentric training protocol using a weighted-vest (1.5kg increments per week), whilst receiving 6-sessions of shockwave therapy concurrently (within 5-weeks). On returning to running, the athlete kept daily pain (VAS) and running scores (miles\*RPE). Foot and ankle function improved according to scores recorded on the VISA-A (59% vs. 97%) and FADI (102 vs. 127/136). Improvements in MT (1.60 cm vs. 1.76 cm) and PA (22.0° vs. 24.8°) were recorded via US. Improvements in Dm (1.15 mm vs. 1.69 mm) and Tc (16.5 ms vs. 15.4 ms) were recorded via TMG. Calf endurance was lower in both legs and the asymmetry between legs remained (L: 31, R: 34). Pain intensity (mean weekly VAS scores) decreased

between week-1 and week-12 (6.6 vs. 2.9), while running scores increased (20 vs. 38) during the same period. The program was maintained up to week-16 at which point weekly mean VAS was 2.2 and running score was 47.

**1200** May 30 10:30 AM - 10:50 AM

**Medial Lower Leg Pain in a Middle-Aged Triathlete**

Allison N. Schroeder, Stephen Schaaf, Kentaro Onishi.  
*University of Pittsburgh Medical Center, Pittsburgh, PA.*

(Sponsor: Tom Best, FACSM)  
Email: aschroel@alumni.nd.edu

*(No relevant relationships reported)*

**HISTORY:** A 43-year-old triathlete presented with left distal medial lower leg pain that started gradually about 2-3 weeks prior to presentation. He denied inciting trauma and described the pain as a 5/10 sharp pain provoked by walking, running, and ankle dorsiflexion and plantarflexion movements. He endorsed mild left distal medial leg swelling but denied leg weakness or numbness and previous injury to this area. He was taking ibuprofen and had seen a chiropractor who performed several treatments including grastin, massage, taping, and a compression sleeve with minimal relief. He was training for his first full Ironman triathlon, scheduled for 12 days from presentation.

**PHYSICAL EXAMINATION:** Gait was non-antalgic. No visible swelling or ecchymoses of the left lower leg. Only tender to palpation in the left distal medial leg near the myotendinous junction of the medial gastrocnemius. Full ROM at the knee and ankle, but left end-range ankle dorsiflexion was painful. Strength was 5/5 about the knee and ankle, but he had pain with toe raises and toe walking on the left.

**DIFFERENTIAL DIAGNOSIS:**

1. Gastrocnemius strain or tear
2. Soleus strain or tear
3. Plantaris strain or tear
4. Achilles tendon injury
5. Posterior tibialis strain or tear
6. Fascial defect/muscle herniation
7. Deep posterior compartment syndrome
8. DVT

**TEST AND RESULTS:** Limited diagnostic ultrasound of the left distal medial leg revealed a near tear of the plantaris tendon near the myotendinous junction with evidence of disruption of tendon fibers and surrounding anechoic fluid. There was neovascularization on color doppler and tenderness to sonopalpation.

**FINAL/WORKING DIAGNOSIS:** Plantaris Tendinopathy

**TREATMENT AND OUTCOMES:** He was encouraged to continue symptomatic treatments with his chiropractor and could also consider kinesiotaping. His goal was to complete the full Ironman, even if he was slower than anticipated and called about one week later to ask if there were additional treatment options. He wished to proceed with experimental sonographically-guided injection of dextrose hyperosmolar solution to the site of pathology of his plantaris tendon, which was performed 4 days prior to the Ironman triathlon. By race day, his pain had improved, and he was able to complete the full Ironman within his original goal time.

**C-14 Clinical Case Slide - Neurologic Injuries**

Thursday, May 30, 2019, 9:30 AM - 10:50 AM  
Room: CC-304E

**1201 Chair:** Cindy Y. Lin. *University of Washington Medical Center, Seattle, WA.*

*(No relevant relationships reported)*

**1202 Discussant**

William F. Micheo, FACSM. *University of Puerto Rico, San Juan, PR.*

*(No relevant relationships reported)*

**1203 Discussant**

David Olson, FACSM. *University of Minnesota, St. Paul, MN.*

*(No relevant relationships reported)*

**1204** May 30 9:30 AM - 9:50 AM

**Post-concussion Syndrome With Retrograde Amnesia in a Pediatric Patient**

Andrew Alexander, Weston Northam, Kevin Carneiro, Jason Mihalik. *University of North Carolina at Chapel Hill, Chapel Hill, NC.* (Sponsor: Kevin Guskiewicz, FACSM)

Email: andrew\_alexander@med.unc.edu

*(No relevant relationships reported)*

**HISTORY:** A 14-year-old female with a history of pervasive developmental disorder (PDD), mild speech abnormalities, dyslexia, hearing loss and migraines sustained a concussion after falling on a slip and slide. The patient hit her head but did not lose consciousness. At clinic 3.5 weeks post injury, she complained of a headache with varied intensity. Reading provoked headaches and blurred vision. The patient experienced photophobia, phonophobia and dizziness. She took more naps during the day and had mood lability. The patient was amnesic to the event and had severe memory lapses. She forgot how to do simple math problems, the names of her family, friends, boyfriend, and that she was a cheerleader.

**PHYSICAL EXAMINATION:** Neurologic: 1) Slow eye movements that provoked headache, 2) Accommodation (blurred vision) and convergence (diplopia) insufficiencies, and 3) Undershooting and eye strain with vertical and horizontal saccades. Tenderness to palpation on right side of the neck and suboccipital region. Patient named current president when asked, but unable to name previous or first president. Otherwise, normal neurologic and musculoskeletal exam.

**DIFFERENTIAL DIAGNOSIS:**

- 1) Post-concussion syndrome with retrograde amnesia
- 2) Anxiety disorder exacerbated by trauma
- 3) Malingering

**TESTS AND RESULTS:**

CT head and neck:

— Normal

**Neuropsychology Evaluation:**

— Test of Memory Malingering - adequate effort

— ImPACT: deficits in Verbal Memory, Visual Memory, Visual Motor Speed, and Reaction Time

— Behavior Rating Inventory of Executive Functioning: Normal

Revised Children's Anxiety and Depression Scale:

— Clinically insignificant

**Sensory Organization Test:**

— No significant balance problems

**FINAL/WORKING DIAGNOSIS:**

Post-concussion syndrome with retrograde amnesia. Underlying PDD, and comorbidities at baseline described earlier likely contributing to headache and cognitive difficulties.

**TREATMENT AND OUTCOMES:**

1. Physical therapy for cervicogenic headaches
2. Vestibular therapy for dizziness and vestibulo-oculomotor dysfunction
3. Neuro-optometry evaluation and rehabilitation
4. All deficits and symptoms greatly improved 2 months post-injury. Vision rehabilitation will be continued prior to return-to-sport.

1205 May 30 9:50 AM - 10:10 AM

**Headache, Vision Loss And Loss Of Consciousness-Wrestling**Jaron Santelli. *University of Maryland School of Medicine, Baltimore, MD.**(No relevant relationships reported)***HISTORY**

JJ is a 20 y/o male with 2 episodes of acute posterior neck pain with radiation into his occiput followed by acute loss of vision bilaterally and brief loss of consciousness vs. presyncopal like episode. The first event occurred while wrestling and the second while bench pressing. There was no preceding chest pain, shortness of breath, or other symptoms. All symptoms resolved approximately 15 minutes after each event.

At the time of the visit he was asymptomatic and unable to reproduce symptoms with head movement. No recent illness. No cardiac or pulmonary past medical history.

**PHYSICAL EXAMINATION**

The examination is overall unremarkable with normal pupillary and extra ocular muscle exam, no visual deficits, normal visual acuity, no midline cervical tenderness, and negative Spurling's test. JJ had a normal extensive neurologic exam including cranial nerves, coordination, sensation and strength. Cardiovascular and pulmonary exams are also normal.

**DIFFERENTIAL DIAGNOSIS**

Vertebral Artery Dissection

TIA/CVA

Vasovagal Syncope

Dehydration

**TESTS AND RESULTS**

CBC, CMP, TSH, EKG all unremarkable

CTA head and neck: bilateral hypoplastic vertebrobasilar system

MRI: negative for ischemia

Transcranial Doppler: nonspecific changes

**FINAL WORKING DIAGNOSIS**

Hypoplastic Vertebrobasilar system

**TREATMENT AND OUTCOMES**

At time of the diagnosis, there was no evidence of ischemia as a result of the occurrences. Possible treatment options for hypoplastic vertebrobasilar systems without ischemia include aspirin and lifestyle modifications. Activity modifications have been made to include proper hydration, training to the start of symptoms but no further and reducing the activities that induce valsalva unnecessarily. Since these modifications have been put in place, there have been no new events. Follow up plans include repeat MRI at 6 months.

1206 May 30 10:10 AM - 10:30 AM

**After Lightning Strikes: A Case Of Anoxic Encephalopathy In A 30 Year Old Soccer Player**Michael Harbus, Miguel X. Escalon. *Mount Sinai School of Medicine, New York, NY.**(No relevant relationships reported)*

**History:** A 30 year old male with a past medical history of hypothyroidism was out playing soccer when he was struck by lightning. After the lightning strike, the patient experienced cardiac arrest, and CPR was performed. Spontaneous circulation was achieved after a 17 minutes of CPR, and the patient was admitted to a burn unit for partial thickness burns of his left anterior chest, abdomen, and right medial lower calf. During the patient's stay on the burn unit, he was noted to have severe cognitive deficits secondary to an anoxic brain injury sustained during his cardiac arrest, and also had a PEG tube placed after developing aspiration pneumonia. Following the burn unit, the patient was transferred to an acute rehab facility to address the severe cognitive deficits he had developed. Upon arrival at the acute rehabilitation facility, the patient was a Rancho Los Amigos level three.

**Physical Exam:** The patient was lying comfortably in bed. He was able to mimic behavior, but was unable to follow commands consistently. On ocular exam, the patient had a left pupil that was fixed and dilated, and sub-conjunctival hemorrhages. Abdominal exam was significant for an in-place PEG tube. Integumentary was significant for partial thickness wounds on his anterior chest and right lower extremity. The patient demonstrated full active range of motion of his upper and lower extremities.

**Differential Diagnosis:**

Anoxic encephalopathy

Encephalopathy secondary to electrocution

Toxic metabolic encephalopathy

**Tests and Results:** -Labs on admission were significant for the following: White blood cell count of 5.0; hemoglobin of 10.3; blood urea nitrogen of 55; AST of 42 and ALT of 70. -CT head on admission showed no evidence of intracranial hemorrhage, lobar infarct, hydrocephalus, or midline shift.

**Final Diagnosis:** Anoxic encephalopathy secondary to lightning strike

**Treatment and Outcomes:** The patient was started on amantadine to stimulate increased attention and wakefulness, and seroquel and trazadone to help address the patient's nocturnal agitation and promote sleep. At the end of his 5 week stay on the acute rehabilitation unit, the patient had advanced to a Rancho Los Amigos level eight. He was fully oriented to his environment, tolerating an oral diet, engaging in appropriate conversation, and ambulating with a walker.

1207 May 30 10:30 AM - 10:50 AM

**She's Only Weak Because She Doesn't Play Sports**Brian Vernau. *Children's Hospital of Philadelphia, Philadelphia, PA.**(No relevant relationships reported)*

**HISTORY:** 8 year-old female presents to pediatric sports medicine for evaluation of clumsiness and muscle weakness. She had been following with the school physical therapist for about one year for concerns about balance, coordination, and core strength. School initially had a concern about her confidence and speed on stairs and not keeping up in gym class. She was referred due to continued coordination issues. Per mother, her difficulty with stairs started when she was pushed down the stairs by a peer. She typically places both feet on the step when she climbs stairs. Her core weakness had been attributed to deconditioning and disinterest in sports. Mom feels the school PT is cutting into education time and would like it to stop. She has always been clumsy, which is present in the rest of the family as well.

The patient endorses mild hip and gluteal muscle soreness that has been attributed to growing pains. She falls a lot but no significant injuries. She has always been a toe walker. No handwriting difficulties. Normal developmental milestones per mother.

**PHYSICAL EXAMINATION:** Genu valgum. Holds thighs together during gait with poor hip swing. Intermittent toe walking with pes cavus. Full pain free ROM about the hips and knees. Mild heel cord tightness. Ligamentous laxity throughout. No tenderness to palpation about the lower extremities. Muscle tone diffusely decreased other than mild increased tone at ankles and feet without atrophy. Strength testing reveals 3/5 straight leg testing, using hands under thighs to move legs. Otherwise, she is 4/5 strength throughout other than 5/5 strength with ankle plantarflexion, great toe extension. DTRs 1+ throughout. Gower's sign negative, but she does walk hands up to feet before standing with difficulty.

**DIFFERENTIAL DIAGNOSIS:** Muscular dystrophy - Beckers, limb-girdle, spinal muscular atrophy, facioscapulohumeral muscular dystrophy, Myositis. Other myopathy

**TEST AND RESULTS:** CMP, lipids, TSH unremarkable CK 235, Genetic testing:

Spinal Muscular Atrophy Type 3 **FINAL WORKING DIAGNOSIS:** Spinal Muscular Atrophy Type 3

**TREATMENT AND OUTCOMES:** She has started nusinersen (Spinraza) therapy and continues with physical therapy. She remains ambulatory 3 months into treatment. Starting to use AFOs for toe walking.

**C-15 Rapid Fire Platform - Muscle Fatigue and Force Development**Thursday, May 30, 2019, 9:30 AM - 10:50 AM  
Room: CC-Hall WA21208 **Chair:** R. Andrew Shanely. *Appalachian State University, Kannapolis, NC.**(No relevant relationships reported)*

1209 May 30 9:30 AM - 9:40 AM

**Tropomyosin-based Effects Of Acidosis On Thin-filament Regulation During Muscle Fatigue**Brent Scott<sup>1</sup>, Mike Woodward<sup>1</sup>, Thavanareth Prum<sup>2</sup>, Jeffrey R. Moore<sup>2</sup>, Edward P. Debold<sup>1</sup>. <sup>1</sup>*University of Massachusetts Amherst, Amherst, MA.* <sup>2</sup>*University of Massachusetts Lowell, Lowell, MA.*

Email: bdsconfig@umass.edu

*(No relevant relationships reported)*

Skeletal muscle fatigue is defined by a loss in the force and velocity generating capacity of a muscle. A portion of the loss in function is attributable to effects of acidosis (i.e. low pH) on the regulatory proteins, troponin and tropomyosin (Tm), which regulate the binding of myosin and actin in a calcium (Ca<sup>++</sup>) dependent manner. However, the relative role of the regulatory proteins is not clear, nor are the mechanisms underlying the effect acidosis has on them. **PURPOSE:** To determine the role of Tm in the acidosis-induced depression of muscle function using isolated muscle proteins in an in vitro motility assay.

**METHODS:** To test this idea we expressed 3 mutant constructs of Tm with the 2 amino acid residues affected by low pH (histidine residues) replaced with alanine residues (H153A, H276A, H153A/H276A). These constructs were compared to a wild-type Tm, to test the hypothesis that acidosis-induced charge changes of the histidine amino acid governs tropomyosin's pH-dependent decrease in maximal velocity and Ca<sup>++</sup>-sensitivity. The effect on RTF function was determined by assessing the impact of acidosis on myosin's ability to move regulated actin filaments (RTF) in the motility assay as a function of increasing level of Ca<sup>++</sup>. This was done separately for the wt-Tm and each structural variant.

**RESULTS:** A two-way ANOVA (pH x Tm construct) revealed that acidosis significantly (p<0.05) depressed the maximal sliding velocity of the RTFs across all versions of Tm, but that the magnitude of the depression was similar among the wt and all of the Tm mutants. Acidosis did not significantly depress the sensitivity to Ca<sup>++</sup> under the unloaded conditions of this assay (p>0.05).

**CONCLUSIONS:** These data suggest that the histidine residues in tropomyosin do not mediate the acidosis-induced depression in contraction velocity observed during muscle fatigue. However, it is possible that these residues are more important in mediating the depression in force, therefore we are currently testing the impact of these mutations in Tm on the acidosis-induced depression in the Ca<sup>++</sup>-sensitivity using a loaded in vitro motility assay. Supported by: 2018 UMass UMOVE Initiative

**1210** May 30 9:40 AM - 9:50 AM  
**Is Fatigue-induced Loss Of Power Associated With a Change In The Curvature Of The Force-velocity Relation?**

Anders Meldgaard Kristensen, Ole Bækgaard Nielsen, Thomas Holm Pedersen, Kristian Overgaard. *Aarhus University, Aarhus, Denmark.*

Email: amk@ph.au.dk

(No relevant relationships reported)

In skeletal muscles, the ability to generate power is reduced during fatigue. Maximal power (P<sub>max</sub>) is determined by the force-velocity relationship, which can be closely approximated by the Hill equation, containing three key parameters: 1) Maximal isometric force (F<sub>max</sub>) 2) Maximum contraction velocity (V<sub>max</sub>) and 3) Force-velocity curvature. **PURPOSE:** To investigate the possible association between the fatigue-induced loss of power and changes in curvature of the force-velocity relation in muscles with different fiber type composition. **METHODS:** The force-velocity relationship was measured before and during development of fatigue in isolated rat soleus (slow-twitch) and EDL (fast-twitch). Muscles were incubated in Krebs-Ringer solution at 30 C° and stimulated electrically at 60 Hz for 0.75 s (soleus) or at 150 Hz for 0.2 s (EDL) to obtain serial concentric contractions leading to fatigue. The Force-velocity relationship was measured at different stages of fatigue and after 1 hour of recovery. Force-velocity data were fitted to the Hill equation, and curvature was determined as the ratio of the curve parameters a/F<sub>0</sub> (inversely related to curvature). **RESULTS:** At the end of the fatiguing protocol, maximal power had decreased by 58 ± 5% (soleus) and 69 ± 4% (EDL) compared to initial values in non-fatigued muscles. Curvature increased in both muscle types as judged from the decrease in a/F<sub>0</sub> of 81 ± 20% (soleus) and by 31 ± 12% (EDL). At the end of the fatiguing protocol, the calculated contributions to the total loss of P<sub>max</sub> was 25 ± 10% from F<sub>max</sub>, 17 ± 3% from V<sub>max</sub> and 58 ± 14% from a/F<sub>0</sub> (soleus) and 64 ± 6% from F<sub>max</sub>, 16 ± 3% from V<sub>max</sub> and 20 ± 9% from a/F<sub>0</sub> (EDL). Complete recovery of a/F<sub>0</sub> was observed following one hour of rest in both muscle types. **CONCLUSIONS:** Increased curvature of the force-velocity relationship occurs during fatigue in both slow and fast twitch muscles. Particularly in slow-twitch muscles, this increase in curvature is strongly associated with fatigue-induced loss of power.

**1211** May 30 9:50 AM - 10:00 AM  
**The Effect Of Low Frequency Fatigue On Dynamic Muscle Function**

Jon H. Herskind, Anders M. Kristensen, Kristian Vissing, Frank V. de Paoli, Kristian Overgaard. *Aarhus University, Aarhus C, Denmark.*

Email: jherskind@ph.au.dk

(No relevant relationships reported)

Following fatiguing contractions, muscle contractile function is decreased more at low frequency stimulation compared to high frequency stimulation. This low frequency fatigue (LFF) is well investigated in isometric contraction models, but the effects on dynamic muscle function are less clear. Furthermore, the degree of LFF induced in dynamic contractions by different contraction modes (concentric, isometric, eccentric) has not been compared.

**Purpose:** To investigate the effect of LFF induced by different types of fatiguing contractions on dynamic muscle function.

**Methods:** Soleus muscles from Wistar rats were dissected out and incubated in Krebs-Ringer solution. The force-velocity relationship was assessed by a series of brief concentric contractions elicited at 20 and 80 Hz before and 1 h after fatiguing

contractions. Fatigue was induced using 3x 5s of either concentric, eccentric or isometric contractions at 60 Hz. Force-velocity data were fitted to the Hill equation. In some experiments, muscles were exposed to supraphysiological concentration of caffeine to assess the influence of calcium release.

**Results:** After fatigue induction, both maximal force, velocity and power parameters were more severely decreased at 20 Hz of stimulation compared to 80 Hz of stimulation for all 3 types of fatiguing protocols. Isometric contractions caused a smaller decrease in maximal power compared to concentric contractions and tended to cause a smaller decrease compared to eccentric contractions. Caffeine alleviated the effects of LFF on both maximal force, velocity and power.

**Conclusion:** LFF can be induced by different types of muscle contraction and affects both maximal isometric force, maximal velocity and maximal power during concentric contractions. These effects can be mitigated by caffeine, indicating an impaired calcium release during LFF.

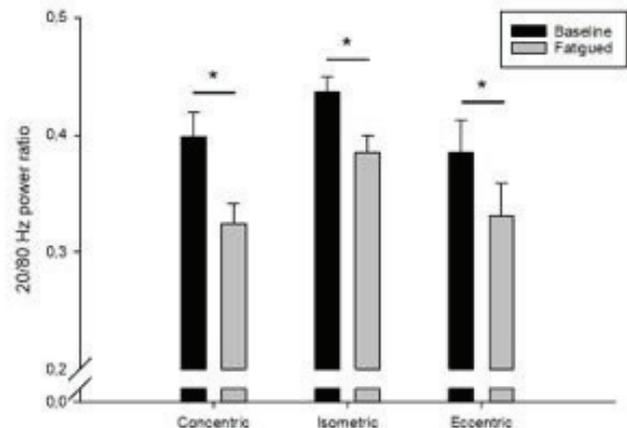


Figure 1: 20/80 Hz power ratio. \*significant difference between baseline and fatigued state.

**1212** May 30 10:00 AM - 10:10 AM  
**Comparison of Agonist and Antagonist Muscle Fatigue on Coactivation and Force Production**

Cameron S. Mackey, Jesus A. Hernandez-Sarabia, Micheal J. Luera, Alejandra Barrera-Curiel, Jason M. DeFreitas. *Oklahoma State University, Stillwater, OK.*

(No relevant relationships reported)

Little research has been done on whether the fatigue status of a muscle influences its magnitude of coactivation during antagonistic contractions. We hypothesized that a fatigued antagonist would coactivate less, thereby increasing agonist force production. **PURPOSE:** To compare the effects of antagonist fatigue on muscle activation and force producing capabilities of the biceps brachii (BB) and triceps brachii (TB). **METHODS:** Fifteen healthy, college-aged men and women volunteered for this study (n = 15; mean ± SD: age = 25 ± 3 yrs). Surface electromyography (sEMG) was recorded from the BB and TB during elbow extension (EXT) and flexion (FLX) maximal voluntary contractions (MVC) prior to and immediately following EXT or FLX fatigue protocols. Fatigue was induced with intermittent, submaximal contractions, each held at 70% MVC for 10-s with 5-s rest periods. The protocol continued until 70% of the pre-MVC could not be achieved. The amplitude of each EMG signal was assessed as the root-mean-square (RMS; V) and normalized to the value obtained during that muscle group's pre MVC. Separate 2-way (time [pre and post] × condition [FLX-fatigue and EXT-fatigue]; "within-within") repeated measures ANOVAs were performed for each dependent variable: FLX force (N), EXT force (N), agonist activation, and antagonist coactivation (%). **RESULTS:** There was a significant time × condition interaction observed for FLX force (p = 0.005) and EXT Force (p ≤ 0.001), but not for BB activation (p = 0.648), TB activation (p = 0.084), nor coactivation during the FLX (p = 0.076) or EXT (p = 0.681). Post-hoc tests revealed that FLX fatigue had no effect on EXT force (p = 0.307). However, EXT fatigue did significantly affect FLX force (MD = -35.96 N; p ≤ 0.001). Surprisingly, FLX fatigue affected the magnitude of TB coactivation during FLX MVCs (MD = +8.3%; p = 0.015), but EXT fatigue did not (MD = +1%; p = 0.696). Neither the FLX fatigue condition (p = 0.30), nor the EXT fatigue condition (p = 0.21) influenced the magnitude of BB coactivation during EXT MVCs. **CONCLUSION:** Contrary to our hypothesis, EXT fatigue had a negative effect on FLX force, not a positive effect. Also unexpected was that EXT fatigue had no effect on TB coactivation during FLX, but FLX fatigue did. More research is needed to determine the factors that influence the magnitude of antagonist coactivation.

1213 May 30 10:10 AM - 10:20 AM

**Effects Of Intermittent Fasting And High Intensity Training On Regulators Of Muscle Mass And Metabolism**

Matthew B. Cooke<sup>1</sup>, Robin Wilson<sup>2</sup>, Alan Hayes<sup>2</sup>, Christos G. Stathis<sup>2</sup>. <sup>1</sup>Swinburne University of Technology, Melbourne, Australia. <sup>2</sup>Victoria University, Melbourne, Australia.  
Email: mbcooke@swin.edu.au

(No relevant relationships reported)

Diet-induced obesity can lead to higher intramuscular fat deposition and inflammatory cell accumulation, ultimately having a negative impact on skeletal muscle morphology and function leading to mitochondrial dysfunction and insulin resistance. Intermittent fasting (IF) and high intensity interval training (HIIT) are both effective strategies for losing weight, specifically fat mass. However, the effects on skeletal muscle, specifically genes that regulate mitochondrial function, energy homeostasis, and muscle atrophy are unknown. **PURPOSE:** To investigate the effects of IF and/or HIIT on molecular markers of skeletal muscle mass and metabolic function in diet-induced obesity. **METHODS:** Eight week old mice (C57BL/6, n=39) had ad libitum access to an obesogenic diet (60% fat, 30% sugar) for 12 weeks. They were then randomly allocated to three intervention groups: IF (fasting for 2 alternate days/week), HIIT (3 days/week), combined IF+HIIT (2 alternate fasting days and 3 days HIIT) or control (CON) for a further 12 weeks. Extensor digitorum longus (EDL) muscle weight and expression of PGC1 $\alpha$ , AMPK, citrate synthase (CS), muscle atrophy F-box (MAFbx), and muscle RING Finger-1 (MuRF1) genes were measured at the end of the intervention period. Data was analysed using ANOVA. **RESULTS:** Muscle weights were similar between groups at the end of the intervention period (CON: 9.5 $\pm$ 1.3mg, HIIT: 9.2 $\pm$ 0.8mg, IF: 9.2 $\pm$ 0.4mg, IF+HIIT: 9.7 $\pm$ 0.8mg, p>0.05). PGC1 $\alpha$  and CS gene expression was significantly lower in the IF group compared to the CON (PGC1 $\alpha$ : 0.8 $\pm$ 0.1 vs 1.0 $\pm$ 0.2, CS: 0.8 $\pm$ 0.2 vs 1.0 $\pm$ 0.4, p<0.05). AMPK gene expression was also significantly lower in the IF group, but only compared to the IF+HIIT group (0.9 $\pm$ 0.1 vs 1.0 $\pm$ 0.1, p<0.05). MAFbx and MuRF1 gene expression was significantly higher in the HIIT group (1.7 $\pm$ 0.8 & 2.2 $\pm$ 0.9) group compared to CON (1.0 $\pm$ 0.4 & 1.0 $\pm$ 0.2), IF (0.9 $\pm$ 0.2 & 0.8 $\pm$ 0.2), and IF+HIIT (1.4 $\pm$ 0.3 & 0.9 $\pm$ 0.2, p<0.01) groups. **CONCLUSIONS:** Intermittent fasting reduced gene expression markers of mitochondrial biogenesis and energy homeostasis, while HIIT appeared to increase markers of atrophy at the end of the intervention period. The combination of IF and HIIT did not show any synergistic effects within the muscle.

1214 May 30 10:20 AM - 10:30 AM

**Muscle Fibertype Composition Affects Contractile Rate of Force Development (RFD) in vivo**

Per Aagaard, Søren Smedegaard, Thomas Madsen, Niels Ørtenblad. University of Southern Denmark, Odense, Denmark.  
Email: paagaard@health.sdu.dk

(No relevant relationships reported)

Differences in muscle fiber type composition across human skeletal muscles are paralleled by comparable differences in electrically evoked contractile Rate of Force Development (RFD), with muscles dominated by type II fibers expressing higher RFD (more steep Force-Time curves) than type I dominated muscles (Harridge et al. 1996). However, little is known about the relationship between muscle fiber type composition and RFD when examined in single heterogeneous muscles in vivo (Maffiuletti et al. 2016, Rodriguez-Rosell et al. 2018). **PURPOSE:** To examine the association between fiber type composition and isolated single-joint RFD for the human quadriceps muscle. **METHODS:** Nine untrained male subjects (physical education students) without prior experience in systematic resistance training were recruited for the study (24.2  $\pm$  7.3 (SD) yr). Maximal isometric gravity-corrected knee extensor torque (MVC) was obtained at 1000 Hz sampling rate at 70° knee joint angle (0° = full knee extension) (KinCom 500H, Chattecx Corp). RFD was analyzed in the early (0-30 and 50 ms) and late (0-100 and 200 ms) phases of rising muscle force (Aagaard et al. 2002). Muscle biopsy samples (VL) were analyzed for fiber type composition and cross-sectional area (CSA) (Andersen & Aagaard 2000). Linear regression analysis was performed using Pearson product-moment method. **RESULTS:** Fiber CSA was 4535  $\pm$  1271, 5084  $\pm$  1865 and 4502  $\pm$  1970  $\mu$ m<sup>2</sup> for type I, IIA and IIX fibers ( $\pm$ SD), respectively, while fiber type area percentage was 48.5  $\pm$  3.1, 35.5  $\pm$  2.5 and 15.9  $\pm$  1.7 %. RFD correlated positively (p  $\leq$  0.01) with type II fiber area percentage (0-30 ms: r=0.79; 0-50 ms: r=0.83; 0-100 ms: r=0.81 and 0-200 ms: r=0.78) (0 ms = onset of force). No relationship was observed between MVC and fibertype composition. **CONCLUSIONS:** Rapid force capacity (RFD) of the human knee extensors was strongly and positively associated with the area weighted proportion of type II myofibers, which explained 63-69% and 61-66% of the variance (r<sup>2</sup>) in RFD during the early (0-30/50 ms) and later (0-100/200 ms) phases of rising muscle force, respectively. In consequence, resistance training aiming to preferentially increase type II myofiber CSA is expected to result in amplified gains in RFD.

1215 May 30 10:30 AM - 10:40 AM

**Effects Of Doublet Stimulation On Dynamic Muscle Contractility In Muscles With K<sup>+</sup>-suppressed Excitability**

Katja K. Pedersen, Ole B. Nielsen, Kristian Overgaard. Aarhus University, Aarhus, Denmark.

Email: katja@ph.au.dk

(No relevant relationships reported)

**PURPOSE:** Obtaining optimal dynamic muscle contractility demands activation frequencies higher than those needed to produce maximal isometric force. However, such high activation frequencies increase cellular efflux of K<sup>+</sup> potentially leading to impaired muscle excitability. *In vivo* stimulation frequencies are often low (*sub-tetanic*), and only contain brief bursts of high frequencies (*supra-tetanic*) in the form of doublets. In the present study, we examined how dynamic muscle contractile performance in fast twitch fibers responds to high constant stimulation frequency or doublets and how this response was modulated by a suppression of excitability through increased extracellular [K<sup>+</sup>]. **METHODS:** Dynamic contractions were elicited in isolated rat EDL muscles stimulated either by constant frequency trains of *tetanic* (150 Hz), by *supra-tetanic* (300 Hz) frequencies, or by a *sub-tetanic* frequency (50 Hz) with or without an initiating doublet (300 Hz). Muscles were incubated at 30°C in Krebs Ringer buffer at 4 or 11 mM K<sup>+</sup>. **RESULTS:** Increasing frequency from 150 Hz to 300 Hz increased maximal power (P<sub>max</sub>) by 15  $\pm$  3 %, maximal velocity (V<sub>max</sub>) by 8  $\pm$  3 %, and rate of force development (RFD) by 23  $\pm$  3 % at 4 mM K<sup>+</sup>, but at 11 mM K<sup>+</sup> these increases were attenuated (V<sub>max</sub> increased by 5  $\pm$  2 %) or abolished. When using *sub-tetanic* frequency trains, addition of a high frequency doublet induced increases at both 4 and 11 mM K<sup>+</sup> in maximal force (F<sub>max</sub>) (15  $\pm$  3% and 6  $\pm$  2 %), P<sub>max</sub> (62  $\pm$  13 % and 23  $\pm$  3 %), V<sub>max</sub> (35  $\pm$  3 % and 22  $\pm$  2 %) and RFD (59  $\pm$  7 % and 31  $\pm$  4 %). These relative doublet-induced increases were significantly higher at 4 mM K<sup>+</sup> than at 11 mM K<sup>+</sup>. However, the absolute level of dynamic contractile function (with or without doublets) was equal or better at 11 mM K<sup>+</sup> than at 4 mM K<sup>+</sup> because an increase in [K<sup>+</sup>] *per se* potentiated the dynamic contractile parameters at the *sub-tetanic* stimulation frequency. **CONCLUSION:** These results show that the improved contractility achieved with high constant stimulation frequency is strongly attenuated when excitability is suppressed by high extracellular [K<sup>+</sup>]. However, when using doublets to initiate a train of *sub-tetanic* frequency, thus, mimicking an *in-vivo* like activation pattern, contractile improvements may be achieved both at normal and at high extracellular [K<sup>+</sup>].

1216 May 30 10:40 AM - 10:50 AM

**Relationship Between Rate of Force Development and Correlates of Muscle Contraction for A Normative Data Set.**

Alexander Olczak. State University of New York at Brockport, Brockport, NY. (Sponsor: Dr. Daniel Too, FACSM)

(No relevant relationships reported)

**PURPOSE:** As a performance measure, rate of force development (RFD) is largely underinvestigated, yet has a profound influence on explosiveness, joint stabilization, and rehabilitation. As a result, little is known about the meaningfulness of RFD and its relationship to neuromuscular function in general. The purpose of this study was to present a normative database for RFD, and to investigate relationships between RFD and factors of muscle contraction. **METHODS:** Two hundred participants completed a series of squat exercises at a speed of 10 degrees per second using a multi-joint, isokinetic dynamometer. Normative data was generated for RFD (M = 2070.2 N\*s<sup>-1</sup>, SD = 1076.0) and presented in the form of percentile ranks. Correlations were examined between RFD and factors of muscle contraction, including force, power, time to peak force, time to peak power, position of peak force, and position of peak power. **RESULTS:** Significant positive correlations were observed between RFD and force (r = .441, p = .000) and power (r = .649, p = .000); significant negative correlations were observed between RFD and time to peak force (r = -.653, p = .000), time to peak power (r = -.655, p = .000), peak force position (r = -.181, p = .010), and peak power position (r = -.552, p = .000). **CONCLUSIONS:** The result is a novel, normative database providing a relative scale of RFD, and relating RFD to correlates of muscle contraction. 4.4482216152605 = 9.80665 \* 0.45359237

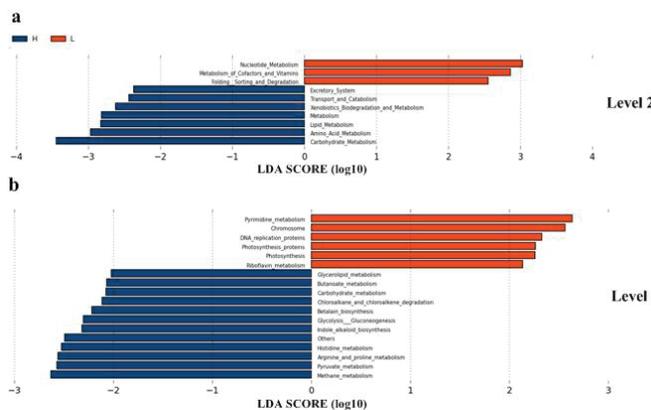
**C-29 Free Communication/Poster - Energetics**

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

**1239 Board #1 May 30 9:30 AM - 11:00 AM  
Characteristics Of The Fecal Microbiota In Professional Martial Arts athletes: Comparison Between Different Competitive Levels**

Ru Liang<sup>1</sup>, Xiangji Peng<sup>1</sup>, Jiyuan Zhou<sup>2</sup>. <sup>1</sup>Beijing Sport University, Beijing, China. <sup>2</sup>Peking University Shenzhen Hospital, Shenzhen Peking University-The Hong Kong University of Science and Technology Medical Center, Shenzhen, China.  
Email: liangru126@126.com  
(No relevant relationships reported)

**PURPOSE:** Recent evidences suggest that the athletes have distinct microbial features compared to the sedentary subjects. However, few data have been assessed for the gut microbiota characteristics of athletes at different levels of competition. The aim of this study is to investigate whether gut microbiome is significant difference between higher and lower-level athletes. **METHODS:** Fecal microbiota communities were analyzed by using hypervariable tag sequencing of the V3-V4 region of the 16S rRNA gene among 28 professional hard martial arts athletes, including 12 higher-level and 16 lower-level athletes. **RESULTS:** The gut microbial richness and diversity (Shannon diversity index ( $p = 0.019$ ) and Simpson diversity index ( $p = 0.001$ )) were significantly higher in higher-level athletes than in lower-level ones. Genera *Phascolarctobacterium*, *Parabacteroides*, *Anaerostipes*, *Anaerotruncus*, *Bilophila*, *Cloacibacillus*, *Desulfovibrio*, *Flavonifractor* and *Oscillibacter* were enriched in the higher-level group. Interestingly, the genera *Parabacteroides* abundance was significantly correlated with time reported exercising during an average week. Further analysis of the functional prediction revealed that three energy metabolism and methane metabolism were markedly over-represented in the gut microbiota of the higher-level athletes. **CONCLUSIONS:** This study provides the first insight into the gut microbiota characteristics of professional hard martial arts athletes. The higher-level athletes have increased diversity and high metabolic capacity of the gut microbiome, which may be positively influential to their performances. This study was supported by China Postdoctoral Science Foundation (grant number 194837) and SZSM201612071.



**Figure 1. Functional predictions for the fecal microbiome of the higher-level (H) and the lower-level (L) groups. (a)** Comparison between the higher-level athletes enriched and lower-level athlete enriched markers on level 2 of KEGG functional category. **(b)** Comparison between the higher-level athletes enriched and the lower-level athletes enriched markers on level 3 of KEGG functional category. LDA, linear discriminant analysis.

**1240 Board #2 May 30 9:30 AM - 11:00 AM  
Relative Exercise Intensity And Energy Expenditure Of Exercising On The Freebouncer™**

Jared Hartung, Paul Mutch, John P. Porcari, FACSM, Kimberly Radtke, Abigail Ryskey, Carl Foster, FACSM. *University of Wisconsin-La Crosse, La Crosse, WI.* (Sponsor: John Porcari, FACSM)  
(No relevant relationships reported)

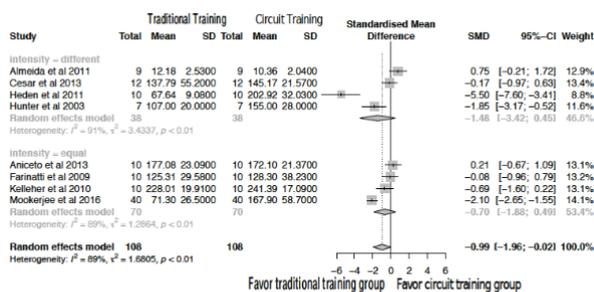
The Freebouncer™ Fitness and Rehab machine incorporates a spring-loaded platform attached to a metal frame and is designed to provide a low-impact total body aerobic workout. The Freebouncer™ has characteristics similar to mini-trampolines, which have been shown to improve aerobic fitness and positively affect body composition. To date, no research has evaluated the intensity of exercising on the Freebouncer™. **PURPOSE:** To examine the relative intensity of exercising on the Freebouncer™ and determine if it meets ACSM guidelines for improving cardiorespiratory fitness and body composition. **METHODS:** Fourteen apparently- healthy volunteers (9 M, 5 F; mean age = 22.6 yrs) completed an incremental maximal exercise test on a treadmill to determine maximal HR (HRmax) and maximal oxygen consumption (VO<sub>2</sub>max). After practice, they then completed a 12-minute interval workout on the Freebouncer™, alternating 30 seconds of squats and bursts with 15 seconds of less vigorous exercises. **RESULTS:** It was found subjects exercised at an average of 75 ± 12.74% of HRmax and 48.0 ± 4.54% of VO<sub>2</sub>max. Average RPE was 12.3 ± 1.35. Males burned an average of 10.9 ± 1.57 kcal/min and females burned an average of 6.6 ± .90 kcal/min. **CONCLUSION:** Collectively these data suggest that exercising on the Freebouncer™ provides a “moderate-intensity” workout that would result in significant improvements in aerobic capacity and body composition if the product is used regularly.

**1241 Board #3 May 30 9:30 AM - 11:00 AM  
Can Intensity In Strength Training Promote Changes In Caloric Expenditure? Systematic Review And Meta-analysis**

Aylton Figueira Junior<sup>1</sup>, Daniel Rodrigues<sup>1</sup>, Ruy Calheiros Neto<sup>2</sup>, Aquiles Yañes<sup>3</sup>, Thiago Ferreira<sup>2</sup>, Roberta L. Rica<sup>1</sup>, Nelson Cavas Jr<sup>4</sup>, Gustavo Allegretti João<sup>1</sup>, Danilo Sales Bocalin<sup>5</sup>.  
<sup>1</sup>Universidade São Judas Tadeu, Sao Paulo, Brazil. <sup>2</sup>Faculdades Metropolitanas Unidas - FMU, Sao Paulo, Brazil. <sup>3</sup>Universidade Mayor, Santiago, Chile. <sup>4</sup>Universidade Ibirapuera, Sao Paulo, Brazil. <sup>5</sup>Universidade Federal do Espírito Santo, Espírito Santo, Brazil.  
Email: fernandalopes.fisio@gmail.com  
(No relevant relationships reported)

Strength training (ST) is considered an important strategy for maintaining body weight, as it promotes an increase in total energy expenditure (EE). However, the combination and manipulation of variables (intensity and volume) allows different training methods. **PURPOSE:** This review aimed to investigate the effect of ST on EE in adults by a systematic literature review and subsequent meta-analysis. **METHODS:** A search was performed on the electronic databases Virtual Library for Health Studies (BVS), PubMed and Science Direct using the following keywords: strength training (resistance training; strength training; strength training method) and energy expenditure (energy metabolisms; energy expenditure; caloric expenditure, caloric cost) with “AND” and “OR” combination. Manual searches of references were also conducted for additional relevant studies. After evaluating the inclusion and exclusion criteria, the selected studies were analyzed according to strength training methods and the training variables used to measure EE. **RESULTS:** The study identified two ST methods from literature review: circuit training (CT) and traditional training (TT). The training density were significantly higher in the CT method when compared with the TT method (TT = 330,61 ± 147,32 vs. CT 749,24 ± 583,70, Δ = -442,32; IC 95% [-833,17, -51,46] t (-2,52), p < 0,05). Meta-analysis showed a significant effect in increases in EE in favor of the TT when compared with CT (-0.99 [95%CI: -1.96, -0.02], p < 0.01) with I<sup>2</sup> of 89% (p < 0.01). After adjusting for bias risk, no significant differences were found in EE associated with intensity (-0.40, 95% CI [0.98, 0.18], p = 0.18). **CONCLUSIONS:** Therefore, the present review and meta-analysis allowed to conclude that the intensity does not seem to be associated to the increase of EE in ST.

THURSDAY, MAY 30, 2019



**Fig. 2** Forest Plot of the energy expenditure effect of the traditional training method as compared to the circuit training method; confidence interval (CI); standardized mean difference (SMD), standard deviation (SD)

**1242 Board #4 May 30 9:30 AM - 11:00 AM**  
**Net Energy Efficiency during Synchronous and Asynchronous Arm Cranking at Three different Body Postures**

Haejung Jang<sup>1</sup>, Somi Yun<sup>1</sup>, Jaemyung Kim<sup>1</sup>, Eunjin Hwang<sup>1</sup>, Ah Reum Jung<sup>1</sup>, Hee Jin Lee<sup>1</sup>, Dae Taek Lee<sup>1</sup>, Ikjin Kwon<sup>2</sup>.  
<sup>1</sup>Kookmin University, Seoul, Korea, Republic of. <sup>2</sup>Chung-Ang University, Seoul, Korea, Republic of.  
 (No relevant relationships reported)

**PURPOSE:** This study examined the net energy efficiency (Ee) during synchronous (Syn) and Asynchronous (Asyn) submaximal arm cycling at three different body postures.

**METHODS:** Nine healthy young men (25.1±3.1 yrs, 177±5 cm, 79.5±12.1 kg, 25.5±3.4 kg/m<sup>2</sup>), who were not familiar with arm ergometer prior to study, were tested for estimating maximal aerobic capacity (VO<sub>2</sub>max) during asynchronous arm cranking on an arm ergometer in 3 body postures; upright (UP; 20.8±2.2, 179±14), recline (RC; 21.1±3.4, 168±17), and forward-bent (BF; 21.4±2.8 ml·O<sub>2</sub>/kg/min, 167±17 beat/min of maximal heart rate). Based on VO<sub>2</sub>max, 70% of work intensity was determined for each posture. All participants underwent 6 submaximal arm cranking tests (3 postures by 2 arm cranking modes; Syn or Asyn). They cranked at 50 rpm for 10 min at each test. During tests, their oxygen uptake (VO<sub>2</sub>) and mechanical work rate was measured. Ee was calculated from work rate divided by energy expenditure, and compared between 2 modes and 3 postures.

**RESULTS:** The average VO<sub>2</sub> was 15.3±2.3, 14.3±2.9, 17.0±2.9, 15.5±1.6, 15.7±3.2, and 16.2±2.1 ml·O<sub>2</sub>/kg/min at UP-Syn, RC-Syn, BF-Syn, UP-Asyn, RC-Asyn, and BF-Asyn, respectively (p>0.05). Their work rate was ranged from 58.3±6.6 to 61.7±7.9 kilojoule. No differences in Ee were found between Syn (20.4±2.5) and Asyn (19.8±1.7%) in UP. Ee was higher during Syn (21.7±2.7) than Asyn (19.0±2.6%) in RC (p<0.05). Ee was not different between Syn (16.9±2.3) and Asyn (17.8±2.2%) in BF. When comparing Ee during Asyn between postures, no differences were found. Ee during Syn in both UP (p<0.05) and RC (p<0.005) was higher than BF.

**CONCLUSIONS:** Ee during Syn arm cranking at RC showed the highest, while that during Syn cranking at BF did the lowest. In UP, the arm cranking mode did not affect Ee. In RC, Syn cranking was highly efficient than Asyn. Ee was less than 18% in BF at two cranking modes. It is certain that Ee was dependent on the body posture and the arm cranking mode.

**1243 Board #5 May 30 9:30 AM - 11:00 AM**  
**Urine Lactate after Continuous and Interval Cycling Exercise Bouts Eliciting Different Blood Lactate Concentrations**

Gregory C. Bogdanis<sup>1</sup>, Spiros Tsirigkakis<sup>2</sup>, George Mastorakos<sup>3</sup>, Vassilis Mougios<sup>4</sup>.  
<sup>1</sup>National and Kapodistrian University of Athens, Dafne, Greece. <sup>2</sup>University of Thessaly, Trikala, Greece. <sup>3</sup>National and Kapodistrian University of Athens, Athens, Greece. <sup>4</sup>Aristotle University of Thessaloniki, Thessaloniki, Greece.  
 Email: gbogdanis@phed.uoa.gr  
 (No relevant relationships reported)

Post-exercise urine lactate (UL) has been suggested as a novel exercise biomarker of lactate production. The few studies examining the association between post-exercise peak blood lactate (BL) and UL have reported moderate to high linear correlations. However, these studies have not considered BL concentration during exercise.

Also, the range of BL values was narrow (about 10 mmol/L), thus limiting the predictive value of UL. **PURPOSE:** To examine the association between UL and BL concentrations during continuous and interval exercise of equal mean power.

**METHODS:** Eleven healthy young males performed four trials in random, counterbalanced order, one week apart. All trials included 20 min of cycling with equal mean power output, performed either continuously (CON) or in the form of interval training including 48 x 10 s (HIIT10), 16 x 30 s (HIIT30), or 8 x 60 s (HIIT60) bouts at a power output corresponding to 100% of VO<sub>2</sub>max. Recovery intervals during the HIIT trials included cycling at 15% of VO<sub>2</sub>max for 150% of the exercise bout time. Capillary BL concentration was measured at rest and every 5 min during exercise, and UL concentration was measured in urine samples obtained pre- and 1 hour post-exercise, with controlled hydration. BL and UL results were analyzed using 2-way ANOVA with repeated measures (trial x time). The association between incremental area under the blood lactate curve (BL-AUC) and UL concentration was determined using linear and exponential functions.

**RESULTS:** BL increased compared with baseline in all trials from the first 5 min of exercise (p < 0.01). BL-AUC increased from CON to HIIT10, HIIT30 and HIIT60 (61.7 ± 21.2, 83.4 ± 29.0, 97.8 ± 34.0, 147.4 ± 44.2 mmol/L x min, respectively, p < 0.01). However, post-exercise UL increased from baseline only in HIIT60 (from 1.2 ± 1.0 to 22.5 ± 23.3 mmol/L, p < 0.001). Exercise BL ranged from 3.0 to 17.7 mmol/L, while post-exercise UL ranged from 0.2 to 76.4 mmol/L. The best function describing the BL-AUC and UL relationship was exponential (r = 0.68, p < 0.05).

**CONCLUSIONS:** The lack of increase in UL despite an increase in BL and their exponential association suggest that there may be a threshold above which BL cannot be disposed within the body and is excreted by the kidneys.

**1244 Board #6 May 30 9:30 AM - 11:00 AM**  
**The Autonomic Balance Of Master Athlete During Stress Is Associated To Antioxidant Profile**

Lysleine Alves Deus, Thiago Santos Rosa, Larissa Alves Maciel, José Morais Souto Filho, Samuel Silva Aguiar, Caio Victor Sousa, Rodrigo Vanerson Passos Neves, Herbert Gustavo Simões.  
 Universidade Católica de Brasília, Brasília, Brazil.  
 Email: lys.deus@gmail.com  
 (No relevant relationships reported)

There is a lack in the literature regarding the relationship between autonomic function, as measured by markers of heart rate variability, and the redox balance of master athletes. **PURPOSE:** The redox profile and autonomic responses to stress were measured in master athletes and untrained controls, and the relationships between markers of HRV and redox balance were determined. **METHODS:** Participants (n=55) were 16 master athletes (52.75±9.7yrs, minimal of 20 yr. of lifelong athletic training), 19 age-matched (49.5±10.5yrs) and 20 young controls (22.42±3.8yrs). The volunteers remained seated for 15-min in early morning, with the final 10-min being considered for baseline HRV recordings (Polar RS800X Heart Rate Monitor®), and then were submitted to a cold pressure test (CPT) by immersing the right hand in cold water (3-4 °C) for two minutes in which HRV was measured. The pro- and anti-oxidant status were determined in blood after 8-hour fasting by using commercial kits. A two-way ANOVA with repeated measures and Pearson's moment correlation enabled for comparisons and correlations.

**RESULTS:** The autonomic profile of master athletes was better than age-matched controls and similar to young control group. No significant correlations were observed between redox profile and HRV parameters in resting [SOD, CAT, AU e TBARS (p>0.05)]. However, during stress (CPT) the participants who presented a higher HRV index (indicating an increased parasympathetic tone during CPT) had a better antioxidant defense, with significant correlations between SOD vs. SDNN (r=0.389; p=0.02), RMSSD (r=0.362; p=0.03), and nn50 (r=0.416; p=0.01); between CAT vs. Mean R-R (r=0.346; p=0.03), SDNN (r=0.375; p=0.02), and RMSSD (r=0.348; p=0.03); as well as between AU vs. nn50 (r=0.383; p=0.02). Similar relationships were observed during post-stress recovery: SOD vs RMSSD (r=0.386; p=0.02) and nn50 (r=0.395; p=0.02); CAT vs. RMSSD (r=0.436; p=0.008) and nn54 (r=0.413; p=0.01); and AU vs. RMSSD (r=0.386; p=0.02) and nn50 (r=0.350; p=0.03). **CONCLUSION:** Besides having a better autonomic and redox balance in comparison to aged-matched controls, the responses of master athletes were similar to young group. Moreover, an improved autonomic balance during stress was associated to a better antioxidant status of the participants.

1245 Board #7 May 30 9:30 AM - 11:00 AM

**Effect Of Wearing Compression Tights On Muscle Oxygenation And Exogenous Glucose Utilization During Prolonged Cycling**Sahiro Mizuno<sup>1</sup>, Eri Yamada<sup>2</sup>, Fumihiko Todoko<sup>2</sup>, Kazushige Goto<sup>1</sup>. <sup>1</sup>Ritsumeikan University, Kusatsu, Japan. <sup>2</sup>DESCENTE Ltd., Osaka, Japan. (Sponsor: Robert Kraemer, FACSM)  
Email: sh0019hs@ed.ritsumei.ac.jp

(No relevant relationships reported)

Mizuno, S.<sup>1,2</sup>, Yamada, E.<sup>3</sup>, Todoko, F.<sup>3</sup>, Goto, K.<sup>1</sup>

1. Ritsumeikan University, Shiga, Japan

2. Research Fellow of the Japan Society for the Promotion of Science

3. DESCENTE Ltd. Osaka, Japan

**PURPOSE:** To determine effect of wearing compression tights on muscle oxygenation and exogenous glucose utilization during prolonged cycling in endurance athletes.**METHODS:** Ten triathletes (19.9 ± 1.2 years, 172.2 ± 4.4 cm, 62.0 ± 3.8 kg, BMI; 20.9 ± 0.7 kg·m<sup>-2</sup>; VO<sub>2</sub>max; 59.3 ± 4.4 ml·kg<sup>-1</sup>·min<sup>-1</sup>) completed 3 trials under respective conditions: 1) wearing a compression tight with approximately 15 mmHg [MED trial], 2) wearing a compression tight with approximately 30 mmHg [HIGH trial], and 3) wearing a tight with below 5 mmHg [CON trial]. The exercise consisted of 90 min of cycling at 65% of VO<sub>2</sub>max. Changes in exogenous glucose utilization (<sup>13</sup>C excretion in expired gas after consuming <sup>13</sup>C labeled glucose), muscle oxygenation (oxy-hemoglobin, deoxy-hemoglobin, total hemoglobin and tissue saturation index), blood parameters (blood glucose and lactate, and serum glycerol, insulin and total ketone body concentrations), blood gas parameters (pH, pO<sub>2</sub>, pCO<sub>2</sub>, HCO<sub>3</sub><sup>-</sup>, Na<sup>+</sup> and K<sup>+</sup>), respiratory variables (VO<sub>2</sub>, VCO<sub>2</sub>, VE, RER), heart rate and rating of perceived exertion were evaluated throughout the exercise. Time to exhaustion test (at 85% of VO<sub>2</sub>max) was performed after completing 90 min of cycling to evaluate endurance performance.**RESULTS:** Exercise rapidly increased <sup>13</sup>C excretion, but highest value of <sup>13</sup>C excretion was significantly shown earlier in the MED trial (47.1 ± 9.9 min) compared with in the other trials (HIGH trial: 67.3 ± 23.7 min, CON trial: 54.0 ± 9.5 min, P = 0.033).

Although MED trial showed significant lower oxy-hemoglobin throughout the exercise (P = 0.003), the changes in deoxy-hemoglobin, total hemoglobin and tissue oxygenation index did not differ among the trials. No significant difference was observed for changes in other variables among the trials.

**CONCLUSION:** Wearing a compression tights exerting approximately 15 mmHg on thigh facilitated exogenous glucose utilization during 90 min of cycling.

1246 Board #8 May 30 9:30 AM - 11:00 AM

**Seasonal Changes in Salivary Biomarkers and Psychomotor Function Among Elite Fencers**Valeriu Tomescu<sup>1</sup>, David Bellar<sup>2</sup>. <sup>1</sup>National Olympic Committee, Bucarest, Romania. <sup>2</sup>University of Louisiana at Lafayette, Lafayette, LA.

Email: olimpicus@yahoo.com

(No relevant relationships reported)

**PURPOSE:** The present investigation sought to follow a group of elite fencers (n=10) through the competitive season monitoring salivary biomarkers and psychomotor function in order to develop a better understanding of the effects of training and peak competition in this sport.**METHODS:** The methods for the present investigation are consistent with the declaration of Helsinki. Athletes provided saliva samples during the morning hours on 22 separate occasions during the main competitive phase of their annual training plan. Additionally, these same athletes completed a standard finger tapping psychomotor test on a tablet before and after training during this same phase of the annual plan. The saliva samples were analyzed via a point of care salivary analysis system for salivary IgA and Cortisol hormone. Finally, the primary coaches for the fencers provided a rank order for the athletes to determine highest and lowest performers. Data was analyzed for trends over time, by athlete rank and by pre-post training sessions using JMP 13.0 Pro software. Statistical significance was set a priori at p<0.05.**RESULTS:** A significant main effect for time was noted when analyzing pre to post practice change in finger tapping speed over the course of the season (F=5.23, p=0.024). Further analysis revealed that rank order of athletes (F=2.08, p=0.043) produced a significant main effect within the data for change in finger tapping speed pre to post practice. (Top half of athletes: 0.259 sec pre, 0.246 sec post; Bottom half of athletes: 0.282 sec pre, 0.251 sec post). Additionally, a significant main effect for time was noted for morning salivary cortisol (F=2.35, p<0.001). Average values for the group were less than 12 nm during the initial part of the training season, peaked during the middle of the monitoring period at 20.6 nm then fell towards the conclusion of the

season during the main competitions back below 12 nm. A main effect for time was not noted for salivary IgA (F=0.969, p=0.504). Average values for the season for salivary IgA were 402.5 ± 203 ug/ml.

**CONCLUSIONS:** Based upon the results of this observational study it appears that stress hormones in elite fencers peak mid-season then decline during the taper at the end of the season. Additionally, it appears that the best of the elite athletes have better baseline psychomotor function.

1247 Board #9 May 30 9:30 AM - 11:00 AM

**Perceived Energy and Well Being in Collegiate Football Players with and without Sick Cell Trait**Matt Martone<sup>1</sup>, Shelly Mullenix<sup>1</sup>, Nathan Lemoine, Jr<sup>1</sup>, Jack Marucci<sup>1</sup>, Derek Calvert<sup>1</sup>, Timothy S. Church<sup>2</sup>, Brian Harrell<sup>2</sup>, Guillaume Spielmann<sup>1</sup>, Brian Irving, FACSM<sup>1</sup>, Jennifer Rood<sup>2</sup>, LaKieitha Poole<sup>2</sup>, Neil Johannsen<sup>1</sup>. <sup>1</sup>Louisiana State University, Baton Rouge, LA. <sup>2</sup>Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Brian Irving, FACSM)

(No relevant relationships reported)

Sickle cell Trait (SCT) has measurable physiological effects. Whether SCT has marked psychological effects in elite collegiate football players (ie perceived their energy levels, mood state, and overall well-being) compared to position-matched controls is unknown. **Purpose:** To examine self-perceptions of sleep quality, mood state, and general well-being in Division 1 football players with and without SCT. **Methods:** Participants with SCT were identified by a team physician and confirmed by electrophoresis and paired with position-matched controls (n=12). Assessments included the Pittsburgh Sleep Quality Inventory (PSQI), Daily Analysis of Life Demands for Athletes Questionnaire (DALDA), Activation-Deactivation Adjective Check List (AD-ACL), and General Well-Being Questionnaire (GWB). Data was collected at three time points; before pre-season camp, after pre-season camp, post-season. **Results:** SCT reported higher levels of energy on the AD-ACL assessment than the control group at baseline (13.65 ± 0.68 vs. 11.56 ± 0.66, p<0.05). No group\*time interaction existed (p=0.20). On the GWB, no differences between groups were found; however, a significant decrease in perceived well-being between pre-camp and post-camp (38.86 ± 1.80 vs. 32.08 ± 1.72, p<.05) and pre-camp and post-season (38.86 ± 1.80 vs. 32.69 ± 1.86, p<.05) was noted across all participants. Perceived sleep quality was similar across all participants at all time points. **Conclusion:** Participants with SCT reported a greater energy level coming into training camp and had similar perceived energy at the beginning and end of the competitive season compared to position-matched controls. GWB did not differ between groups but decreased in all athletes throughout the season. Interestingly, the post-season survey may be skewed by the win or loss from the final game. The decrease at the start of the season could be due to increased stress due to academic responsibilities or the expectation to perform well and win competitions. Future research will correlate these psychological findings to biological markers of stress and fatigue.

1248 Board #10 May 30 9:30 AM - 11:00 AM

**Effect of Gas Exchange Measurements on Critical Power and Determination of Peak Oxygen Uptake during 3 min Critical Power Tests**Alan D. Moore, FACSM<sup>1</sup>, Joshua M. Kern<sup>2</sup>, Shannon L. Jordan<sup>1</sup>, Daniel R. Chiles<sup>1</sup>. <sup>1</sup>Lamar University, Beaumont, TX. <sup>2</sup>Louisiana State University, Baton Rouge, LA.

Email: alan.moore@lamar.edu

(No relevant relationships reported)

No data have been reported regarding the effect of performing gas exchange measurements during 3 min "all-out" tests of cycling Critical Power (CP) on the CP value itself. Conflicting data exists regarding the validity of determining peak oxygen uptake (VO<sub>2peak</sub>) during 3 min CP tests. **PURPOSE:** To determine if differences exist between CP measurements performed with metabolic gas exchange data (WMD) and without (Control) during 3 min leg cycling tests. A second aim of this study was to determine if VO<sub>2peak</sub> can be determined using data from the 3 min CP test. **METHODS:** Nineteen physically active (VO<sub>2peak</sub> = 34.7 ± 7.7 ml/kg/min) subjects completed a ramp test to determine VO<sub>2peak</sub> and two 3 min CP tests (WMD and control). VO<sub>2peak</sub> was determined from an average of the last 30 sec of the ramp test and compared to VO<sub>2</sub> measured during the final 30 sec of the WMD CP test. Critical power (watts) was the mean power attained during the last 30 sec of the CP tests. The curvature constant (W') was computed as the power-time integral above CP. **RESULTS:** No differences (p = 0.11) were observed for CP in the WMD trial compared to the control condition (172 ± 46 W, 169 ± 49 W, respectively). Similarly, no differences occurred for W' (11.3 ± 5.4 kJ WMD, 11.7 ± 4.4 kJ control, p = 0.61) and peak watts (673 ± 326 W WMD, 636 ± 335 W control, p = 0.84). In regard to VO<sub>2peak</sub> measured during the CP test (2517 ± 576 ml/min) and that of the ramp test (2564 ± 550 ml/min), there were no differences (p = 0.23). **CONCLUSIONS:** These data indicate that CP, peak W, and W' values do not differ between a 3 min all-out test performed with or without gas exchange measurements. Thus, one can be confident

that performing metabolic gas measures during the 3 min CP test does not bias the CP and W' data. As no significant differences were found for  $VO_{2peak}$  between the ramp and CP test, the data supports the contention that it is possible to obtain  $VO_{2peak}$  in a 3 min all-out CP test.

**1249** Board #11 May 30 9:30 AM - 11:00 AM  
**Potential Benefit of Repeated Resting Metabolic Rate Measurements**

Greggory Davis<sup>1</sup>, Mary Lavergne<sup>1</sup>, Derek Scott<sup>1</sup>, Benjamin Kern<sup>1</sup>, David Bellar<sup>1</sup>, Arnold Nelson, FACSM<sup>2</sup>. <sup>1</sup>University of Louisiana at Lafayette, Lafayette, LA. <sup>2</sup>Louisiana State University, Baton Rouge, LA. (Sponsor: Arnold Nelson, FACSM)  
 Email: grd4805@louisiana.edu  
 (No relevant relationships reported)

Obtaining valid and reliable measurements for resting metabolic rate (RMR) via indirect calorimetry is critical for clinical and research purposes. **PURPOSE:** The primary aim of the study was to determine the reliability of RMR measurements under standard (best practice conditions). The secondary aim was to determine if normal fluctuations in skin temperature, core temperature, heart rate, or environmental factors affect repeated RMR measurements. **METHODS:** Twenty college-aged men entered the lab following an overnight fast. Following twenty minutes of sitting quietly, continuous measurements of environmental temperature, relative humidity, skin temperature, core temperature, and heart rate were recorded along with RMR. Following the initial RMR measurement, participants sat quietly for an additional forty minutes. A second RMR measurement was then completed following the same protocol. Differences between the initial measurement and second measurement for RMR, inter-beat interval, core temperature, skin temperature, and environment were determined using a paired samples t-test for normally distributed data. A Wilcoxon signed-rank test was used for non-normally distributed data. Multiple linear regression was used to determine the relationship between inter-beat interval, core temperature, skin temperature, and environment on RMR measurements. All data are presented as mean  $\pm$  SEM. **RESULTS:** The higher of the two RMR measurements was 2067.58  $\pm$  66.03 kcal/day while the lower of the two RMR measurements was 1975.31  $\pm$  64.85 kcal/day ( $t = 4.32$ ,  $p < 0.01$ ). Similarly, the higher of the two core temperature measurements was 37.05  $\pm$  0.09°C while the lower of the two core temperature measurements was 36.74  $\pm$  0.09°C ( $t = 7.17$ ,  $p < 0.01$ ). The change in R-R interval for heart rate was significantly correlated with the higher and lower RMR measurements ( $r = 0.47$ ,  $p = 0.04$  and  $r = 0.53$ ,  $p = 0.02$ , respectively). No other factors were significantly related to changes in RMR. **CONCLUSION:** Even when best practice guidelines are followed, significant variability in RMR measurements separated by forty minutes suggest that two measurements of RMR may be necessary to obtain accurate data.

**1250** Board #12 May 30 9:30 AM - 11:00 AM  
**Effects Of Eccentric Versus Concentric Exercise Of The Trunk Extensor On Muscle Function, Blood Lipid Profile And Glycemic Response**

Ah-Ram Kim<sup>1</sup>, Ho-Seong Lee<sup>2</sup>. <sup>1</sup>Namseoul University, Cheonan-si, Korea, Republic of. <sup>2</sup>Dankook University, Cheonan-si, Korea, Republic of.  
 Email: ptark@nsu.ac.kr  
 (No relevant relationships reported)

The variability in the insulin-stimulated glucose uptake of different skeletal muscles may be partly attributable to the differences in the muscle fiber type composition and the level of expression of the insulin-responsive glucose transporter known as Glucose transporter type 4. **PURPOSE:** To compare and evaluate the functional and metabolic changes from EIMD of the trunk extensor as compared with those induced by concentric contractions. **METHODS:** In a double-blinded, randomized, crossover trial, and ten men performed a single bout of 50 maximal voluntary concentric (CON) and eccentric (ECC) contractions of the trunk extensor at 2 weeks interval. The indirect markers of muscle damage (muscle soreness; SOR, creatine kinase; CK), the muscle function (muscle strength and muscle endurance), the lipid profile (triaclylglycerols; TGs, total cholesterol; TC, high-density lipoprotein cholesterol; HDLC, low-density lipoprotein cholesterol; LDLC) and the glycemic response (glucose, insulin, homeostasis model assessment; HOMA, and glycosylated hemoglobin) were measured before, immediately after, and 24, 48, 72, and 96 hours after each bout of exercise. Moreover, the muscle activity of paraspinal muscles were also recorded during CON and ECC.

**RESULTS:** The SOR at 24, 48, 72, and 96 hours after ECC had significant increased as compared with that after CON ( $p < 0.05$ ). The TG, TC, LDLC, and TC/HDLC levels were significant lower at 48, 72, and 96 hours after ECC, as compared with those after CON ( $p < 0.05$ , respectively). The levels of glucose and HOMA were significantly higher at 48 and 72 hours after ECC as compared with those after CON ( $p < 0.05$ , respectively). However, no significant changes in the muscle strength and endurance,

HDLC, insulin, and glycosylated hemoglobin were observed between the two groups. Meanwhile, the LM and ILL activities were significantly higher during ECC than during CON ( $p < 0.05$ , respectively).

**CONCLUSIONS:** Thus, the study confirmed that EIMD of the trunk extensor had positive effects on the blood lipid profile and the glycemic response, and the LM and ILL showed a high level of muscle activity during ECC.

**1251** Board #13 May 30 9:30 AM - 11:00 AM  
**Lactate Threshold Velocity At 4 mMol/l Does Not Maintain Blood Lactate Levels During Steady State Intensity**

Juan C. Mazza<sup>1</sup>, Raúl L. Festa<sup>1</sup>, Sandra L. Prieto<sup>2</sup>, Patricia Cosolito<sup>1</sup>, Alvaro N. Gurovich, FACSM<sup>3</sup>. <sup>1</sup>Biosystem Institute Sports Sciences, Rosario, Argentina. <sup>2</sup>Colombia State University, Bogotá D.C., Colombia. <sup>3</sup>The University of Texas at El Paso, El Paso, TX.  
 Email: juancmazza@wninternet.com  
 (No relevant relationships reported)

Evidence shows that lactate threshold (LT) is a valid tool to evaluate endurance capacity and is used to prescribe training intensities. However, there are discrepancies between LT test methodologies and the way to use LT to prescribe training velocities, maintaining metabolic stress in steady-state intensity bouts. Few studies have investigated the relationship of LT Velocity at 4 mMol/l (V4) with intensity prescription on Interval Training (IT) workouts. **PURPOSE:** To determine if V4, obtained via an incremental test, can maintain Blood Lactate (BL) predicted, during a steady-state IT workout in swimmers. **METHODS:** Ten well trained swimmers (19.42 $\pm$ 6.77 yrs) performed two freestyle tests: an incremental 6x200-m test with 1-min passive rest, measuring Heart Rate (HR) and BL after each repetition to determine V4; and, 4 days after, a steady-state IT 10x200-m test with 1-min passive rest at V4, measuring BL and HR after reps. 2-4-6-8-10. Paired t-tests were used to compare V4 vs. IT speeds and times and BL@V4 vs. BL after reps. 2-4-6-8-10. In addition, repeated measures ANOVA was used to compare BL after reps. 2-4-6-8-10. Finally, Pearson's correlations ( $r$ ) were obtained between BL vs HR in both incremental and steady state tests. **RESULTS:** Same speeds and times for V4 and IT were observed (1.38 $\pm$ 0.07 m/s and 145.4 $\pm$ 7.6 s vs 1.38 $\pm$ 0.07 m/s and 145.5 $\pm$ 7.5 s, respectively,  $p > 0.05$ ). BL levels were maintained at BL@V4 levels only during reps 2 and 4 (4.10 $\pm$ 0.52; 3.72 $\pm$ 0.63 mMol/l, respectively,  $p > 0.05$  vs. BL@V4); however, BL levels decreased over time during reps 6, 8, and 10 (3.59 $\pm$ 0.29; 3.40 $\pm$ 0.33; 3.13 $\pm$ 0.30 mMol/l, respectively,  $p < 0.01$  vs. BL@V4 and vs. reps 2 and 4). Additionally, there was a moderate correlation ( $r = 0.69$ ) between BL and HR during the incremental test. However, a low correlation ( $r = 0.26$ ) between BL and HR during the steady state IT test was observed. **CONCLUSION:** V4 from an incremental test underestimates BL level showing, a progressive decrease during the steady-state IT test. These results suggest that IT at V4 might not be enough to maintain metabolic stress during an IT bout, especially during the second half of it. Additionally, the moderate and low correlations observed between BL vs. HR suggest that HR might not be a good marker of exercise intensity in swimmers.

**1252** Board #14 May 30 9:30 AM - 11:00 AM  
**Validation Of Gas Analysis Over Incremental Work Intensities - A Comparison Of Two Metabolic Measurement Systems**

Leila A. Walker<sup>1</sup>, David P. Looney<sup>1</sup>, Heather M. Hansen<sup>1</sup>, Maxwell N. Rome<sup>2</sup>, William J. Tharion<sup>1</sup>, Alexander P. Welles<sup>1</sup>, Adam W. Potter<sup>1</sup>, Christopher R. Chalmers<sup>2</sup>, Reed W. Hoyt<sup>1</sup>, Holly L. McClung<sup>1</sup>. <sup>1</sup>US Army Research Institute of Environmental Medicine, Natick, MA. <sup>2</sup>Oak Ridge Institute for Science and Education, Oak Ridge, TN.  
 (No relevant relationships reported)

Indirect calorimetry is a practical and accurate method of measuring metabolic gas exchange rate, specifically volume of oxygen and carbon dioxide ( $\dot{V}O_2$  and  $\dot{V}CO_2$ ). Commercial stationary and mobile systems typically include automated metabolic gas analyses. Metabolic cart systems are considered the standard; however, they pose limitations due to cost and portability. **PURPOSE:** To compare the accuracy of a commercially available mobile system (CareFusion Oxycon Mobile®, OXYCON) to a criterion stationary cart system (ParvoMedics TrueOne 2400®, PARVO). **METHODS:** Fifteen volunteers (13 Male, 2 Female; 24  $\pm$  6 y (mean  $\pm$  SD), 77  $\pm$  13 kg BW,  $VO_{2peak}$  3.9  $\pm$  0.7 L $\cdot$ min<sup>-1</sup>) completed four trials over two non-consecutive study days. Trials consisted of a rest period, followed by three incremental treadmill work rates: walk (23-36%  $VO_{2peak}$ ), jog (49-67%  $VO_{2peak}$ ), and run (60-76%  $VO_{2peak}$ ) in controlled laboratory conditions (20  $\pm$  0.5 °C; 45  $\pm$  22 % RH). Metabolic system order was randomized and data collected was averaged over 3-4 minute steady-state periods from each work intensity. Correlation coefficients and systematic bias were used to evaluate the agreement between the systems. **RESULTS:** Measurements of  $\dot{V}O_2$  from

the OXYCON and PARVO were highly correlated ( $R^2=0.99$ ). The OXYCON showed some positive bias ( $0.18 \pm 0.16 \text{ L}\cdot\text{min}^{-1}$ ) that increased with work intensity: rest ( $\dot{V}O_2$   $0.05 \pm 0.06 \text{ L}\cdot\text{min}^{-1}$ ), walk ( $\dot{V}O_2$   $0.15 \pm 0.09 \text{ L}\cdot\text{min}^{-1}$ ), jog ( $\dot{V}O_2$   $0.26 \pm 0.16 \text{ L}\cdot\text{min}^{-1}$ ), and run ( $\dot{V}O_2$   $0.31 \pm 0.16 \text{ L}\cdot\text{min}^{-1}$ ).

**CONCLUSION:** The mobile OXYCON is an acceptable alternative to stationary metabolic cart systems for measuring metabolic gas exchange rate during rest and low intensity exercise. Clinicians may consider alternative devices for assessments at higher work intensities.

**1253** Board #15 May 30 9:30 AM - 11:00 AM  
**Tissue Oxygen Index Response During Maximal On-ice And Cycling Performances With Short Track Speed Skaters**

Fanie St-Jean Miron<sup>1</sup>, Emily Walsh<sup>2</sup>, Bianca Marois<sup>1</sup>, Gilles Gouspillou<sup>1</sup>, Alain Steve Coimtois<sup>1</sup>. <sup>1</sup>University of Quebec in Montreal, Montreal, QC, Canada. <sup>2</sup>Loyola University Chicago Stritch School of Medicine, Chicago, IL.

(No relevant relationships reported)

Cycling tests are usually performed to assess short track speed skater's performances. However, the cycling movement patterns and body position are quite different from the skating movement patterns and the low position that skaters adopt during speed skating on the short track. Thus, a comparison of muscle oxygenation between cycling and skating was conducted, as the low skating position may restrict blood flow to the lower limbs.

**PURPOSE:** The aim of this project was to create an on-ice test to compare skaters'  $\dot{V}O_{2\text{max}}$  and tissue oxygen index (TOI%), while performing maximal progressive tests during on-ice skating and on a cycle ergometer.

**METHODS:** Twenty-four Canadian short track speed skaters of the provincial level or higher participated in the study. Skaters took part in two separate progressive maximal tests on ice and on a cycle ergometer. Oxygen consumption ( $\dot{V}O_2$ ) was continuously monitored during both tests with a portable metabolic analyzer. Tissue oxygen index (TOI%) was also continuously measured on the vastus lateralis of both legs during both tests and during the post exercise recovery phase. A modified Borg scale was used to assess the rate of perceived cardiovascular effort (RPE), as well as leg pain.

**RESULTS:**  $\dot{V}O_{2\text{max}}$  reached on-ice was significantly lower than  $\dot{V}O_{2\text{max}}$  reached on a cycle ergometer ( $3.56 \pm 0.65$  vs  $4.28 \pm 0.79 \text{ L}\cdot\text{min}^{-1}$ ,  $p=0.001$ , respectively). When expressed as a function of  $\dot{V}O_2$ , the TOI% was significantly lower during skating vs cycling for any tested  $\dot{V}O_2$ . The TOI% of the right leg (RL) was significantly lower than the left leg (LL) at any  $\dot{V}O_2$  for both skating and cycling. At maximal capacity ( $\dot{V}O_{2\text{max}}$ ), TOI% was similar for both skating and cycling (~10%). During the recovery phase, TOI% peaked at 80% after 180s of recovery after skating, while it took 120s after cycling. The RPE of cardiovascular effort was significantly lower at the end of the on-ice test vs ergometer cycling test ( $15.9 \pm 2.1$  vs  $17.0 \pm 2.1$ ,  $p=0.005$ ). However, no differences were detected for leg pain ( $18.5 \pm 1.1$  vs  $18.4 \pm 1.5$ ,  $p=0.671$ , respectively).

**CONCLUSIONS:** The low position adopted by speed skaters appears to restrict blood flow to the lower limbs and thereby negatively impacts muscle oxygenation. These findings reveal the importance of testing short track speed skaters directly on the ice.

**1254** Board #16 May 30 9:30 AM - 11:00 AM  
**Minimal Effects of Hypoxia on Energy System Contribution during Supramaximal Upper-Body Exercise in Women**

Tristan Starling-Smith<sup>1</sup>, David Boffey<sup>1</sup>, Michael La Monica<sup>2</sup>, Jeffrey Stout<sup>1</sup>, David Fukuda<sup>1</sup>. <sup>1</sup>University of Central Florida, Orlando, FL. <sup>2</sup>Missouri State University, Springfield, MO.

(No relevant relationships reported)

High-intensity exercise performed under hypoxic conditions may yield beneficial physiological adaptations due to altered reliance on the anaerobic energy system. This type of intervention is commonly evaluated during lower body cycling; however, considerable differences exist in the upper body musculature, particularly in women.

**PURPOSE:** To determine the effects of normobaric hypoxia on energy system contribution in females during high-intensity upper-body time to exhaustion trials. **METHODS:** Thirteen recreationally active women (age:  $22.7 \pm 2.6$  y; height:  $167 \pm 8.6$  cm; weight:  $66.4 \pm 9.7$  kg; body fat:  $27.6 \pm 5\%$  body fat) completed a graded exercise test in both normobaric hypoxia (H;  $F_{iO_2} \sim 14\%$ ) and normoxia (N;  $F_{iO_2} \sim 20\%$ ) to exhaustion on an arm ergometer to determine the relationship between  $O_2$  uptake and peak power output (PPO). Each participant completed two constant work-rate arm-cranking tests at 110 and 120% PPO in both N and H. Utilizing oxygen consumed during the constant work-rate tests, energy system contribution was determined using the accumulated oxygen deficit method. Two-way (condition  $\times$  intensity) repeated measures ANOVA was used to compare absolute AOD ( $\text{L}\cdot\text{min}^{-1}$ ) and AOD relative to lean arm mass ( $\text{L}\cdot\text{min}^{-1}\cdot\text{kg}^{-1}$ ). Three-way (condition  $\times$  intensity  $\times$  energy system) repeated measures ANOVA was used to compare the percent contributions of the aerobic and anaerobic energy systems. Results are reported as

95% confidence intervals (CI). **RESULTS:** No significant condition  $\times$  intensity interactions were noted for relative or absolute AOD ( $p>0.05$ ). A main effect was observed for energy system ( $p<0.05$ ) with aerobic values (95% confidence interval: 59.8% to 71.3%) being greater than anaerobic values (95% CI: 28.7% to 40.2%), while an intensity  $\times$  energy system interaction was shown ( $p<0.05$ ) with greater anaerobic contribution at 120% PPO (95% CI: 32.6% to 44.3%) compared to 110% PPO (95% CI: 22.9% to 27.9%). **CONCLUSIONS:** Moderate normobaric hypoxia had little effect, if any, on energy system contribution during high-intensity, constant work-rate arm-cranking in women. These findings suggest that limitations may exist for women when considering hypoxia as a means of altering metabolic stress during supramaximal upper body exercise.

**1255** Board #17 May 30 9:30 AM - 11:00 AM  
**Dual Stress Warm-Up Protocol Does Not Significantly Alter Blood Glucose Concentration**

Margaret M. Glick<sup>1</sup>, Matthew P. Sacco<sup>1</sup>, Eric C. Bredahl<sup>1</sup>, Michael T. Lane<sup>2</sup>, Jacob A. Siedlik<sup>1</sup>. <sup>1</sup>Creighton University, Omaha, NE. <sup>2</sup>Eastern Kentucky University, Richmond, KY. (Sponsor: Joan Eckerson, FACSM)

(No relevant relationships reported)

Dual stress challenges (e.g. paired physical and psychological challenges) have been shown to increase catecholamine and cortisol responses above that of exercise alone; however, the underlying mechanisms to explain this effect are not well defined. The increased hormonal response is thought to be the result of a greater glucose demand due to the challenges imposed on both the brain and skeletal muscle. **PURPOSE:** To determine whether a dual stress warm-up protocol significantly alters circulating glucose concentrations before and after a Wingate Anaerobic Test (WAnT).

**METHODS:** Thirteen college-aged subjects (Mean  $\pm$  SD; age =  $21 \pm 3$  yr; Height =  $177 \pm 9$  cm; Weight =  $81.8 \pm 11.8$  kg) volunteered to participate and completed a familiarization WAnT on a Monark cycle ergometer using a resistance of 7.5% bodyweight prior to testing. On two separate visits, separated by at least 3 d but no more than 1 wk, subjects randomly completed a WAnT preceded by either a 5 min warm-up at a resistance of 1.5% BW at a pedal rate of 70-80 rpm (CTRL) or the same warm-up while also completing the Paced Auditory Serial Test, which is a mental arithmetic challenge (EXPT). Blood glucose was measured at 5 time points (pre, post warm up, post WAnT, and at 5 min and 10 min post WAnT) using a Contour NEXT Blood Glucose Monitor. Subjects abstained from caffeine, alcohol, and exercise for the 24 hr prior to testing. Diet was standardized across subjects for the 12 hr prior to each visit. Data were analyzed using a 2x5 repeated measures ANOVA ( $\alpha < 0.05$ ).

**RESULTS:** There were no significant interactions between the two conditions. However, there was a main effect for time ( $p = .001$ ) with glucose concentrations significantly increased at 5 min post WAnT. **CONCLUSION:** These findings suggest that incorporating a psychological challenge during a warm-up session had no effect on glucose concentrations following a WAnT when compared to warm-up session alone. The lack of a significant finding may be due to the relatively small sample size or by the lack of difficulty of the mental challenge. Future studies are warranted using higher-stress cognitive tests to gain a better understanding of the effect of dual stress challenges on glucose concentrations prior to and following exercise.

**1256** Board #18 May 30 9:30 AM - 11:00 AM  
**Exercise Intensity, Energy Expenditure And Enjoyment During Variable High Intensity Exercise In Healthy Adults.**

Jenna Thompson, Matthew Wolfe, Meral Culver, Kelly E. Johnson, Justin P. Guilkey. Coastal Carolina University, Conway, SC.

Email: jthomp4@coastal.edu

(No relevant relationships reported)

Variable high-intensity exercise bouts may generate similar energy expenditures and possibly be favored over moderate-intensity exercise as an alternative to obtain optimal health benefits. **PURPOSE:** To examine exercise intensity, energy expenditure and perceptual responses to work-matched moderate-intensity steady-state exercise (MIE) and variable-intensity exercise (VIE) conditions in healthy adults ( $n = 6$ , age =  $24.3 \pm 5.4$  yrs). **METHODS:** A graded exercise test on the cycle ergometer to maximal exertion was utilized to determine maximal oxygen uptake ( $\dot{V}O_2$ ), maximal heart rate (HR) and work rate max (WRmax) for subsequent conditions. The two experimental conditions (MIE and VIE) were randomized and performed on separate days. MIE consisted of continuous moderate-intensity exercise at 40% of WRmax. VIE consisted of sixteen 10-sec supramaximal sprints (120% WRmax), sixteen 20-sec high intensity bouts (60% WRmax) and low-intensity recovery (20% WRmax) interspersed throughout the exercise. Total duration and total work were matched between conditions.  $\dot{V}O_2$ , heart rate (HR) were averaged over the entire bout for both conditions. OMNI ratings of perceived exertion (RPE) and affect, via Feelings Scale, were measured during exercise and enjoyment was measured post-exercise using the physical activity enjoyment scale. Responses between conditions were analyzed

using paired t-tests. Significance was established if  $p < 0.05$ . **RESULTS:** During VIE and MIE, HR ( $156 \pm 10$  bpm vs.  $141 \pm 12$  bpm) and percent of maximal HR ( $81.6 \pm 3.2\%$  vs.  $73.3 \pm 4.1\%$ ) were significantly different. Absolute  $\dot{V}O_2$  during VIE and MIE were  $1.42 \pm 0.22$  L $\cdot$ min $^{-1}$  and  $1.27 \pm 0.24$  L $\cdot$ min $^{-1}$  ( $p = 0.13$ ). The intensities relative to  $\dot{V}O_{2max}$  were similar between bouts (VIE =  $50.9 \pm 10.3\%$ ; MIE =  $44.9 \pm 8.0\%$ ). Total energy expenditure of VIE and MIE were  $212.5 \pm 32.3$  kcal and  $189.4 \pm 36.3$  kcal, respectively ( $p = 0.12$ ). While perceived exertion (VIE =  $4.6 \pm 0.9$ ; MIE =  $3.6 \pm 1.3$ ) was similar between trials, in-exercise affect and post-exercise enjoyment were greater in VIE ( $2.0 \pm 0.9$  and  $92.2 \pm 3.3$ ) compared to MIE ( $1.7 \pm 1.0$  and  $77.2 \pm 5.8$ ). **CONCLUSION:** In healthy adults, VIE was perceived as more positive and enjoyable, while eliciting a greater HR response and similar energy expenditure compared to MIE. VIE may be an alternative exercise to MIE to obtain health benefits.

**1257** Board #19 May 30 9:30 AM - 11:00 AM

### Muscle Energy and Salivary Cytokine Response During a 100 Mile Trail Run: A Case Study

Taran Bailey<sup>1</sup>, Ellis Jensen<sup>2</sup>, Steven Namanny<sup>2</sup>, Andrew Creer<sup>2</sup>.  
<sup>1</sup>allen parcell, Provo, UT. <sup>2</sup>Utah Valley University, Orem, UT.  
(Sponsor: allen parcell, FACSM)  
(No relevant relationships reported)

**Purpose:** The purpose of this study was to determine the impact of competing in a 100-mile ultramarathon on muscle fuel stores and cytokine production. **Methods:** One experienced male runner (40 yrs, 76.3 kg, 177.8 cm) completed the 100.5-mile distance in 32.9 hrs. Measurements were collected pre-race, at each support crew accessible aid station (28.5, 41, 52, 66, and 80 miles), and post-race. Measures included saliva cytokine markers (IL-6 and TNF- $\alpha$ ), muscle energy status, and body mass. Saliva was collected using a passive drool technique and samples were stored on dry ice until they could be sent out for analysis. Muscle energy status (MES) was determined by scanning the right rectus femoris with a portable ultrasound transducer. Scanned muscle images were uploaded to a cloud-based application where they were analyzed for MES, which is an arbitrary number assigned to the muscle based on predicted glycogen concentration. Caloric expenditure was predicted based off average pace and terrain. Caloric intake was monitored by a combination of self-reporting, product wrapper collection, and unconsumed fluid measurement. **Results:** Caloric expenditure was estimated at 13,184 kcal (401 kcal/hr), while caloric intake was recorded at 5888.3 kcal (180 kcal/hr). Body mass declined 2.4% from pre to post-race, although it fluctuated throughout the race (76.3, 74.7, 74.1, 75.1, 75.9, 75.4, 74.5 kg; respectively). MES was reduced 57% from pre to post-race, but also fluctuated throughout the race (88.0, 34.4, 71.9, 25.1, 69.1, 70.9, 38.2). IL-6 levels correlated with MES values ( $R^2 = 0.6987$ ). TNF- $\alpha$  values followed a similar pattern to IL-6; however, no correlation was found between TNF- $\alpha$  and MES. **Conclusion:** These data provide some interesting insights into potential MES plasticity and cytokine regulation during prolonged exercise. More specifically, fluctuating MES values observed during the current activity suggest that glycogenolysis and glycogenesis may occur throughout an ultra-event depending on terrain and intensity, even with a discrepancy between caloric intake and expenditure. Additionally, salivary IL-6 activity may be related to MES, suggesting that periods of low glycogen may increase physiological stress.

**1258** Board #20 May 30 9:30 AM - 11:00 AM

### Tissue Oxygen Recovery Time in Back and Front Squats

Patrick R. Davis, John P. Yakel, Matthew C. Wagner, Allison P. Glave. Sam Houston State University, Huntsville, TX.  
Email: davis@shsu.edu  
(No relevant relationships reported)

Near infrared spectroscopy (NIRS) can be used to measure skeletal muscle tissue oxygen ( $SmO_2$ ) levels, which may be a useful indicator of recovery and fatigue during resistance training.

**Purpose:** The purpose of this study was to determine the  $SmO_2$  recovery rate in both the Vastus Lateralis (VL) and Biceps Femoris (BF) muscles in traditional back squats and front squats.

**Methods:** Eleven recreationally resistance trained participants completed the study. The 1-repetition maximum (1-RM) was determined for the front and back squats on two different occasions. In subsequent visits a wireless NIRS device was applied over the VL and BF on each leg. Participants completed 3 sets of 15 repetitions with 2-3 minutes of recovery using 70% of their 1-RM weight. During recovery, participants sat on a bench next to the squat rack. To complete the study, participants would repeat the above procedures for the other squat form (front or back) with at least 48 hours in-between visits. Repeated measures ANOVA was used to determine differences in the recovery rate.

**Results:** The recovery rate of  $SmO_2$  (% $SmO_2/0.5$  sec) was calculated as the slope of  $SmO_2$  over time between 10-50 seconds of during each recovery period. The mean recovery rate during the third set recovery for VL in back squats was  $0.885 \pm 0.194$  % $SmO_2/0.5$  sec and  $0.785 \pm 0.129$  % $SmO_2/0.5$  sec in front squats. Mean recovery rate for third set recovery for BF in back squats was  $0.449 \pm 0.083$  % $SmO_2/0.5$  sec

and  $0.290 \pm 0.059$  % $SmO_2/0.5$  sec in front squats. There were significant differences in the  $SmO_2$  recovery rates between the BF and VL in both legs ( $p < 0.05$ ). There were no significant differences between the recovery rates in back vs front squats. Similar differences were found in the first and second set recovery periods.

**Conclusion:** During front and back squats the initial rate of recovery of  $SmO_2$  is more rapid in the VL than in the BF. Additionally, there are no differences in  $SmO_2$  recovery rate between front and back squats.

## C-30 Free Communication/Poster - Cardiac

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

**1259** Board #21 May 30 9:30 AM - 11:00 AM

### Mycardial Strain Imaging in Asian Competitive Athletes - A Single Centre

Yann Shan Keh. Singhealth Cardiology, Singapore, Singapore.  
Email: yannshan.keh@mohh.com.sg  
(No relevant relationships reported)

#### ABSTRACT INTRODUCTION

To date there has been limited literature pertaining to Athlete's Heart Syndrome in Asian athletes, especially for those in South East Asia.

#### METHODS

We performed a single center cross-sectional case-control study of elite athletes and controls, using current speckle-tracking echocardiography (STE) and tissue Doppler imaging (TDI)-based techniques. We reanalyzed previous data to further characterize the biomechanical changes in exercise induced cardiac remodeling elite athletes and controls at a tertiary hospital in Singapore.

#### RESULTS

The Left Ventricular (LV) strain of the athletes' group was significantly lower as compared to the control group ( $-19.0 \pm 2.0$  vs  $-20.3 \pm 1.8$ ,  $p = 0.011$ ). Furthermore, both LV torsion ( $14.3 \pm 17.8$  %/s vs  $14.4 \pm 6.7$  %/s,  $p = 0.031$ ) and Lateral S' ( $7.21 \pm 1.4$  vs  $8.7 \pm 1.6$ ,  $p = 0.001$ ) showed small but statistically significant decreases in the athletes' group versus the controls. The athletes group demonstrated a significantly lower Basal Right Ventricular (RV) free wall strain as compared to the controls ( $-19.8 \pm 5.5$  vs  $-26.5 \pm 6.4$  P < 0.001). The mid RV strain was marginally higher in the athletes' group versus the controls ( $-25.0 \pm 4.3$  vs  $-24.7 \pm 15.3$  P = 0.023).

#### CONCLUSIONS

Our findings of impaired LV strain and torsion as well basal RV free walls strain in the South East Asian athletes group mirror studies done in Western cohorts. The higher mid RV free wall strain could represent compensatory response to the impaired basal RV function in athletes.

**1260** Board #22 May 30 9:30 AM - 11:00 AM

### Factors Affecting Aortic Root Diameter in a Population of Former Professional Football Players

Genevieve E. Smith, Mark M. Cassidy, Gregory W. Stewart, FACSM. Tulane University, New Orleans, LA. (Sponsor: Gregory Stewart, MD, FACSM)  
Email: glum@tulane.edu  
(No relevant relationships reported)

**Purpose:** Examine potential factors affecting aortic root size and dilation prevalence in former professional football players. Additionally, two methods of aortic root dilation (ARD) assessment were compared. **Methods:** For this cross-sectional study, former professional football players ( $n = 1325$ ) were sampled for demographics, anthropometry, blood pressure, and 2D echocardiographic measurement of aortic root diameter (AoD) at the Sinus of Valsalva. Body surface area (BSA) was used to obtain indexed aortic root diameter (IAR). ARD was assessed by two methods: using previously described nomograms for IAR prediction (pIAR) and by  $IAR > 1.9$  cm $^2$  (Asi), according to normal IAR range. Subjects were stratified by age and position groups for comparison. Statistical analysis included ANOVA, T-test, and Chi-square where appropriate. **Results:** The prevalence of ARD was  $15.2\% \pm 2.4$  and  $2.4\% \pm 1.0$  according to pIAR and Asi methods, respectively ( $p < 0.0001$ ). Both age and position group (PG) had a significant effect on AoD ( $p < 0.0001$  and  $p = 0.0018$ , respectively) and IAR ( $p < 0.0001$  and  $p = 0.0005$ , respectively). However, when age was considered a covariate for PG, only IAR tended to remain significant ( $p = 0.0560$ ). Both AoD and IAR increased with age; While ARD prevalence increased with each 20-year increase in age according to both prediction methods (pIAR:  $p < 0.0001$ ; Asi:  $p = 0.0025$ ), there was no effect of PG (pIAR:  $p = 0.2879$ ; Asi:  $p = 0.4856$ ). While IAR was greater in hypertensive versus normotensive subjects ( $p = 0.0076$ ), AoD did not differ between the two ( $p = 0.6616$ ), and ARD prevalence was higher in hypertensive subjects only via the Asi method ( $p = 0.0202$ ). Finally, the presence of left ventricle

hypertrophy (LVH) contributed to ARD prevalence when pIAR was used ( $p < 0.0001$ ), but not when the ASi method was considered ( $p = 0.1047$ ), with larger AoD in subjects with LVH versus those with normal geometry ( $p = 0.0090$ ), while IAR did not differ between the two ( $p = 0.1106$ ). **Conclusions:** Body size, age, playing position, and LVH were all found to impact both aortic root size and ARD. Thus, methods of ARD assessment in these men should ideally account for both body size and age. Therefore, pIAR may be best for assessment of ARD in this population.

Study funded and supported by the NFL's Player Care Foundation.

**1261** Board #23 May 30 9:30 AM - 11:00 AM  
**Effects of Aerobic and Resistance Training on Diabetic Heart Function: Roles of Titin and Collagen**

Shunchang Li<sup>1</sup>, Min Liang<sup>1</sup>, Derun Gao<sup>1</sup>, Quansheng Su<sup>1</sup>, Ismail Laher<sup>2</sup>. <sup>1</sup>Chengdu Sport Institute, Chengdu, China. <sup>2</sup>University of British Columbia, Vancouver, BC, Canada. (Sponsor: Tongjian You, FACSM)

Email: lishunchang\_1983@163.com

(No relevant relationships reported)

**PURPOSE:** To examine the effects of aerobic and resistance exercise training on cardiac function, and investigate the roles of cardiomyocyte passive tension regulators (titin and collagen) in the mechanism of exercise-induced changes in cardiac function in diabetic rats.

**METHODS:** Sixty male SD rats were randomly divided into six groups: control (C), aerobic exercise (A), resistance exercise (R), diabetic (D), diabetic plus aerobic exercise (DA), and diabetic plus resistance exercise (DR). Type II diabetes was induced by high-fat diet feeding and low-dose streptozocin injection. Rats in the A and DA groups ran on a treadmill at 21m/min for 60 min, and rats in R and DR groups climbed a ladder bearing incremental loads daily, 5 days per week for 8 weeks. Fasting blood glucose (FBG) and insulin (FINS) concentrations were determined by a standard procedure. Cardiac function (such as the specific indicators of cardiac diastolic dysfunction-- Min dp/dt, Tau) was measured using a catheter insertion through the right carotid artery and a Labchart data acquisition and analysis system. Expression levels of collagen I, collagen III and TGF $\beta$ 1 were determined using Western blot, and titin expression levels were analyzed using Immunofluorescence. Two-way ANOVA and post-hoc tests were used to assess differences between groups.

**RESULTS:** Compared to non-diabetic groups, diabetic groups had higher FBG ( $P < 0.01$ ), lower Min dp/dt ( $P < 0.05$ ), and longer Tau ( $P < 0.05$ ); in addition, the diabetic groups had significantly lower expression levels of titin ( $P < 0.05$ ), and higher expression levels of collagen I and TGF $\beta$ 1 ( $P < 0.05$ ). Compared to non-exercise diabetic rats, diabetic plus exercise groups had lower FBG ( $P < 0.01$ ), -54.3% in DA and -66.0% in DR) and HOMA-IR ( $P < 0.01$ , -46.6% in DA and -53.8% in DR); the DA rats had higher expression levels of titin ( $P < 0.05$ ) and Min dp/dt ( $P < 0.05$ ), lower expression levels of collagen I ( $P < 0.05$ ) and TGF- $\beta$ 1 ( $P < 0.05$ ), and shorter Tau ( $P < 0.05$ ), but the DR rats had higher expression levels of collagen I ( $P < 0.05$ ) and TGF $\beta$ 1 ( $P < 0.01$ ).

**CONCLUSION:** Greater improvements in diabetic cardiac function occurred with aerobic exercise training, possibly through decreasing titin-dependent myocardial stiffness and collagen-dependent interstitial fibrosis.

**1262** Board #24 May 30 9:30 AM - 11:00 AM  
**Cardiovascular Drift Response Over Two Different Constant-load Exercises In Healthy Non-athletes. Case Study.**

Camilo Germán Alberto Pérez Chaparro, Frank Mayer, Claudia Beckendorf. University of Potsdam, Potsdam, Germany.

Email: perezcha@uni-potsdam.de

(No relevant relationships reported)

Cardiovascular drift (CV-d) is a steady increase in heart rate (HR) over time while performing constant load moderate intensity exercise (CME)  $> 20$  min. CV-d presents problems for the prescription of exercise intensity by means of HR, because the work rate (WR) during exercise must be adjusted to maintain target HR, thus disturbing the intended effect of the exercise intervention. It has been shown that the increase in HR during CME is due to changes in WR and not to CV-d.

**Purpose**

We aimed to investigate whether, indeed, the CV-d in healthy young people exercising at the WR corresponding to the lactate individual anaerobic threshold (IAT) determined in two different cardiorespiratory exercise test (CPT), was related to the WR difference.

**Methods**

Seven participants ( $30 \pm 3$  years old,  $1.75 \pm 0.1$  m.,  $74.6 \pm 12.8$  Kg.) performed on different days two CPT with a WR increase of 20 Watts (W) every one or three minutes until exhaustion. The WR corresponding to the IAT was determined during these tests. The participants then performed two CME with a WR corresponding to the IAT. HR and blood lactate (La) were continuously measured during all tests. A comparison between CPTs and CMEs were made using a paired  $t$ -test. A one-way ANOVA repeated measurements was used to compare La values during the CME.

**Results**

$VO_{2max}$  ( $36.9 \pm 59$  vs.  $35.6 \pm 5.7$  ml·Kg<sup>-1</sup>·min<sup>-1</sup>;  $p > 0.05$ ), maximal HR ( $181 \pm 9$  vs.  $178 \pm 11$  bpm;  $p = 0.3$ ), and peak La ( $8.7 \pm 1.6$  vs.  $7.8 \pm 1.6$ ;  $p = 0.1$ ) did not differ between CPTs. Maximal power output ( $271 \pm 80$  vs.  $223 \pm 75$  W;  $p < 0.001$ ) and WR at the IAT ( $164 \pm 63$  vs.  $137 \pm 45$  W;  $p > 0.01$ ) were different between CPTs. La between CMEs and minutes 10 and 30 were not different ( $3 \pm 0.4$  vs.  $3.3 \pm 0.5$ ;  $p = 0.1$ ). One-CME mean HR was  $157 \pm 12$  bpm with an increase of  $8 \pm 4$  bpm between minutes 10-30. Three-CME HR was  $147 \pm 14$  bpm and the HR increased by  $9 \pm 7$  bpm between minute 10-30. Only a difference in HR between the two CME was found ( $p = 0.009$ ) whereas there was no difference in the HR change between minute 10-30 ( $p = 0.7$ ).

**Conclusion**

In this case study, the CV-d was not significantly different between the two CMEs (One-IAT and Three-IAT) despite a significant difference in the amount of WR between CMEs ( $26 \pm 19$ ). Other factors aside from the WR like an increase in peripheral blood flow, hyperthermia, plasma volume reduction, catecholamine levels, and training status play a role in the CV-d phenomenon.

**1263** Board #25 May 30 9:30 AM - 11:00 AM  
**Evaluations Of Nonstationary And Stationary Autonomic Nervous Function Using Heart Rate Variability For Syncope Patientswith Non-cardiogenic Causes**

Noritaka Hata<sup>1</sup>, Kazukuni Hirabuki<sup>1</sup>, Tomoya Suda<sup>1</sup>, Yuki Sano<sup>1</sup>, Marina Fukuie<sup>2</sup>, Takahiro Uechi<sup>1</sup>, Ai Hirasawa<sup>1</sup>, Takeaki Matsuda<sup>1</sup>, Shigeki Shibata<sup>1</sup>. <sup>1</sup>Kyorin University, Tokyo, Japan. <sup>2</sup>University of Tsukuba, Ibaraki, Japan.

Email: hatanori1019@gmail.com

(No relevant relationships reported)

**Background:** One of the main causes of syncope is neuroregulatory syncope. Thus, it is very important to assess autonomic nervous function for syncope patients. Heart rate variability (HRV) was widely used for indirect evaluation of cardiac autonomic function. HRV was usually assessed with RR intervals changes of resting condition. Recently, however, HRV analysis using 24 hours Holter electrocardiogram became available to evaluate cardiac autonomic function during activity. **Purpose:** The aim of this study was to evaluate cardiac autonomic function of non-cardiogenic syncope patients using HRV analysis. **Method:** Seventy-six patients with non-cardiogenic causes of syncope were enrolled. They were divided into initial group ( $n=31$ ,  $68 \pm 15$  years old, 19 males, 12 females) and recurrence group ( $n=45$ ,  $57 \pm 24$  years old, 24 males, 21 females). RR intervals were measured with electrocardiogram at rest (stationary) and with 24 hours Holter electrocardiogram during activity (nonstationary). The three HRV frequency-domains (low frequency power: LF, high frequency power: HF, LF/HF ratio) were calculated. **Results:** At the nonstationary state, HF was significantly higher in the recurrence group than in the initial group. (HF:  $160 \pm 19$  ms<sup>2</sup> vs.  $410 \pm 69$  ms<sup>2</sup>,  $P=0.01$ , ANCOVA; age and sex). There were no significant differences in LF and LF/HF ratio between the two groups at the nonstationary state. At the stationary state, there were no differences in LF, HF and LF/HF ratio between the two groups. There were significant relationships in LF and HF between the stationary and nonstationary states (LF:  $r=0.78$ , HF:  $r=0.83$ ,  $P < 0.01$ ), while LF/HF ratio did not show significant relationship. **Conclusion:** Our results indicated that the recurrent non-cardiogenic syncope patients had increased parasympathetic nerve activity at the nonstationary state. The evaluation of HRV at the nonstationary state may be more important for syncope patients than that at the stationary state, although HRV showed significant relationships between the stationary and nonstationary states.

**1264** Board #26 May 30 9:30 AM - 11:00 AM  
**The Effects of Low Intensity Resistance Exercise Training on Cardiac Autonomic Function in Obese Postmenopausal Women**

Alexei Wong<sup>1</sup>, Arturo Figueroa, FACSM<sup>2</sup>. <sup>1</sup>Marymount University, Falls Church, VA. <sup>2</sup>Texas Tech University, Lubbock, TX. (Sponsor: Arturo Figueroa, FACSM)

Email: awong@marymount.edu

(No relevant relationships reported)

Menopause and obesity are associated with a deterioration of cardiac autonomic dysfunction (CAF) and are independent risk factors for cardiovascular disease (CVD). Heart rate variability (HRV) is a non-invasive tool for the evaluation of CAF. HRV is adversely influenced by menopause and obesity in women. Resistance exercise has emerged as an important strategy for the prevention and treatment of CVD. Low intensity resistance exercise training (LIRET) appears to be a useful modality for promoting improvements in muscular mass and strength, while being relatively safe for populations with increased cardiovascular risk. However, the possibility of improving CAF in obese postmenopausal women is currently unknown. **PURPOSE:** The purpose of this study was to examine the effects of LIRET on HRV and strength

in obese postmenopausal women. **METHODS:** Twenty obese postmenopausal women [age ( $54 \pm 1$  years) and body mass index ( $34.4 \pm 0.8$  kg/m<sup>2</sup>)] were randomized to either (n= 10) or no-exercise control group (n= 10) for 12 weeks. LIRET consisted on 4 different exercises for the leg musculature per session 3 x week. Participants performed 2-3 sets involving 18-22 repetitions for each exercise per session. 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 leg strength were measured before and after 12 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, and ( $P < 0.01$ ) for leg strength. There were significant decreases ( $P < 0.01$ ) in nLF ( $-6 \pm 1\%$ ) and LnLF/LnHF ( $-0.7 \pm 0.1$ ) as well as significant increases ( $P < 0.01$ ) in nHF ( $5 \pm 1\%$ ) and leg strength ( $27 \pm 2$  kg) following LIRET compared with no changes after control. No significant changes were observed in LnTP or HR after 8 weeks for both groups. **CONCLUSIONS:** Our findings indicate that LIRET improves CAF by improving sympathovagal balance in obese postmenopausal women.

**1265** Board #27 May 30 9:30 AM - 11:00 AM  
**Atg7 Involves In Cardioprotection Induced By Exercise Preconditioning Against Exhaustive Exercise-induced Myocardial Injury**

Dongfeng Wan, Shanshan Pan. *Shanghai University of Sport, Shanghai, China.*

Email: derfulwon@126.com

(No relevant relationships reported)

The cardioprotective effects induced by exercise preconditioning (EP) in early phase has been proved, while the mechanism involved in cardioprotection is a multifactorial process. Several studies have identified that autophagy is one of the mechanisms of cardioprotection induced by EP. As a rate-limiting enzyme, Atg7 plays a pivotal role in autophagy.

**Purpose:** The aim of this research was to investigate the alteration of Atg7 during the early cardioprotective effects of EP against exhaustive exercise-induced myocardial injury.

**Methods:** Male 8-week-old Sprague-Dawley rats were divided into four experimental groups randomly: Group C (control), Group EE(exhaustive exercise), Group EEP (early exercise preconditioning) was subjected to an intervallic exercise of four periods of 10 min running at 30 m/min with 10 min intervallic rest, Group EEP+EE (early exercise preconditioning plus exhaustive exercise) was used to explore cardioprotection of EEP against exhaustive exercise-induced myocardial injury. Atg7 was detected by immunofluorescence and western-blot.

**Results:** In group C, Atg7 positive expression stained red and scattered in myocardial cytoplasm, and the nucleus was bright blue. Compared with group C, the positive reaction of Atg7 increased strongly in group EE and group LEP. The high Atg7 levels observed after exhaustive exercise were significantly ( $0.46 \pm 0.14$  vs.  $0.73 \pm 0.40$ ,  $p < 0.05$ ). The levels of Atg7 were increased significantly after early phase of EP ( $0.46 \pm 0.14$  vs.  $0.74 \pm 0.30$ ,  $p < 0.05$ ). Although there were no significant differences of Atg7 levels between group EE and group EEP+EE ( $p > 0.05$ ), they had a downward trend in group EEP+EE.

**CONCLUSION:** The increased levels of Atg7 induced by autophagy might involve in the early cardioprotection of EP against exhaustive exercise-induced myocardial injury. Supported by the National Natural Science Foundation of China (Grant No. 31471136)

**1266** Board #28 May 30 9:30 AM - 11:00 AM  
**Reliability Of A Vagal Modulation Index In Different Conditions**

Daniel A. Boulos<sup>1</sup>, André R. Medeiros<sup>1</sup>, Scott Michael<sup>2</sup>, Anthony S. Leicht<sup>3</sup>. <sup>1</sup>Universidade Católica de Brasília, Brasília, Brazil. <sup>2</sup>University of Wollongong, Wollongong, Australia. <sup>3</sup>James Cook University, Townsville, Australia.

(Sponsor: Carl Foster, FACSM)

Email: d\_boulos@yahoo.es

(No relevant relationships reported)

Previous studies conducted with athletes have suggested a minimum of 3 days are required for identifying training induced adaptations in supine, morning, resting heart rate variability (HRV). However, there are no studies evaluating the minimum days required for appropriate reliability of HRV measures in non-athletes, and during different conditions of evaluation. **PURPOSE:** 1) To evaluate the reliability of a prominent HRV measure, the root mean square of the successive differences of R-R intervals (RMSSD), during different conditions in non-athletes; 2) to identify the minimum number of days required for weekly (5-day) evaluations of RMSSD. **METHODS:** Thirty-four young, physically active individuals ( $22.2 \pm 3.6$  years) completed daily 4-min R-R recordings during supine, seated, standing and walking (5 km/h) conditions over 5 days. Relative (intraclass correlation coefficients, ICC) and absolute (technical error of measurement, TEM; coefficient of variation, %CV)

reliability, and bias were calculated for 1, 2, 3, and 4 days, and compared with weekly (5 days) assessments. **RESULTS:** Excellent reliability was identified for all conditions over 4 days ( $ICC \geq 0.986$ ,  $CV \leq 2.8\%$ ) that was diminished when examined over 3 ( $ICC \geq 0.970$ ,  $CV \leq 3.4\%$ ), 2 ( $ICC \geq 0.932$ ,  $CV \leq 5.7\%$ ) and 1 ( $ICC \geq 0.804$ ,  $CV \leq 10.2\%$ ) day. When compared with weekly recordings, 2 day recordings demonstrated excellent and similar reliability values for all conditions examined, with better values observed for supine vs. seated vs. standing vs. walking conditions. **CONCLUSIONS:** From the current results, daily assessment of RMSSD is highly reliable with a minimum of 2 days of recordings recommended for determination of weekly HRV in non-athletes, regardless of the condition.

**1267** Board #29 May 30 9:30 AM - 11:00 AM  
**Effects of Wheel Running on Health-Related Outcomes in Growth Restricted Mice.**

Eric C. Leszczynski, Logan A. Pendergrast, David P. Ferguson. *Michigan State University, East Lansing, MI.*

(No relevant relationships reported)

Growth restriction caused by early life undernutrition leads to an increased risk of cardiovascular disease, hypertension, type II diabetes and sarcopenia. However, limited information exists on the beneficial effects of physical activity engagement in growth restricted individuals. **PURPOSE:** To determine the effects of wheel running access on health-related outcomes in growth restricted mice. **METHODS:** Mice were undernourished in gestation (GUN, N=15) or lactation (PUN, N=17) by feeding FVB mothers a low protein diet (8% protein). The control group (CON, N=14) was fed a normal protein diet (20% protein) throughout gestation and lactation. At postnatal day 21 (PN21), all pups were weaned and re-fed with the control diet. At PN45, mice were singly housed and either given access to a free moving running wheel (VOL-wheel access) or used as a non-active control (SED-sedentary). At PN70 a maximal treadmill test was performed to determine exercise capacity, and at PN72 echocardiography was performed to evaluate cardiovascular function. **RESULTS:** Final body weight showed SED PUN (M:  $21.22 \pm 2.07$  g, F:  $17.42 \pm 1.7$  g) weighed significantly ( $P = 0.0002$ ) less than SED CON (M:  $26.83 \pm 2.2$  g, F:  $20.65 \pm 1.65$  g) and SED GUN (M:  $26.9 \pm 1.5$  g, F:  $19.98 \pm 1.6$  g) mice, while the VOL CON mice (M:  $24.9 \pm 1.62$  g, F:  $23.0 \pm 1.42$  g) were significantly larger ( $P = 0.0441$ ) than VOL PUN mice (M:  $22.6 \pm 2.7$  g, F:  $20.0 \pm 2.26$  g). Wheel access improved treadmill running time to exhaustion in CON ( $P = 0.045$ , VOL: 1078±47s, SED: 936±40s), and GUN mice ( $P = 0.042$ ; VOL 1021±39s SED 890±44s), but not PUN mice ( $P = 0.59$ ; VOL 933±31s and SED 908±32s). Echoes showed heart rate was significantly lowered ( $P = 0.002$ ) in GUN mice (VOL:  $366 \pm 11$  bpm; SED:  $421 \pm 10$  bpm) with running wheel access. Stroke volume was also significantly higher ( $P = 0.02$ ) in GUN mice (VOL:  $27 \pm 1.2$  uL; SED:  $23 \pm 1.1$  uL). VOL CON ( $1.64 \pm 0.08$ mm) mice had a significantly greater ( $P = 0.05$ ) left ventricular anterior wall thickness at systole than SED CON ( $1.38 \pm 0.08$ mm). **CONCLUSION:** Voluntary wheel access does not attenuate growth-restriction in PUN mice nor does it improve maximal treadmill tests. This is due to a lack of improvements in cardiac function for PUN mice, despite access to voluntary wheel running, while GUN mice did improve.

**1268** Board #30 May 30 9:30 AM - 11:00 AM  
**Carnosine Essential For Cardiac Function. A Study With Knockout Rats For The Carnosine Synthase Gene**

Livia S. Goncalves, Lucas Sales, Alan Lins Fernandes, Tiemi Raquel Saito, José Natali, Leonardo Jensen, Alexandre Arnold, Isis Correa, Diogo Sant'Anna, Juliane Campos, Lislely Ramalho, Maria Cláudia Irigoyen, Júlio Ferreira, Guilherme Giannini Artioli. *University of Sao Paulo, São Paulo, Brazil.*

Email: liviasouzaigoncalves@gmail.com

(No relevant relationships reported)

Carnosine is present in high concentrations in heart, where it appears to increase the sensitivity of the contractile apparatus to Ca<sup>2+</sup>. However, it is currently unknown whether this role is relevant to the cardiac physiology. **Purpose:** To evaluate the impact of the lack of carnosine on myocardial contractile function in rats knockout (KO) for the CARN1 gene (carnosine synthase1). **Methods:** We developed the first KO animal model for the CARN1 gene through CRISPR-Cas9 technology. Male wild-type (WT) and KO rats (4 months-old) were used. *In vivo* cardiac function was assessed by echocardiography (ECO) and cardiac electrical activity by electrocardiography (ELECTRO). Cardiomyocyte contractile function was assessed in isolated cardiomyocytes by measuring cardiomyocyte and sarcomere contractility analysis, along with the determination of Ca<sup>2+</sup> transient. Unpaired t-tests were used to compare variables between WT and KO. The study was approved by the Ethics Committee on the Use of Animals of USP. **Results:** ECO (WT:n=4; KO:n=6) showed that KO rats presented a higher systolic diameter (WT:  $0.008 \pm 0.001$ mm/g; KO:  $0.011 \pm 0.001$ mm/g;  $p = 0.002$ ), lower Fraction of Left Ventricular Ejection (WT:  $80.26 \pm 6.86\%$ ; KO:  $69.86 \pm 4.67\%$ ;  $p = 0.01$ ) and lower Fraction of Left Ventricular Shortening (WT:  $51.12 \pm 7.39\%$ ; KO:  $40.88 \pm 3.92\%$ ;  $p = 0.01$ ), characterizing systolic dysfunction. ELECTRO (WT: n=8; KO: n=8) showed higher T wave amplitude in the KO group (WT:  $0.06 \pm 0.02$ mV; KO:  $0.13 \pm 0.03$ mV;  $p = 0.005$ ), indicating a disturbance

in the  $Ca^{2+}$  channels. *In vitro* contractility data (WT:  $n=3$ ; KO:  $n=3$ ) showed that sarcomere shortening is reduced in the KO (WT:  $11.75 \pm 4.20\%$ ; KO:  $9.28 \pm 3.71\%$ ) (WT:  $6.81 \pm 3.15s$ ; KO:  $4.33 \pm 1.87s$ ;  $p < 0.0001$ ), and the time to reach 50% of maximal shortening is longer in the KO (WT:  $0.04 \pm 0.01s$ ; KO:  $0.05 \pm 0.01s$ ;  $p < 0.0001$ ).  $Ca^{2+}$  transient analysis showed lower amplitude of  $Ca^{2+}$  in the KO group (WT:  $0.20 \pm 0.10$ ; KO:  $0.16 \pm 0.06$  F340/380 ratio;  $p = 0.001$ ) and longer time for to reach 50% of the  $Ca^{2+}$  decay rate (WT:  $0.21 \pm 0.04s$ ; KO:  $0.24 \pm 0.03s$ ;  $p = 0.001$ ). **Conclusion:** Absence of *carnosine* resulted in systolic dysfunction associated with  $Ca^{2+}$  transient changes in cardiac muscle. This is the first evidence to demonstrate *in vivo*, *ex vivo* and *in vitro* that *carnosine* is essential for normal cardiac function. Supported by FAPESP 2014/11948-8 and CAPES

**1269 Board #31 May 30 9:30 AM - 11:00 AM**  
**Left Ventricular Morphology and Function of Recurrent Syncope Patients**

Kazukuni Hirabuki. *Kyorin University, tokyo, Japan.*  
 Email: hirabuki0303@gmail.com  
 (No relevant relationships reported)

[Purpose]

It has been known that number of syncope episodes during life is the strongest predictor for future syncope recurrence. It has been reported that impaired left ventricular diastolic function (LVDF) and low cardiac output due to left ventricular (LV) atrophy are related with orthostatic intolerance. The aim of this study was to clarify whether the number of syncope episodes would be related to LV morphology and function.

[Methods]

We enrolled clinically non-cardiogenic syncope patients who presented at the emergency department of Kyorin University Hospital between 2015 and 2018. We divided them into 2 groups: F (1 episodes of syncope during life) and R (2 or more). Early diastolic filling velocity (E), atrial filling velocity (A), deceleration time (DT), peak early diastolic velocity of the mitral annulus ( $e'$ ), E/A, and  $E/e'$  were assessed by echocardiography. LV mass (LVM) was calculated by Devereux Formula, which was normalized by BSA (LVM index, LVMI). Stroke volume (SV) and ejection fraction (EF) were estimated by modified Simpson's method. ANCOVA statistics, adjusting for sex and age, was used to compare those parameters between the 2 groups.

[Results]

Of 80 patients enrolled, F group were 35 (68±17 years old, 19 men) and R group were 45 (56±23 years old, 23 men).  $E/e'$  was significantly lower in the F group than that in the R group ( $E/e'$ :  $8.72 \pm 0.44$  vs.  $10.00 \pm 0.39$ ,  $p = 0.037$ ). There were no significant difference between the two groups in E ( $67 \pm 3$  vs  $70 \pm 2$  m/s,  $p = 0.45$ ), A ( $73 \pm 3$  vs  $74 \pm 2$  m/s,  $p = 0.85$ ), E/A ( $1.05 \pm 0.05$  vs  $1.11 \pm 0.05$ ,  $p = 0.44$ ), DT ( $222 \pm 11$  vs  $227 \pm 9$  ms,  $p = 0.72$ ),  $e'$  septal ( $7.3 \pm 0.2$  vs  $6.8 \pm 0.2$  m/s,  $p = 0.18$ ),  $e'$  lateral ( $9.0 \pm 0.4$  vs  $9.1 \pm 0.3$  m/s,  $p = 0.87$ ), SV ( $48 \pm 2$  vs  $46 \pm 2$  ml,  $p = 0.36$ ), EF ( $65 \pm 1$  vs.  $63 \pm 1$  %,  $p = 0.66$ ), LVM ( $138 \pm 7$  vs.  $148 \pm 6$  g,  $p = 0.28$ ) and LVMI ( $86 \pm 4$  vs.  $91 \pm 3$  g/m<sup>2</sup>,  $p = 0.36$ ).

[Conclusions]

These results suggest that impaired LVDF is one possible pathophysiology for repeated non-cardiogenic causes of syncope, but LV morphology and systolic function are not.

**1270 Board #32 May 30 9:30 AM - 11:00 AM**  
**The Impact Of Acute Hyperglycemia On Heart Rate Variability In Men And Women.**

Jennifer S. Williams, Taylor Stimpson, Jacob T. Bonafiglia, Joshua C. Tremblay, Alyssa M. Fenuta, Brendon J. Gurd, Kyra E. Pyke. *Queen's University, Kingston, ON, Canada.*  
 Email: willij3@mcmaster.ca  
 (No relevant relationships reported)

**BACKGROUND:** Heart rate variability (HRV) is used to non-invasively assess autonomic nervous system (ANS) regulation of the heart. Chronic hyperglycemia has been known to reduce HRV; however, no research has examined the impact of acute hyperglycemia on HRV, considering the potential for sex- and menstrual cycle phase-based differences. **PURPOSE:** To examine the impact of acute hyperglycemia on HRV, in men and women during the early and late follicular phases of the menstrual cycle. **METHODS:** 41 healthy men and naturally menstruating women (17F, age: 21±1 years) were recruited. Women were assessed during the early and late follicular phases of the menstrual cycle. 'Ultra short-term' assessments of HRV (1-minute recordings) were completed using an electrocardiogram before, and 60- and 90-min after consuming a 75g oral glucose challenge. Analysis of HRV time-domain variables was performed. **RESULTS:** Acute hyperglycemia resulted in elevated HR (shorter R-R intervals) at 60- and 90-min post-glucose ingestion (Pre:  $61 \pm 1$ , Post60:  $65 \pm 1$ , Post90:  $66 \pm 1$  bpm;  $p = 0.005$ ,  $p < 0.001$  respectively), with no differences between men and women, or across phases of the menstrual cycle. The root mean square of successive differences between R-R intervals (RMSSD) and standard deviation in normal R-R intervals (SDNN) were significantly lower Post90 vs Pre ( $p = 0.022$ ,  $p = 0.048$  respectively), with no sex differences. Additionally, women, regardless of phase, had higher average HR compared to men ( $p < 0.001$ ). **CONCLUSION:** Acute

hyperglycemia appears to decrease HRV, indicative of an acute change in ANS regulation. Furthermore, this study confirmed previously observed sex differences in HR, but not in HRV. Research supported by: NSERC Discovery Grant & Canadian Graduate Scholarship - Master's

**1271 Board #33 May 30 9:30 AM - 11:00 AM**  
**Post exercise Heart Rate And Vagal Reactivation Correlates With Vagal Withdrawn After Orthostatic Maneuver In Men**

Guilherme Eckhardt Molina, Edgard Soares, Davi A. de Lima, Daniel Saint Martin, Giliard Lago Garcia, Carlos Janssen da Cruz, Luiz Guilherme Grossi Porto. *University of Brasilia, Brasilia, Brazil.*  
 Email: gmolina@unb.br  
 (No relevant relationships reported)

**PURPOSE:** The relationship between post-exercise parasympathetic reactivation, chronotropic reserve recovery (CRR) and the cardiac autonomic modulation responsiveness to active postural change at rest is still an open field to be explored. Therefore, our objective was correlate parasympathetic reactivation, CRR with cardiac autonomic status after an orthostatic maneuver (active stand from supine position) at rest.

**METHODS:** Cardiac Parasympathetic reactivation (rMSSD) at 1<sup>st</sup> min and CRR from the 1<sup>st</sup>, to 5<sup>th</sup> min following sub-maximal graded exercise were correlated with absolute and relative change of time-domain index (rMSSD) after active postural change from supine to standing position using heart rate variability (HRV) in 20 physically active, non-athlete men. Statistical analysis employed non-parametric tests with two-tailed p-value set at 5%.

**RESULTS:** Parasympathetic reactivation in the 1<sup>st</sup> min of post-exercise recovery correlated positively with absolute and relative vagal withdrawal (rMSSD) after orthostatic maneuver ( $r_s = 0.41$   $p = 0.02$  and  $r_r = 0.58$   $p = 0.01$ ). CRR at 1<sup>st</sup> min post-exercise time did not correlated with absolute or relative cardiac autonomic modulation responsiveness after active postural change at rest. However, CRR from the 2<sup>nd</sup> to the 5<sup>th</sup> min positively correlated with absolute and relative vagal withdrawal (rMSSD) after orthostatic maneuver (Absolute:  $r_s = 0.64$ -0.73;  $p = 0.01$  -  $< 0.01$ ) and (Relative:  $r_s = 0.37$ -0.53;  $p = 0.04$  -  $< 0.01$ ).

**CONCLUSIONS:** Parasympathetic reactivation and CRR during the initial 1<sup>st</sup> to 5<sup>th</sup> minutes of the recovery period after sub-maximal graded exercise is exercise is positively correlated with the parasympathetic decrease (reserve) after active postural change at rest in physically active, non-athlete men. In others words, we observed that highest parasympathetic decrease after postural change at rest, highest was CRR during post-exercise recovery.

**1272 Board #34 May 30 9:30 AM - 11:00 AM**  
**Sympathetic Activity and Cardiovascular Risk Markers in Non-diabetic and Diabetic Mexican Older Adults**

Patricia C. García Suárez<sup>1</sup>, Rebeca B. Fonseca-Viana<sup>2</sup>, Iván Rentería<sup>1</sup>, Ermilo Canton-Martínez<sup>1</sup>, Alberto Jiménez-Maldonado<sup>1</sup>, José Moncada-Jiménez<sup>3</sup>. <sup>1</sup>Universidad Autónoma de Baja California, Ensenada, Baja California, Mexico. <sup>2</sup>Instituto Federal de Educação, Ciência e Tecnologia do Sul de Minas Gerais, Minas de Gerais, Brazil. <sup>3</sup>Universidad de Costa Rica, San José, Costa Rica.  
 Email: patricia.garcia@uabc.edu.mx  
 (No relevant relationships reported)

Age-related metabolic dysfunctions occur in a wide variety of clinical manifestations, including hyperglycemia, dyslipidemia and increased body fat. These conditions increase the risk of cardiovascular diseases (CVD), which can develop low heart rate variability (HRV) and higher resting heart rate (HR). The pathological metabolic conditions in older adults are associated with a hyperactive sympathetic nervous system (SNS). **PURPOSE:** To compare the SNS activity and metabolic markers associated to CVD in type 2 diabetic (T2D) and non-diabetic (ND) Mexican older adults. **METHODS:** Volunteers were 11 T2D (Age =  $60.8 \pm 5.2$  yr., body mass index [BMI] =  $29.9 \pm 4.6$  kg/m<sup>2</sup>) and 17 ND (Age =  $64 \pm 4.8$  yr., BMI =  $28.4 \pm 4.1$  kg/m<sup>2</sup>) older adults residing in Baja California, Mexico. Morning blood serum samples were collected after 8-h fasting following body composition analysis (InBody 770, Cerritos, CA). A 5-min resting ECG recording (BioRadio, Cleveland, OH) was used to analyze HRV. Time and frequency domain analysis were assessed with Kubios HRV 3.1 software (Kubios Oy, Finland). **RESULTS:** Between-group differences were found on blood glucose (T2D =  $171.9 \pm 91.6$  vs. ND =  $80.17 \pm 12.0$  mg/dL,  $p < 0.001$ ), and triglycerides (T2D =  $266.9 \pm 126.17$  vs. ND =  $60.54 \pm 47.8$  mg/dL,  $p < 0.02$ ). Non-significant between-group differences were found on cholesterol (T2D =  $183.0 \pm 45.1$  vs. ND =  $180.9 \pm 29.7$  mg/dL,  $p = 0.88$ ), HDLc (T2D =  $60.54 \pm 55.8$  vs. ND =  $47.88 \pm 20.73$  mg/dL,  $p = 0.92$ ) and LDLc levels (T2D =  $84.4 \pm 44.6$  vs. ND =  $107.84 \pm 26.74$  mg/dL,  $p = 0.22$ ). The HR (T2D =  $72.6 \pm 11.5$  vs. ND =  $71.7 \pm 7.8$  bpm,  $p = 1.0$ ), beat-to-beat intervals (RR) (T2D =  $845.7 \pm 128.7$  vs. ND =  $843.7 \pm 93$  ms,  $p =$

0.94), Root Mean Square of the Successive Differences (RMSSD) (T2D = 68.7±58.0 vs. ND = 45.6±31.2ms,  $p = 0.45$ ) and relative successive beats with > 50ms of difference (pNN50) (T2D = 23.4±25.5 vs. ND = 9.7±13.7%,  $p = 0.32$ ) were similar in both groups. High- (T2D = 48.14±24.64 vs. ND = 45.5±22.9n.u.,  $p = 0.67$ ) and Low-frequency (T2D = 51.7±24.5 vs. ND = 54.0±23.3n.u.,  $p = 0.70$ ) time domains and LF/HF ratio (T2D = 2.0±2.4 vs. ND = 2.4±3.0,  $p = 0.68$ ) were similar in both groups. **CONCLUSIONS:** Diabetic conditions did not affect substantially SNS activity compared with non-diabetic condition in a sample of Mexican older adults.

**1273** Board #35 May 30 9:30 AM - 11:00 AM

**Effects of Maturational Development on Central Hemodynamics in Pre and Post Adolescent Children**

Austin T. Lassiter, Kaitlin T. McShea, Hwan Kim, Nicholas D. Tocci, Marco Meucci. *Appalachian State University, Boone, NC.* (Sponsor: Scott R. Collier, FACSM)  
Email: lassiterat@appstate.edu  
(No relevant relationships reported)

There has been a clear trend of increased cardiovascular disease risk development in adulthood as children have begun to develop large artery stiffness at an earlier age due to possible increased adiposity and poor diet. In recent years, there has been a pressing need to observe the implications of maturation on central hemodynamic parameters among children before and after pubertal development. **PURPOSE:** This study sought to observe the differences in central hemodynamic parameters between children pre and post-adolescence. **METHODS:** Children pre and post-adolescence (ages 7-12 and 13-17 years, N= 33, N= 20, respectively) were included in this study. Central hemodynamics including ejection duration percentage (ED%), forward pulse height (PH<sub>f</sub>), reflected pulse height (PH<sub>r</sub>), reflection magnitude (RM%), augmentation index (AIx75), heart rate period (HRP), and time to reflected wave (T2) were assessed through brachial blood pressure measurement using the Sphygmocor XCEL device. Pulse wave velocity (PWV) was obtained through carotid applanation tonometry. **RESULTS:** From pre-adolescence to post-adolescence, values indicate a significant decrease in ED% (42.2 ± 5.7% to 37.4 ± 4.3%,  $p = 0.002$ ), AIx75 (13.6 ± 13.6% to 3.2 ± 9.7%,  $p = 0.004$ ), and RM% (49.2 ± 6.1% to 44.0 ± 5.9%,  $p = 0.003$ ). However, significant increases were observed in PWV (4.3 ± 0.7 m/s to 5.1 ± 0.8 m/s,  $p = 0.0003$ ), HRP (791.2 ± 133.5 ms to 929.8 ± 134.3 ms,  $p = 0.001$ ), and PH<sub>f</sub> (25.5 ± 4.0 mmHg to 29.5 ± 4.5 mmHg,  $p = 0.002$ ). **CONCLUSION:** Major findings indicate that increases in PWV may be due to pubertal development and ED%, and HRP may be associated with an increase in heart mass. decreases in AIx75 and RM% and an increased PH<sub>f</sub> may be associated with increased height or vessel length. Future studies are necessary to determine possible factors responsible for seen changes.

**1274** Board #36 May 30 9:30 AM - 11:00 AM

**The Influence of Cardiovascular and Metabolic Variables on Autonomic Nervous System Activity**

Michael Jarrett, Travis Anderson, Laurie Wideman, FACSM, Paul Davis, FACSM. *University of North Carolina, Greensboro, Greensboro, NC.* (Sponsor: Paul G. Davis, FACSM)  
Email: msjarret@uncg.edu  
(No relevant relationships reported)

Multiple factors influence the balance of parasympathetic (PS) and sympathetic (SY) drive in the autonomic nervous system (ANS). Root mean square of successive differences of R-R intervals (RMSSD), is a linear metric obtained during the assessment of heart rate variability (HRV) and represents PS input to the heart. Systolic time intervals (STI) assessed via pre-ejection period (PEP, the time from the start of the QRS complex to the opening of the aortic valve), are a non-invasive measure that reflects SY activity at rest. **PURPOSE:** To investigate the effects of biological variables typically associated with metabolic syndrome on ANS activity as measured by RMSSD and PEP. **METHODS:** Utilizing the Atherosclerosis Risk in Communities (ARIC) dataset, 1,216 subjects (62.8% female, 74±4.8yrs) free from known cardiovascular disease, hypertension, myocardial infarction, and diabetes, not currently taking beta-blockers, and non-smokers were evaluated for fasting glucose (FBG) and insulin (FI) concentrations, waist circumference (WC), blood pressure (BP), RMSSD and PEP. Simultaneous 5-minute recordings of resting ECG, carotid arterial pulse, and phonocardiogram were used to assess PEP and RMSSD. FBG, FI, and WC inferred a latent variable termed glucose management (GM), where pulse and diastolic BP inferred a latent variable termed cardiac control (CC). Path analysis assessed the relationship between latent variables and RMSSD and PEP, after controlling for age, race, and sex. **RESULTS:** The model fit was acceptable (root mean square error of approximation = 0.108 [90% CI = .098, .118], comparative fit index = .649, and standardized root mean square residual = .07), with CC positively associated with PEP ( $\beta = .27, p < .01$ ), but negatively associated with RMSSD ( $\beta = -.41, p < .01$ ). Contrary to CC, GM was negatively associated with PEP ( $\beta = -.18, p < .01$ ), but positively associated with RMSSD ( $\beta = .20, p < .01$ ). **CONCLUSIONS:** Latent variables (CC and GM) in this model show opposing associations with RMSSD and PEP, suggesting that the metabolic syndrome risk factors included influence HRV and STI. This

Abstract was prepared using ARIC Research Materials obtained from the NHLBI Biologic Specimen and Data Repository Information Coordinating Center and does not necessarily reflect the opinions or views of the ARIC or the NHLBI.

**1275** Board #37 May 30 9:30 AM - 11:00 AM

**Early Ovarian Hormone Deprivation Increases Cardiac Contractility In Old Female Rats - Role Of Physical Training**

HUGO C.D. SOUZA, Ana Carolina S. Felix, Sabrina G.V. Dutra, Stella V. Philbois, Tábata P. Faccioli. *UNIVERSITY OF SAO PAULO, Ribeirão Preto, Brazil.*  
Email: hugocds@fmrp.usp.br  
(No relevant relationships reported)

Physiological menopause occurs around 51 years of age. However, in some cases, menopause can happen early, that is, before the age of 40. Of the main consequences of early ovarian hormones deprivation or early menopause, one of the most alarming is the increased risk of cardiovascular diseases, contributing to an increase in the morbidity and mortality rate in these women. Our hypothesis is that early deprivation of ovarian hormones, when associated with the aging process, promotes more adverse cardiac remodeling and greater damage to cardiac function related to physiological ovarian failure. Thus, aerobic physical training is fundamental to attenuate these deleterious effects. **PURPOSE:** The objective of the present study was to investigate the effects of early deprivation of ovarian hormones on cardiac morphological and functional parameters in 82 week-old female rats subjected to ovariectomy at 10 weeks of age, as well as to evaluate the application of aerobic training as a non-pharmacological therapeutic tool. **METHODS:** Female Wistar rats (N = 48) were divided into two groups, at 10 weeks of life: early ovarian hormones deprivation by ovariectomy (OVX; N=24) and sham (SHAM; N=24). Between weeks 62 and 82, 12 animals of each group underwent aerobic training (OVX-T and SHAM-T, N=12). At the end of week 82, all were evaluated by echocardiography, cardiac function (Langendorff technique) and cardiac  $\beta$ -adrenergic receptor expression quantification. **RESULTS:** Echocardiography showed slight changes in morphology between OVX and SHAM. OVX ( $\Delta = 101 \pm 4.7$  mmHg) showed higher values for maximal left intraventricular pressure in response to dobutamine, when compared to SHAM ( $\Delta = 55 \pm 11.8$  mmHg). Both OVX-T ( $\Delta = 70 \pm 4.0$  mmHg) and SHAM-T ( $\Delta = 22 \pm 6.6$  mmHg) showed a reduction in this response. While,  $\beta$ -adrenergic receptor expression was not different between the sedentary groups, SHAM-T (0.23 ± 0.02AU) and OVX-T (0.29 ± 0.01AU) showed decreased expression of these receptors when compared to their respectively sedentary groups. **CONCLUSIONS:** Early ovarian hormones deprivation associated with aging, promotes discrete changes in cardiac morphology, increasing cardiac contractility. Aerobic training decreases  $\beta$ -adrenergic receptors expression, influencing the cardiac contractility. Supported by FAPESP Grant 01937-9

**1276** Board #38 May 30 9:30 AM - 11:00 AM

**Strength Training Attenuates Hypertension And Preserves The Diastolic Function Of Spontaneously Hypertensive Rats: Role Of Linear Periodization**

Danilo S. Bocalini<sup>1</sup>, Roberta L. Rica<sup>2</sup>, Ariana A. Silva<sup>2</sup>, Adriano F. Maia<sup>1</sup>, Mauro S. Perilhão<sup>3</sup>. <sup>1</sup>Federal University of Espírito Santo, Vitoria, Brazil. <sup>2</sup>São Judas Tadeu University, São Paulo, Brazil. <sup>3</sup>Federal University of São Paulo, São Paulo, Brazil.  
(No relevant relationships reported)

**PURPOSE:** Among non-pharmacological strategies to hypertension control, aerobic physical training as well as strength training has been indicated as an important time point to general treatment. However, little is known when the training program is periodized in a linear progression. In this way the aim of this study was evaluated the effects of a linear strength training program on parameters of cardiac remodeling in spontaneously hypertensive rats. **METHODS:** Thirty rats were distributed in three groups: untrained normotensive (N, n: 10), untrained hypertensive (H, n: 10) and trained hypertensive (TH, n: 10). The training protocol (12 climbs with 90 second intervals) was organized in three mesocycles of four weeks, with an increase in the training load organized in a linear progression (60%, 65%, 70% and 75%) for each block, considering the weight established in the maximum load test. The following parameters were evaluated: ventricular function evaluated by echocardiogram, systemic blood pressure, ventricular hemodynamics, cardiac morphometric and myocardium contractility. **RESULTS:** No significant changes ( $p > 0.05$ ) were found in FEAT between groups, however, animals from group H had a longer isovolumetric relaxation time compared to other groups, which did not differ between them. There was a significant reduction of caudal BP in the TH group after eight training weeks, additionally, negative correlations were found between systolic blood pressure and increased muscle strength as well as total work, indicating the influence of these parameters on SBP control. The HR, PSVE, and PDFVE values of the H and TH groups did not differ, but both were higher than N group. The values of +dP/dt of H group were lower than the N and HT groups, which did not differ from each other. The RV, LV and cardiac mass values did not differ ( $p > 0.05$ ) between the H and HT

groups, however, they were superior to the N group. The nuclear volume was not different between groups; however, the total collagen content of H group was higher than N and HT group. **CONCLUSIONS:** Briefly, the findings in this study suggest that the training program performed promoted pressure attenuation and preserved the ventricular function of spontaneously hypertensive rats with no change in heart mass.

### C-31 Free Communication/Poster - Imaging and Assessment in Skeletal Muscle, Bone and Connective Tissue

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

#### 1277 Board #39 May 30 9:30 AM - 11:00 AM Dynamic Ultrasonography of Anterior Femoral Translation: Comparison to Ballet Turnout and Hip Symptoms in Dancers

Kristin E. Schwarz, Sarah Jackson, Dai Sugimoto, Rebecca Zwicker, Pierre A. d'Hemecourt, FACSM. *Boston Children's Hospital, Boston, MA.*  
Email: kristin.schwarz@childrens.harvard.edu  
(No relevant relationships reported)

#### Purpose:

To determine if there is a relationship between turnout, self-reported hip symptoms, and femoral head anterior translational motion under dynamic ultrasound in a population of adolescent ballet dancers.

#### Methods:

Cross-sectional cohort study. Population: 25 ballet academy students, 17 females and 8 males, ages 14-18 yrs. Dynamic ultrasound of the bilateral hips was performed on each study participant in supine position. With the low frequency linear ultrasound probe in sagittal oblique plane, the distance between the femoral head and acetabular rim was measured in 3 positions: both hips in neutral position, ipsilateral hip in neutral and contralateral hip hyperflexed, and with the ipsilateral hip in extension and external rotation and the contralateral hip hyperflexed. Compensated turnout was defined as difference between functional turnout angle in first position and total bilateral hip passive external rotation in prone. Each participant completed the Hip Osteoarthritis and Outcome Score (HOOS) questionnaire.

#### Results:

Spearman's rho correlation coefficient ( $r$ ) was used to test strength of association between variables, defined as  $<0.3$  = poor,  $0.3-0.5$  = fair/moderate,  $0.5-0.7$  = good,  $>0.7$  = strong.  $P=0.05$  was used as threshold for statistical significance. IBM SPSS software (version 23, SPSS, Chi, IL) was used for all analyses. Mean maximal femoral translation distance for the right hip:  $0.66\text{mm}$  ( $\pm 1.74\text{mm}$ ), and the left hip:  $1.56\text{mm}$  ( $\pm 1.93\text{mm}$ ). Mean compensated turnout:  $62.8^\circ$  ( $\pm 14.8^\circ$ ). There was no significant correlation between femoral translation and HOOS scores, nor between femoral translation and compensated turnout (right:  $p=.56$ ,  $r=0.123$ , left:  $p=.203$ ,  $r=-0.64$ ). There was a significant correlation between greater compensated turnout and higher mean bilateral HOOS scores, with strongest association in the domains: symptoms ( $p=.02$ ,  $r=.463$ ), quality of life ( $p=.003$ ,  $r=.561$ ) and activities of daily living ( $p=.034$ ,  $r=.426$ ).

#### Conclusions:

In this population of adolescent ballet dancers, there was no significant correlation between femoral head translational motion on ultrasound and compensated turnout or self-reported symptoms. There was significant correlation between degree of compensated turnout and more favorable self-reports on hip symptoms and function.

#### 1278 Board #40 May 30 9:30 AM - 11:00 AM Effects Of Downhill Running On Muscle MRI T2 In Young mdx Mice

Zahra Moslemi, Christopher Lopez, Abhinandan Batra, Andrew Rennick, Sean C. Forbes. *University of Florida, Gainesville, FL.*  
Email: zmoslemi@ufl.edu  
(No relevant relationships reported)

Previous studies have demonstrated that downhill treadmill running causes skeletal muscle damage that can be detected with magnetic resonance transverse relaxation time ( $T_2$ ) in adult dystrophic mice (*mdx*). However, young *mdx* mice (under 12 weeks of age) are characterized by a peak inflammatory phase with greater heterogeneity among muscles, potentially making it more difficult to detect  $T_2$  changes. **PURPOSE:** To determine whether muscle damage following downhill running can be detected in young *mdx* mice using proton magnetic resonance imaging (MRI) and spectroscopy (MRS). **METHODS:** C57BL/10ScSn-DMDmdx (*mdx*,  $n=5$ ) and wild-type C57BL/10ScSn (controls,  $n=5$ ) male mice of 6-9 weeks of age performed downhill

running on a treadmill (14% grade at 8-12m/min for 45-60 min). MRI/MRS was conducted prior to and 24 hours following running in the mice hindlimbs.  $T_2$ -weighted, multiple-slice, single spin-echo MR axial images were acquired (TR 2s, TE 14/40 ms, 12 slices) from the hindlimbs. MRI  $T_2$  values were calculated on a pixel-by-pixel basis for the anterior compartment (AC), posterior compartment (PC), and the deep medial region between the tibia and fibula (MC). In addition, single voxel  $^1\text{H}$ -MRS data were acquired from the soleus and gastrocnemius using stimulated echo acquisition mode (STEAM; TR 9 s, 32 TE's exponentially spaced: 5-288 ms, 4 phase cycles) with a 4.7 T Varian/Agilent MR system. **RESULTS:** At baseline,  $T_2$  was elevated ( $p<0.05$ ) in *mdx* mice ( $26.8\pm 1.2\text{ms}$ ) compared to controls ( $24.8\pm 0.9\text{ms}$ ). Following downhill running, the *mdx* mice had elevated ( $p<0.05$ )  $T_2$  values compared to baseline when a composite of the compartments were compared (Pre:  $26.8\pm 1.2\text{ms}$ ; Post:  $28.8\pm 1.4\text{ms}$ ). The MC was typically (80%) the most affected hindlimb region in the *mdx* mice. Similarly,  $^1\text{H}$ -MRS derived  $T_2$  values were increased ( $p=0.05$ ) in a composite measure of the soleus and gastrocnemius after downhill running ( $29.8\pm 4.2\text{ms}$ ) in *mdx* compared to before downhill running ( $26.4\pm 2.8\text{ms}$ ). There were no significant changes in  $T_2$  in control mice after performing the downhill running protocol. **CONCLUSIONS:** Overall, our findings support the use of downhill running combined with MR  $T_2$  measures as a valuable approach for testing potential therapeutic interventions in young dystrophic mice. **Funding Source:** NIH (NIAMS) R01 AR070101.

#### 1279 Board #41 May 30 9:30 AM - 11:00 AM Interactions Among Age, Sex, and Scanning Location in the Assessment of Rectus Femoris Echo Intensity

Adam Burton, Matthew Stock. *University of Central Florida, Orlando, FL.*  
Email: aburton426@gmail.com  
(No relevant relationships reported)

Echo intensity is an ultrasound-derived measurement of skeletal muscle quality believed to reflect both fibrous tissue content and adipocyte infiltration. Moderate correlations between echo intensity and measures of muscle function have been reported in older adults. But, it is less clear if the aging process results in comparable declines in muscle quality in men and women. Also, it has yet to be determined if age and sex discrepancies are uniform throughout a muscle. **PURPOSE:** The purpose of this investigation was to examine differences in echo intensity among younger and older men and women along the length of the rectus femoris. **METHODS:** Fifteen younger men (mean  $\pm$  SD age =  $23 \pm 3$  years), fifteen younger women ( $21 \pm 2$  years), eight older men ( $75 \pm 6$  years), and sixteen older women ( $70 \pm 5$  years) participated in this study. Participants were untrained, healthy, and had a body mass index  $\leq 30\text{ kg/m}^2$ . B-mode ultrasonography was used to acquire panoramic images of the dominant rectus femoris in the transverse plane at the one-third, one-half, and two-thirds distances along the length of the rectus femoris. ImageJ software was used to analyze the images. Echo intensity was corrected for subcutaneous tissue thickness using sex-specific equations. Analyses of variance and effect size statistics were used to analyze the data. **RESULTS:** When collapsed across scanning location, differences between men and women (marginal mean difference =  $28.1\text{ AU}$ ,  $p < .001$ ) were greater in magnitude than those for younger versus older adults (marginal mean difference =  $7.0\text{ AU}$ ,  $p = .237$ ). However, age had a strong influence on differences among scanning locations, with proximal echo intensity ( $107.8 \pm 14.5\text{ AU}$ ) being significantly lower than the middle ( $127.6 \pm 13.7\text{ AU}$ ) and distal ( $130 \pm 19.6\text{ AU}$ ) values for older men ( $F = 7.4$ ,  $p = .018$ , partial  $\eta^2 = .514$ ), with a similar trend for older women ( $F = 2.9$ ,  $p = .073$ , partial  $\eta^2 = .164$ ). Within each sex, younger adults had very similar echo intensity values at the proximal, middle, and distal sites (greatest mean difference  $< 5.0\text{ AU}$ ). **CONCLUSION:** The difference in corrected echo intensity is greater for men versus women compared to younger versus older adults. Furthermore, aging results in nonuniform changes in muscle quality throughout the belly of the rectus femoris, with greater deterioration at the middle and distal portions.

#### 1280 Board #42 May 30 9:30 AM - 11:00 AM Can Changes In Echo-intensity Be Used To Detect The Presence Of Muscle Swelling?

Noam Yitzchaki, Tayla E. Kuehne, Samuel L. Buckner. *University of South Florida, Tampa, FL.* (Sponsor: Marcus Kilpatrick, FACSM)  
Email: noamy@mail.usf.edu  
(No relevant relationships reported)

When examining skeletal muscle, it has been suggested that changes in echo-intensity (EI) measured with B-mode ultrasound can detect the presence of edema-induced muscle swelling. Specifically, if an increase in muscle size is accompanied by an increase in EI it is thought that true growth has not occurred. Interestingly, our research group has shown that small upward and downward tilting of the ultrasound probe can have a large influence on EI, while having minimal impact on muscle thickness (MT). This suggests that proposed changes in EI following resistance exercise may be artifact from probe tilt as opposed to swelling. **PURPOSE:** To examine the acute changes in biceps MT and EI, while accounting for probe tilt, following 4 sets of biceps curls.

**METHODS:** 49 resistance-trained men and women were recruited. Individuals in the experimental group (n = 23) visited the laboratory twice. During the first visit, paperwork and one repetition maximum (1RM) strength were measured. During the second visit, individuals performed 4 sets of biceps curls to volitional failure using 70% of their 1RM. B-mode ultrasound images of the biceps were taken to examine changes in both MT and EI. The ultrasound probe was equipped with a standard spirit level to ensure that probe tilt would play a minimal role in all EI measurements. Ultrasound measurements were taken immediately before and following exercise. Individuals in the control group (n = 26) visited the lab on one occasion and served as a time-matched control for changes in both MT and EI. Results are presented as means (95% CI). **RESULTS:** For MT there was a group by time interaction ( $p < 0.001$ ). MT increased in the experimental group [mean change = 0.44 (0.33-0.54) cm], but not in the control group [mean change = -0.015 (-0.03-0.01) cm]. For EI, there was no group x time interaction ( $p = 0.074$ ). In addition, there were no main effects for group ( $p = 0.254$ ) or time ( $p = 0.314$ ). The mean difference in the change in EI between groups was -2.99 (-6.25-3.03) arbitrary units. **CONCLUSIONS:** Our results suggest that EI does not appreciably change in response to acute swelling when accounting for probe tilt. In addition, changes in EI were not different compared to a time matched non-exercise control. It seems unlikely that EI can provide meaningful information regarding the presence of muscle swelling following exercise.

**1281 Board #43 May 30 9:30 AM - 11:00 AM**  
**The Validity And Reproducibility Of A 5-minute**  
**Endurance Test Of The Diaphragm Muscle**

Hallie R. Wachsmuth, Elizabeth K. Pryor, Kevin K. McCully, FACSM. *University of Georgia, Athens, GA.* (Sponsor: Dr. Kevin McCully, FACSM)  
 Email: hrw89340@uga.edu  
 (No relevant relationships reported)

Diaphragmatic function could be important in treating respiratory failure. Electrical stimulation and accelerometer-based mechanomyography have been used to identify the endurance index of various muscles, but not of the diaphragm.

**PURPOSE:** Measure the validity and reproducibility of an endurance test of the diaphragm muscle using electrical stimulation of the phrenic nerve.

**METHODS:** Ten healthy subjects (21.3±1.1 yrs) were tested in the supine position on two separate occasions within one week. Custom-made stimulation electrodes were placed on the left (n=12) or right (n=2) phrenic nerve, which lies underneath the sternocleidomastoid muscle. The stimulation intensity to induce a vigorous contraction was determined. An accelerometer was placed on the abdomen. The endurance test consisted of 5 minutes of electrical stimulation on 5 Hz, with a sampling rate of 400 Hz. The average acceleration per minute was recorded. The endurance index, which equals the ending value/peak value\*100, was then calculated. A series of practice tests were performed before data collection.

**RESULTS:** The test was successfully completed 27/30 times. The time to find the phrenic nerve was 43.9±50.4 s for trial 1 and 25.9±26.3 s for trial 2. The average endurance index for trial 1 and 2 were 70.5±11.2% and 70.4±12.4%, respectively (between days,  $p=0.54$ ,  $CV=7.71\%$ ).

**CONCLUSIONS:** The time to find the phrenic nerve decreased with practice. The endurance test was reproducible and did not have an order effect. With additional training and testing, the diaphragm endurance test may be practical in clinical populations.

**1282 Board #44 May 30 9:30 AM - 11:00 AM**  
**Effects Of Downhill Running On Skeletal Muscle Of**  
**Dystrophic Mice Evaluated By <sup>31</sup>P-MRS magnetic**  
**resonance spectroscopy**

Christopher Lopez, Abhinandan Batra, Zahra Moslemi, Andrew Rennick, Sean C. Forbes. *University of Florida, Gainesville, FL.*  
 Email: christopherlopez@phhp.ufl.edu  
 (No relevant relationships reported)

In this study we examined the effects of downhill treadmill running on dystrophin-deficient skeletal muscle of *mdx* mice, an animal model of Duchenne muscular dystrophy (DMD). **Purpose:** We hypothesized that *mdx* mice would be susceptible to muscle damage following downhill running and this would be associated with altered muscle energetic status and magnesium ( $Mg^{2+}$ ). **Methods:** Mice (wild-type 5, *mdx* 5) underwent downhill running (14° decline) on a motorized treadmill at a speed of 8-10 m/min, for 45-60 min. Unlocalized <sup>31</sup>P-MRS magnetic resonance spectroscopy (<sup>31</sup>P-MRS) data was collected using an 11.1T MR system from the posterior hindlimb compartment to measure adenosine triphosphate (ATP), phosphocreatine (PCr), inorganic phosphates (Pi), intracellular pH, and magnesium ( $Mg^{2+}$ ) before and 24 hours after exercise. In addition, we acquired MRI-T<sub>2</sub> weighted images to identify regions of muscle damage in the hindlimbs and performed localized <sup>31</sup>P-MRS measures to co-register with damaged regions. **Results:** Downhill running resulted in a significant ( $p<0.01$ ) decrease in relative intracellular  $Mg^{2+}$  concentration in *mdx* compared to pre-exercise (Pre: 0.398 ± 0.072 mM; Post: 0.241 ± 0.050 mM), but no differences

were observed in controls. Also, there was a trend ( $p=0.18$ ) towards an elevated Pi/PCr in the gastrocnemius and soleus muscles in *mdx* after exercise compared to before exercise (Pre: 0.046 ± 0.028; post: 0.061 ± 0.018). The energetic alterations in *mdx* were enhanced in the regions of muscle damage identified with T<sub>2</sub>-weighted MRI. **Conclusions:** Downhill running resulted in intracellular changes in *mdx* mice evident with <sup>31</sup>P-MRS, including lower intracellular  $Mg^{2+}$  concentrations, likely due to compromised sarcolemma integrity. Overall, <sup>31</sup>P-MRS measures are sensitive to acute muscle damage induced by downhill running and may be a valuable technique for testing potential therapeutic interventions in dystrophic muscle. **Funding Source:** NIH (NIAMS) R01 AR070101.

**1283 Board #45 May 30 9:30 AM - 11:00 AM**

**Evaluation of Resistane Exercise-Induced Muscle Swelling Using Bioelectrical Impedance Analysis**

Maki Atsuta, Yuri Misonoo, Shun Kondo, Hiroaki Ito, Yuto Yamada, Natsuko Okamoto, Atsushi Iwashita, Yusuke Mizutani, Haruna Nagatsuka, Kurumi Watanabe, Mikihiro Wata, Seishiro Kayanuma, Ayame Iwata, Kazushige Goto. *Ritsumeikan University, Kusatsu, Japan.* (Sponsor: Robert Kraemer, FACSM)  
 Email: sh0141sh@ed.ritsumei.ac.jp  
 (No relevant relationships reported)

**PURPOSE:** The purpose of the present study was to examine time course changes of muscle swelling evaluated by bioelectrical impedance analysis (BIA) following resistance exercise.

**METHODS:** Nine subjects (20.8 ± 0.4 yrs, 174.4 ± 6.8 cm, 67.4 ± 8.1 kg) conducted exercise condition (EX) and rest condition (REST) on different days (a week between conditions). In the EX, subjects conducted unilateral arm curl exercise (12 repetitions × 5 sets, 90 s rest period between sets) for biceps brachii muscle at 60% of maximal voluntary contraction. In the REST, the subjects maintained rest for identical period from exercise duration in the EX. Time course changes in BIA (locally evaluated BIA for biceps brachii muscle), muscle thickness (evaluated by ultrasound) for biceps brachii muscle, circumference of upper arm and blood lactate concentrations were determined before exercise (or rest), immediately after, 30 min and 60 min after exercise (or rest).

**RESULTS:** The EX caused significant increases in muscle thickness and circumference during post-exercise ( $p < 0.05$ ). Moreover, blood lactate concentration was significantly increased in the EX after exercise ( $p < 0.05$ ). In contrast, no significant change was observed for these variables in the REST. The EX showed rapid reduction of BIA immediately after exercise (from 28.7 ± 10.4 kΩ to 18.5 ± 4.6 kΩ,  $p < 0.05$ ). Furthermore, BIA revealed significantly lower values in the EX than those in the REST immediately after exercise (EX: 18.5 ± 4.6 kΩ vs. REST: 27.7 ± 6.7 kΩ,  $p < 0.05$ ) and 15 min after exercise (EX: 22.0 ± 7.0 kΩ vs. REST: 29.5 ± 9.5 kΩ,  $p < 0.05$ ).

**CONCLUSION:** Resistance exercise reduced local BIA during post-exercise, with concomitant increases in muscle thickness and circumference. Therefore, acute reduction of BIA following resistance exercise may reflect exercise-induced muscle swelling and increased water volume in the muscle.

**1284 Board #46 May 30 9:30 AM - 11:00 AM**

**The Assessment Of Muscular Characteristics Using**  
**Tensiomyography In Hemiplegic Stroke Patients**

Shin Who Park, M.D., Won Kim, M.D., Kyoung Hyo Choi, M.D., Ph.D. *Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea, Republic of.*  
 (No relevant relationships reported)

**PURPOSE:**

Tensiomyography (TMG) has been used to assess muscular characteristics of the lower extremity. However, in stroke patients, the TMG characteristics have not been reported to date. The aim of this study was to investigate the functional behavior and stiffness of muscles in hemiplegic stroke patients

**METHODS:** Fifteen patients with hemiplegic stroke (mean age: 64±12.51 years; 13 males, 2 females) were recruited. In hemiplegic side, the presence of hypertonus was proved by the H/M ratio and we excluded the subjects with abnormal muscle tone in sound side. The evaluation included: muscular function by TMG with a digital transducer Dc-Dc Trans-Tek® and muscle stiffness by sonoelastography. Functional elements of the lower extremity muscle groups (Rectus femoris, RF, Biceps femoris, BF, Gastrocnemius, GCM and Tibialis anterior, TA) were evaluated and the following parameters were assessed from muscular point of view: contraction time (Tc), sustain time (Ts), delay time (Td), relax time (Tr) and displacement maximal amplitude (Dm) after electrical stimulation. We performed comparative analysis of between the sonoelastographic data of sound side and affected side. Then, we checked the correlation between TMG parameters and the sonoelastographic parameters.

**RESULTS:** 1) There were no significant differences in the vast majority of the TMG parameters between affected and sound side of lower extremities. The RF-Tr ( $p=0.008$ ), the RF-Dm ( $p=0.041$ ) and the TA-Tr ( $p=0.05$ ) were decreased, compared to the sound side. 2) At the affected side of BF, GCM and TA, the quantitative analysis of

the color histogram revealed a significantly greater intensity of red ( $p=0.030$ ,  $p=0.001$ ,  $p=0.004$ ) and a lower intensity of blue ( $p=0.004$ ,  $p=0.001$ ,  $p=0.026$ ) than sound side. 3) In affected side, the red intensity of TA is correlated with the RF-Tc ( $r=-0.566$ ,  $p=0.044$ ) and TA-Ts ( $r=0.618$ ,  $p=0.043$ ). The red intensity of GCM is correlated with the GCM-Tc ( $r=0.714$ ,  $p=0.047$ ) and the GCM-Tr ( $r=-0.786$ ,  $p=0.021$ ). The red intensity of BF is correlated with GCM-Tr ( $r=-0.857$ ,  $p=0.014$ ).

#### CONCLUSIONS:

The results of our study help understanding muscle physiologic change associated with CNS lesion. These are useful to detect muscle dysfunction and assess the effect of neuromuscular rehabilitation in stroke patients

#### 1285 Board #47 May 30 9:30 AM - 11:00 AM Exercise-induced Changes In Muscle Thickness As Measured By Both A-mode And B-mode Ultrasound

Tayla E. Kuehne<sup>1</sup>, Noam Yitzchaki<sup>1</sup>, B. Sue Graves, FACSM<sup>2</sup>, Samuel L. Buckner<sup>1</sup>. <sup>1</sup>University of South Florida, Tampa, FL. <sup>2</sup>Florida Atlantic University, Boca Raton, FL.  
Email: tkuehne@mail.usf.edu  
(No relevant relationships reported)

Acute changes in muscle thickness (MT) following resistance exercise are often examined to determine the anabolic potential of an exercise stimulus. This acute change is often attributed to swelling and has been postulated to act as a proliferative signal resulting in a shift towards muscle growth. B-mode ultrasound is commonly used to track acute changes in MT. However, A-mode ultrasound presents a more affordable alternative to measure these same changes. Although A-mode ultrasound may be used to image skeletal muscle, this method does not allow live imaging across a large area of tissue like B-mode ultrasound. In addition, interface detection may be more difficult due to the quality of the image. **PURPOSE:** To compare MT values between A-mode and B-mode ultrasound before and following four sets of biceps curls. **METHODS:** Participants visited the laboratory twice. During the first visit, paperwork and one repetition maximum (1RM) strength assessment were completed. During the second visit, participants performed 4 sets of biceps curls to volitional failure using an exercise load equal to 70% of 1RM. MT measurements were taken before and immediately following exercise. MT measures were taken with both A-mode and B-mode ultrasound. Results are displayed as means (95% CI). **RESULTS:** A total of 23 resistance trained men ( $n=12$ ) and women ( $n=11$ ) completed the study. For MT, there was no interaction, the mean difference in the exercise-induced change in ultrasound-measured MT between A-mode and B-mode was 0.02 (-0.11 - 0.05) ( $p = .51$ ) cm. There were, however, main effects for time ( $p < 0.001$ ) and measurement type ( $p = 0.001$ ). MT increased from pre [3.62 (3.25-3.99) cm] to post [4.07(3.66-4.47) cm] exercise. In addition, MT values as measured by A-mode ultrasound were smaller than those measured by B-mode ultrasound [mean difference 0.174 (0.08- 0.26) cm]. **CONCLUSIONS:** Our results suggest MT measurements taken using A-mode ultrasound are smaller than those using B-mode ultrasound. Despite this difference, it appears A-mode can detect similar acute changes in MT following resistance exercise when compared to B-mode. These results suggest that A-mode ultrasound can serve as a useful tool to examine acute changes in MT, which may also help to better understand the effectiveness of a resistance exercise stimulus.

#### 1286 Board #48 May 30 9:30 AM - 11:00 AM Age-related Change In Cross Sectional Area Of The Psoas Major Muscle In Japanese

Mitsuharu KAYA<sup>1</sup>, Masanori Takemura<sup>2</sup>, Junzo Tsujita<sup>3</sup>, Ken-ichi Ichihashi<sup>2</sup>. <sup>1</sup>Hyogo University of Health Sciences, Kobe, Japan. <sup>2</sup>Ichihashi Clinic, Kobe, Japan. <sup>3</sup>Institute of Health & Sports Medical Science, Hyogo, Japan.  
Email: kaya@huhs.ac.jp  
(No relevant relationships reported)

Although skeletal muscle mass decreases in sarcopenia, it is not clear whether it occurs systemically or partially. It is important to clarify the age-related change of each skeletal muscle as a basic component of sarcopenia research. **PURPOSE:** The purpose of this study was to investigate characteristics of age related changes in the cross sectional area of psoas major muscle as part of elucidation of sarcopenia. **MRTHODS:** Subjects consisted of 2014 persons (938 males and 1076 females) aged 10 to 91 (classified every 5years) examined at our clinic. Using MRI, muscle cross-sectional area was measured on psoas major muscle at height of the iliac crest (L4 - L5). Data was divided into gender and age, and analysis of variance and multiple comparisons were performed. We also examined the relationship with BMI for 614 subjects who were able to confirm their height and weight. **RESULTS:** The cross-sectional area of psoas major muscle peaked the ages of 15 to 19, and declined with age. The decline was noticeable after the aging 50s in both sexes. A remarkable decrease was also observed in the late 30s and 70s in men. Interaction between sex and age was observed, and differences in patterns were observed between men and women. As a result of analysis of variance, no correlation was found between BMI and age, but a correlation was found between gender and BMI and between sex and age. In all age

groups, it was confirmed that the group having a larger BMI exhibited a larger muscle cross sectional area. **CONCLUSIONS:** These results showed the characteristics of age-related change of cross sectional area of the psoas major muscle. Further investigation is needed for sarcopenia research.

#### 1287 Board #49 May 30 9:30 AM - 11:00 AM Skeletal Muscle VO<sub>2</sub> Kinetics By Nirs "Repeated Occlusions Method" During Recovery From Cycle Ergometer Exercise

Lucrezia Zuccarelli. *Università degli Studi Udine, Udine, Italy.*  
(Sponsor: Bruno Grassi, FACSM)  
(No relevant relationships reported)

Near-infrared spectroscopy (NIRS) has been utilized as a non-invasive method to evaluate skeletal muscle mitochondrial function in humans, by calculating muscle VO<sub>2</sub> ( $\dot{V}O_{2m}$ ) recovery kinetics (repeated occlusions method) following brief (~15 s) light-intensity (unknown work rate) plantar flexion exercise. **Purpose:** The aim was to determine  $\dot{V}O_{2m}$  recovery kinetics, by the same approach, following standard cycle ergometer exercise of different intensities, and to compare them with pulmonary VO<sub>2</sub> ( $\dot{V}O_{2p}$ ) recovery kinetics. **Methods:** Fifteen young physically active healthy males performed on a cycle ergometer an incremental exercise (INCR) up to exhaustion (to determine peak  $\dot{V}O_{2p}$  and the gas exchange threshold [GET]) and two repetitions of constant work-rate (CWR) exercises at 80% of GET (MOD) and at 40% of the difference between GET and peak  $\dot{V}O_{2p}$  (HEAVY).  $\dot{V}O_{2p}$  and vastus lateralis muscle fractional O<sub>2</sub> extraction by NIRS ( $\Delta[\text{deoxy}(\text{Hb}+\text{Mb})]$ ) were recorded continuously. Transient arterial occlusions (5-10 s each; rapid cuff inflation at ~300 mmHg) were carried out at rest and during the recovery for  $\dot{V}O_{2m}$  calculation by standard methods. The time constants ( $\tau$ ) of the monoexponential  $\dot{V}O_{2m}$  and  $\dot{V}O_{2p}$  kinetics during the first 7-6 minutes of recovery were determined. **Results:** Peak  $\dot{V}O_{2p}$  was  $47.5 \pm 6.7$  ml $\cdot$ kg<sup>-1</sup>·min<sup>-1</sup>.  $\dot{V}O_{2m}$  values at the onset of recovery were ~27, ~38 and ~35 times higher (in MOD, HEAVY and INCR, respectively) than at rest.  $\tau$  of  $\dot{V}O_{2m}$  recovery (coefficient of determination,  $r^2$ , ranging from 0.93 to 0.99) was lower (faster kinetics) following MOD ( $29.1 \pm 6.8$  s) vs. HEAVY ( $P < 0.001$ ) or INCR ( $P < 0.001$ ) ( $40.8 \pm 10.9$  and  $42.9 \pm 10.9$ , respectively). Also  $\tau$  of  $\dot{V}O_{2p}$  recovery was lower following MOD ( $37.5 \pm 6.2$  s) vs. HEAVY ( $P < 0.01$ ) or INCR ( $P < 0.001$ ) ( $41.9 \pm 5.9$  and  $44.7 \pm 5.1$ , respectively). A significant difference between  $\tau$  of  $\dot{V}O_{2m}$  and  $\dot{V}O_{2p}$  kinetics was observed only in MOD ( $P < 0.0001$ ).  $\tau$  of  $\dot{V}O_{2p}$  recovery kinetics were significantly ( $P = 0.0002$ ,  $r = 0.53$ ) correlated with  $\tau$  of  $\dot{V}O_{2m}$ . **Conclusion:** Both  $\dot{V}O_{2m}$  and  $\dot{V}O_{2p}$  kinetics were faster in the recovery from moderate- vs. heavy- or maximal-intensity cycle ergometer exercise.  $\dot{V}O_{2m}$  recovery kinetics, determined non-invasively by the NIRS "repeated occlusions" technique can be utilized as a functional evaluation tool also following conventional cycle ergometer exercise.

#### 1288 Board #50 May 30 9:30 AM - 11:00 AM Pelvic Limbs Length And Knee Alterations In Health Sciences College Students.

Karla S. Vera-Delgado, Cipriana Caudillo-Cisneros, Fernando Sotelo-Barroso, Sergio Marquez-Gamiño, Montserrat Vera-Delgado. *Universidad de Guanajuato, León, Mexico.*  
Email: ksvera@ugto.mx  
(No relevant relationships reported)

**PURPOSE:** To assess muscle-skeletal conditions (MEC) of pelvic limbs and knees in the University of Guanajuato Health Sciences Division freshmen. **METHODS:** Transversal, descriptive study designed to clinically evaluate musculoskeletal alterations of the pelvic limbs and knees in first-year students enrolled in health sciences college programs of a Central Mexico University. The evaluation was performed by a team integrated by a certified orthopedist and traumatologist, two physiologists, a medical sciences doctor, and a graduate student. Methods were based on Viladot (2004). **RESULTS:** 293 students mean age  $18.9 \pm 1.7$  ( $\pm$  s.d.) were evaluated. 208 of them women and 85 men; 291 singles and two married; 39 employed, 247 do not have a different occupation than being students; 7 did not respond the question. Four participants were classified as obese, 15 as robust, 205 as having medium complexion and 68 as being slim. The sample showed various limbs and knees musculoskeletal alterations: four participants had a center of gravity anteriorized; eighty had shortening in the right pelvic member, and five in the left side. 52 persons shown *genu valgum* and five, *genu varum*. One participant presented tibial *varum*. **CONCLUSIONS:** Prevalence of limb and knee musculoskeletal alterations in freshman health sciences students is similar to the one for other sectors of the Mexican population. Considering that health providers are prone to develop bone, muscle and joints alterations derived from their professional activities, it is important to know predisposing conditions, to support exercise preventing programs.

1289 Board #51 May 30 9:30 AM - 11:00 AM

**Effect Of Limb Position On Vastus Lateralis Muscle Morphology Measured By B Mode Ultrasonography**

Isobel Thornley, Mark I. Johnson, Peter Francis. *Leeds Beckett University, Leeds, United Kingdom.*  
Email: i.thornley@leedsbeckett.ac.uk  
(No relevant relationships reported)

**PURPOSE:** A narrative review of studies which measured vastus lateralis (VL) muscle thickness (MT) using Ultrasonography (US) revealed inconsistencies in the procedures and techniques used for measurement. One consideration for measurement is the position of the limb and participant. Knee extension was the most commonly reported position, however some studies used knee flexion. The extent to which this alters muscle morphology is unknown and therefore, there is uncertainty as to whether data from studies using different positions can be compared. The aim of this study was to analyse whether limb position, knee extension or knee flexion, had a significant effect on VL-MT, pennation angle and fascicle length.

**METHODS:** In order to have a homogenous sample, thirty two full time male professional soccer players took part in the study [age = 18.3 ± 0.5 years (mean ± SD), height = 179 ± 1.7cm, mass = 77.3 ± 3.5kg]. In vivo MT and architecture was measured using B mode US (LOGIQ e, GE Healthcare). Two images were taken of the VL in the dominant leg while the participant was supine with their knee extended or flexed at 90 degrees (leg off the bed). Images were downloaded to an imaging software (Image J, v1.51k; NIH; Bethesda; USA). Analysis of the data was conducted in SPSS v24. Descriptive statistics were calculated for each of the dependant variables (MT, pennation angle and fascicle length). A Paired T test was performed for each of the data sets. P < 0.05 was classed as significant. **RESULTS:** MT was significantly greater in the supine/knee extended position compared to the supine/knee flexed position (2.43 ± 0.18cm vs. 2.36 ± 0.17cm; t(31) = 2.76, p = < .010). Pennation angle was also significantly larger in knee extension compared to knee flexion (18.47 ± 1.18° vs. 16.87 ± 1.14°; t(31) = 7.59, p = < .000). Whereas fascicle length was significantly greater in knee flexion compared to knee extension (9.87 ± 0.53cm vs. 9.04 ± 0.92cm; t(31) = -7.652, p < .000). **CONCLUSIONS:** This study is the first to demonstrate differences in muscle morphology, dependent on limb position, as measured by US. The differences in MT were less than the smallest real difference calculated for US in our laboratory. A standard operating procedure for the measurement of MT using US is required. This study only addresses one aspect of a standard operating procedure.

1290 Board #52 May 30 9:30 AM - 11:00 AM

**Profiles of Quadriceps Muscles after Downhill Running using Ultrasonography**

Min-Ghyu SUN, Maengkyu KIM, Choun-Sub KIM, Hye-Young JUNG, Yong-Woo KIM. *Kyungpook National University, Daegu, Korea, Republic of.*  
Email: sunminghyu@naver.com  
(No relevant relationships reported)

**PURPOSE:** The aim of study was to examine the changes of muscle properties after downhill running at different intensities, and further to investigate the optimal biomarkers for muscle damage. **METHODS:** Eleven sedentary men were randomly assigned to repeated measured running sessions set up either at High (HS, 70% HR<sub>max</sub>) or Low (LS, 50% HR<sub>max</sub>) with -9° (-16% gradient). Each session consisted of 30 min downhill running on separate occasions 2-wk apart. Range of motion (ROM) was calculated from voluntary maximal extension and flexion. Muscle soreness was recorded on visual analog scale (VAS) with algometry on rectus femoris (RF), vastus lateralis (VL), and vastus medialis (VM). Echo intensity (EI) was scanned with B-mode ultrasonography and analyzed with gray scale analysis. In addition, serum creatine kinase (CK) activity had evaluated as a blood biomarker. All parameters were taken at PRE, POST, 24, 48, and 72hr, respectively. **RESULTS:** Significant differences were found in EI and CK activity (p < .05, respectively) between sessions including baseline. Interestingly, significant increases of EI were found on RF (at POST, 24hr, & 48hr) and VL (at POST & 24hr) after HS (p < .05, respectively). Also, significant interactions were found on RF and VL after HS (p < .05, respectively) whilst no significant differences and interactions were indicated on VM at both sessions. In particular, significantly greater EI was found after HS than LS (p < .05). In addition, CK activity was significantly different at both sessions (at 24 & 48hr), but HS had significantly greater CK activity at 24hr, compared to LS (p < .05). Moreover, significantly greater VAS on RF (p < .05 at 24 & 48hr, respectively) and VL (p < .05 at 24hr) after HS yet there were no significant differences after LS. Furthermore, ROM had significant differences at both sessions, compared to baseline (p < .05, respectively) while significantly greater changes were found after HS (p < .05 at 48hr). **CONCLUSIONS:** Downhill running at different intensities does have effect on serum protein and muscle quality. In particular, echo intensity reflected the muscle damage differences depending on exercise intensities, similar to CK changes. Thus, this study has suggested the non-invasive ultrasonography is an effective method for muscle damage evaluation. Supported by NRF-2017R1C1B1006196

1291 Board #53 May 30 9:30 AM - 11:00 AM

**Feasibility of Using Shear Wave Elastography to Quantify Achilles Tendinopathy Stiffness Before and After Rehabilitation**

Robert A. Whitehurst<sup>1</sup>, Shane L. Koppenhaver<sup>2</sup>, Stephanie R. Albin<sup>3</sup>, Matt T. Hartshorne<sup>4</sup>, Darren W. Hearn<sup>5</sup>, Mita T. Lovalekar<sup>1</sup>, Bradley C. Nindl, FACSM<sup>1</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>Baylor University, Waco, TX. <sup>3</sup>Regis University, Denver, CO. <sup>4</sup>Geneva Foundation, Tacoma, WA. <sup>5</sup>University of North Carolina, Chapel Hill, NC. (Sponsor: Bradley C. Nindl, FACSM)  
(No relevant relationships reported)

**BACKGROUND:** Chronic Achilles tendinopathy is characterized by a softening of the elastic property of the tendon which can be quantified with Shear Wave Elastography (SWE). Blood flow restriction training (BFR) may increase tenocyte proliferation and repair when combined with a loading protocol, thereby restoring stiffness to softened tendons. **PURPOSE:** The primary purpose of this study was to evaluate the feasibility of using SWE to measure changes in Achilles tendon elasticity before and after rehabilitation. A secondary purpose was to evaluate feasibility and effectiveness of incorporating BFR or sham BFR in addition to an eccentric exercise protocol. **METHODS:** Participants presenting with unilateral Achilles tendinopathy to outpatient physical therapy clinics performed eccentric exercises as a home exercise program (HEP) 2x/day. Participants came into the clinic 2x/week for 12 weeks and were randomized to perform either BFR (limb occlusion pressure = 80%, n = 6) or sham BFR (limb occlusion pressure < 10%, n = 5). Tendon stiffness was quantified with SWE as Young's modulus in symptomatic (SYM) and asymptomatic (ASY) tendons at baseline and after 12 weeks. **RESULTS:** At baseline participants' (n = 11, age = 33.9 ± 10, weight = 80.6 ± 16.3 kg, male = 63.6%, weeks of symptoms = 34.1 ± 24.1) Young's modulus was lower in SYM tendons than in ASY tendons (mean ± SD = 432.2 ± 124.8 kPa vs 496.6 ± 66.5 kPa). At the end of 12 weeks the SYM tendon had normalized to the ASY side (530.0 ± 93.1 kPa vs 527.0 ± 75.4 kPa). The change in Young's modulus in the BFR group was approximately twice that of the sham BFR group (123.2 ± 71.4 kPa vs 67.4 ± 185.8 kPa) in the SYM tendons. Both groups compliance with the HEP was > 80% (BFR 83.3% vs sham BFR 91.6%), and there was no difference between in-clinic compliance (BFR 74.4% vs sham BFR 74.7%). Blinding in the sham BFR group resulted in 80% of subjects unable to determine correct group assignment. **CONCLUSIONS:** It is feasible to use SWE to measure changes in Achilles tendon stiffness. The addition of BFR to eccentric exercises may result in larger improvements in tendon stiffness. High compliance in both groups support the feasibility of BFR training in addition to a HEP of eccentric exercise, and sham BFR can be used as a control. This work was funded by the AMEDD Advanced Technology Initiative #6042, TATRC, US Army MRMCM.

1292 Board #54 May 30 9:30 AM - 11:00 AM

**Examination of Tendon and Muscle Architecture and Their Influence on Postural Stability**

Lauren E. Pacinelli, Jeffery A. Williams, John P. Vardiman, Ryan M. Thiele. *Kansas State University, Manhattan, KS.*  
(No relevant relationships reported)

Total length of the Achilles tendon (AT<sub>Length</sub>) and strength characteristics of the triceps surae have been utilized to investigate musculotendinous stiffness and tendon compliance. However, very few studies have examined the relationship between tendon characteristics and fascicle-specific muscle architecture (pennation angle; PA), or their influence on subsequent functional performance. **PURPOSE:** Evaluate the relationship between AT<sub>Length</sub> and medial gastrocnemius (MG) PA, as well as their influence on balance performance (overall stability index; OSI). **METHODS:** Eighteen female (mean ± SD: age = 19 ± 1 years) participants laid in a prone position on a cushioned table, with their hip and knee in extension, and ankle maintained in a neutral position (90°). Ultrasonography (US) PA images were scanned in a longitudinal position at the medial 1/3 of the low leg with a linear-array probe at the level of the tibial tuberosity, and were identified as the angle formed between the muscle fascicles and the deep fascia of the MG muscle. AT<sub>Length</sub> was captured in the extended-field of view setting starting at the calcaneal insertion of the AT and ending at the MG musculotendinous junction (MTJ). AT<sub>Length</sub> was identified as the distance (cm) between the calcaneal notch and MG MTJ. All US image measurements were analyzed using a third-party image analysis software. Balance assessments were performed on a commercially designed balance unit with an adjustable dynamic platform and involved three, 20-s single leg balance trials. Pearson product-moment correlation coefficients (r) were used to examine the relationships between AT<sub>Length</sub>, MG PA, and OSI. **RESULTS:** A significant negative correlation (r = -0.499; R<sup>2</sup> = 0.247; p = 0.035) was observed between MG PA and AT<sub>Length</sub>. No significant correlations were observed between OSI and MG PA (r = -0.109, R<sup>2</sup> = 0.012; p = 0.666) or OSI (r = 0.071; R<sup>2</sup> = 0.005; p = 0.778) and AT<sub>Length</sub>. **CONCLUSION:** The present investigation revealed a longer Achilles tendon length was associated with a diminished pennation angle of the

medial gastrocnemius in young females. Additionally, balance assessments may not be a sensitive measure for determining the influence of musculotendinous architecture on functional performance.

**1293 Board #55 May 30 9:30 AM - 11:00 AM**  
**Assessing Agreement of Lateral Leg Composition Using Dual X-ray Absorptiometry**

Christiana J. Raymond-Pope, Tyler A. Bosch, Donald R. Dengel, FACSM. *University of Minnesota, Minneapolis, MN.* (Sponsor: Donald R. Dengel, FACSM)  
 Email: raymo191@umn.edu  
 (No relevant relationships reported)

**PURPOSE:** Recently, we reported the accuracy of a novel lateral segmentation dual X-ray absorptiometry (DXA) scanning method for measuring lower extremity total, lean, and fat masses in the lateral view on the GE Lunar iDXA compared to the standard whole-body frontal DXA scanning view. Therefore, the current study was undertaken to examine the agreement of this lateral segmentation DXA scanning method using a Hologic Horizon A DXA scanner. **METHODS:** Thirty healthy college-age participants (16 female;  $\bar{X}_{age} = 21.5 \pm 1.7$  yrs.) received three DXA scans (1 whole-body and 2 lateral leg scans) to quantify and compare leg composition in the frontal and lateral plane. To mark regions of interest (ROIs) that would be visible on the DXA scan, metallic markers were placed at 60% of the length above and below each leg's lateral epicondyle. Using lateral subject positioning, leg composition was measured with participants lying on their right and left sides, with the scanned leg elevated using two foam pads at the ankle and the widest portion of the upper-leg. Paired t-tests examined the lateral DXA scanning method's agreement when quantifying total, lean, and fat masses, and bone mineral content (BMC) compared to measurements of equal area obtained in the standard whole-body frontal DXA scanning view. **RESULTS:** Comparisons of frontal and lateral view DXA scan measurements for right leg total mass ( $7.12 \pm 0.91$  kg vs.  $6.40 \pm 0.85$  kg), lean mass ( $5.14 \pm 1.05$  kg vs.  $4.78 \pm 0.93$ g), fat mass ( $1.70 \pm 0.44$  kg vs.  $1.36 \pm 0.33$  kg), and BMC ( $0.28 \pm 0.06$  kg vs.  $0.23 \pm 0.05$  kg), respectively, were significantly different (all  $p < 0.001$ ). Similarly, comparisons of frontal and lateral left leg total mass ( $7.12 \pm 0.97$  kg vs.  $6.44 \pm 0.93$  kg), lean mass ( $5.15 \pm 1.12$  kg vs.  $4.82 \pm 1.01$  kg), fat mass ( $1.70 \pm 0.44$  kg vs.  $1.35 \pm 0.41$  kg), and BMC ( $0.28 \pm 0.06$  kg vs.  $0.23 \pm 0.06$  kg), respectively, were all significantly different (all  $p < 0.001$ ). **CONCLUSIONS:** Unlike our previous study in which we reported agreement of lateral leg composition measurements in comparison to frontal composition measurements of equal area utilizing the GE iDXA scanner, we did not observe agreement between the two views using the Hologic Horizon A DXA scanner. Therefore, caution should be used when examining leg composition in the lateral view using a Hologic Horizon A DXA scanner.

**C-32 Free Communication/Poster - Motor Control**

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

**1294 Board #56 May 30 10:30 AM - 12:00 PM**  
**Neuromuscular Responses in Lower Limb Bilateral Deficit: A Pilot Study**

M. Travis Byrd, Taylor K. Dinyer, Pasquale J. Succi, Haley C. Bergstrom. *University of Kentucky, Lexington, KY.*  
 Email: mark.travis.byrd@uky.edu  
 (No relevant relationships reported)

**Neuromuscular Responses in Lower Limb Bilateral Deficit: A Pilot Study**

M. Travis Byrd, Taylor K. Dinyer, Pasquale J. Succi, Haley C. Bergstrom  
 University of Kentucky, Lexington, KY  
 The bilateral deficit is the phenomenon in which the sum of the forces produced unilaterally is greater than the force produced bilaterally during maximal contractions of the limbs. **PURPOSE:** This study examined the neuromuscular responses during the measurement of lower limb bilateral and unilateral muscular strength. **METHODS:** Twelve (male: n = 6; female: n = 6) subjects (mean  $\pm$  SD age:  $24.5 \pm 4.8$  yrs, body mass:  $74.2 \pm 14.6$  kg) completed randomized, isometric, seated leg extension bilateral and unilateral maximum voluntary isometric contractions (MVIC). On a separate day, the subjects completed a randomized, bilateral and unilateral dynamic, seated leg extension for the determination of the 1 repetition maximum (1RM) strength. The electromyographic (EMG) and mechanomyographic (MMG) amplitude (AMP) and mean power frequency (MPF) were measured from the vastus lateralis of the right and left lower limbs during the MVIC and 1RM trials, and were normalized to the corresponding signal from the MVIC trials. Statistical analyses included paired samples t-test ( $p \leq 0.05$ ). **RESULTS:** Six of the 12 subjects demonstrated a 1RM bilateral deficit (BLD;  $-9\% \pm 2.9\%$ ). Within the BLD subjects, the EMG MPF was significantly greater ( $p = 0.03$ ) during the unilateral 1RM than the bilateral 1RM, but

EMG AMP, MMG AMP, and MMG MPF were not different (Figure 1). There were no differences between unilateral and bilateral neuromuscular responses for the non-BLD (n = 6) subjects. **CONCLUSION:** These findings indicated the BLD could be due to different motor control strategies, such as changes in muscle fiber conduction velocity, in a bilateral versus a unilateral movement of the lower limbs.

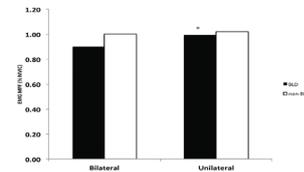


Figure 1. Mean  $\pm$  SD of the bilateral and unilateral (curved) electromyographic mean power frequency (EMG MPF) normalized values during the dynamic, seated leg extension 1RM for the subjects (n = 6) with a 1RM bilateral deficit (BLD) and the subjects (n = 6) with no bilateral deficit (non-BLD). \*Significantly ( $p < 0.05$ ) greater than the bilateral dynamic, seated leg extension 1RM.

**1295 Board #57 May 30 10:30 AM - 12:00 PM**  
**Recommendations For The Evaluation Of The Foot Tapping Test (ftt) In A Healthy Population**

Morgan K. Delp, Brian A. Pribble, Daniel J. Larson, Christopher D. Black, FACSM, Rebecca D. Larson. *University of Oklahoma, Norman, OK.*  
 Email: Morgan.K.Delp-1@ou.edu  
 (No relevant relationships reported)

The foot tapping test (FTT) is a neurological exam used to assess upper-motor neuron (UMN) function in clinical populations. However, little research has been done to determine the best method of conducting the FTT. Furthermore, it is unknown how participant characteristics such as lower limb lean mass may impact the FTT. **PURPOSE:** This study sought to evaluate the reliability of the FTT in a healthy population when using different counting methods and testing conditions, as well as to assess the impact of lower limb muscle mass on tapping rates. This information could be used to establish testing recommendations for the FTT in clinical populations. **METHODS:** Thirty-eight healthy individuals (age 18-63) completed a series of FTT trials over 4 visits. Participants had their foot positioned so that the ball of the foot was over a small force plate and the heel off. They were then instructed to tap as many times as possible over a 10 second period. A total of 32 trials under different conditions (shoes ON, shoes OFF, dom. foot, and non-dom. foot) were performed. A DXA scan was used to measure lower limb mass. Means were compared between trial #, visit #, shoe condition (ON or OFF), dom. vs. non-dom. foot (footedness), and counting method. Correlations between subject characteristics (such as age, activity level, shoe size, weight, height, and lower limb lean mass) and tapping rates were also calculated. **RESULTS:** Significant differences were found between footedness, shoes ON/OFF and in foot taps counted using each counting method ( $p < 0.001$ ). In addition, significant interactions were found between force plate count and shoes ON/OFF ( $p = 0.011$ ), as well as live count and shoes ON/OFF ( $p < 0.001$ ). Live and video counts showed no significant differences; however, force plate counts were significantly lower ( $p < 0.001$ ). Foot tapping rate was not correlated with any of the participant characteristics ( $p > 0.05$ ,  $R < 0.282$  for all). **CONCLUSION:** These results suggest that the FTT should be performed whilst wearing shoes, and measured using the force plate counting method. These conditions were found to be the most accurate for this population, and thus should be used if a force plate is available. Future research should attempt to determine normative FTT rates in clinical and aging populations in order to evaluate the extent that UMN function is affected.

**1296 Board #58 May 30 10:30 AM - 12:00 PM**  
**Sleep Restriction Negatively Influences Visually and Memory-Guided Force Control**

Sarah A. Brinkerhoff<sup>1</sup>, Stephen M. Strayer<sup>2</sup>, Jaimie A. Roper<sup>1</sup>, Anne-Marie Chang<sup>2</sup>, Kristina A. Neely<sup>1</sup>. <sup>1</sup>Auburn University, Auburn, AL. <sup>2</sup>The Pennsylvania State University, State College, PA. (Sponsor: Mark Tillman, FACSM)  
 Email: sab0042@auburn.edu  
 (No relevant relationships reported)

Cognitive performance is negatively influenced by sleep restriction, and athletic performance is improved through sleep extension. However, little work has quantified motor output under rigorous and controlled conditions of sleep restriction. **PURPOSE:** This study examined the effects of sleep restriction on visually and memory-guided grip force control. **METHODS:** Participants (N=9) were inpatients in a sleep restriction study, during which behavioral, physiological, and neuroimaging experiments occurred. Here, we report the results of a grip force task conducted on three days: (D1) after two nights of adequate sleep, (D2) after four consecutive nights of sleep restriction, and (D3) after one night of recovery sleep. Participants completed four

20-s trials of isometric force with their index finger and thumb, to 25% of their maximal voluntary contraction. In the full-vision (FV) condition, visual feedback was provided for the duration of the trial. In the no-vision (NV) condition, visual feedback was provided for the first 8 s of the trial, and then visual feedback was removed. Participants were to maintain force output for the remaining 12 s. RESULTS: In FV, participants produced less mean force on D2 (24.0%) relative to D1 (24.9%) and D3 (25.0%). Mean force did not differ as a function of day in NV. The coefficient of variation was higher on D2 relative to D1 and D3, in both FV (D1: 1.7%, D2: 5.6%, D3: 1.5%) and NV (D1: 5.2%, D2: 5.6%, D3: 5.0%). CONCLUSIONS: These findings are the first demonstrations that restricted sleep negatively impacts force control.

**1297** Board #59 May 30 10:30 AM - 12:00 PM

**The Effect of Muscle Contraction Type on Neuromuscular Complexity in Trained Individuals**

Luis Hernandez, Peter Chomentowski, Clayton L. Camic.  
Northern Illinois University, DeKalb, IL.  
Email: LHernandez6@niu.edu  
(No relevant relationships reported)

Physiological systems exhibit high levels of complexity characterized by non-linearity and persistent fractal correlations (low levels corresponding to states such as disease, injury, and fatigue) and has become recognized as a defining feature of healthy physiological functioning. Neuromuscular complexity is affected by fatigue and intensity of contractions, although no study has investigated the effect of contraction type on complexity.

**Purpose:** The purpose of this study was to investigate the effect of contraction type on neuromuscular complexity.

**Methods:** Twelve collegiate-aged resistance-trained females ( $21 \pm 1$  years,  $63.3 \pm 7.4$  kg) were recruited to visit the laboratory on two occasions, the first for familiarization purposes. In session two, participants performed three maximal knee extensor contractions on an isokinetic dynamometer for each contraction type [concentric (CON), eccentric (ECC), and isometric (ISO)] in random order. Relative knee angle was standardized to  $120^\circ$  during ISO contractions. Angular speed was standardized to  $30^\circ \cdot s^{-1}$  and range of motion to  $90^\circ$  ( $90^\circ - 180^\circ$  at full extension) during CON and ECC contractions. Each contraction lasted three seconds with three seconds rest between contractions. Electromyographic (EMG) signals were recorded from the vastus lateralis using a bipolar electrode configuration. Sample entropy (SE), a unitless measure of statistical irregularity was used as an index of physiological complexity. A one-way repeated measures ANOVA was performed to investigate differences in EMG SE among contraction types. Alpha level was set to 0.05.

**Results:** Contraction type was observed to have a significant effect on EMG SE ( $F(2,22) = 7.212, p = 0.004$ ). Specifically, CON contractions ( $1.671 \pm 0.193$ ) displayed significantly greater EMG SE than ECC ( $1.497 \pm 0.321, p = 0.017$ ) and ISO ( $1.569 \pm 0.223, p = 0.028$ ) contractions.

**Conclusion:** These findings indicated that neuromuscular complexity is contraction-type dependent, being significantly higher during CON than ECC and ISO contractions. In addition, there exists no generally accepted framework to explain the underlying factors regulating complexity and thus, further investigation may provide valuable insight into these potential mechanisms.

**1298** Board #60 May 30 10:30 AM - 12:00 PM

**Reliability of Motor Unit Behavior during a Maximal Voluntary Isometric Contraction of the Knee Extensors**

Ryan J. Colquhoun, Patrick M. Tomko, Mitchel A. Magrini, Sydney R. Fleming, Matthew C. Ferrell, Nile F. Banks, Trey Gradnigo, Nathaniel D.M. Jenkins. Oklahoma State University, Stillwater, OK.  
(No relevant relationships reported)

**PURPOSE:** To establish the intra- and inter-day reliability of the mean firing rate (MFR) versus recruitment threshold (RT) of the vastus lateralis (VL) during a maximal voluntary isometric contraction (MVIC) of the knee extensor muscle. **METHODS:** Thirty-two young, healthy males (Mean  $\pm$  SD; Age:  $23 \pm 3$  years; Height:  $176.4 \pm 5.9$  cm; Weight:  $87.3 \pm 13.4$  kg) reported to the laboratory on three separate occasions, each separated by  $6 \pm 1$  days. Each visit occurred at the same time of day ( $\pm 1$  hour) and consisted of MVIC testing and ramp contractions, during which MU behavior was recorded. Specifically, subjects completed 2 MVIC attempts each separated by approximately 2 min., in the subject's maximal force ( $F_{MAX}$ ) was obtained. Following an additional 2 minutes of rest, subjects completed 2 maximal ramp contraction, each separated by 2 minutes of rest, during which MU behavior was recorded through surface electromyography (sEMG). The ramp contraction trajectory consisted of a 3 second quiescent period, followed by a 10 second linear increase to  $F_{MAX}$ , a 6 second hold at  $F_{MAX}$ , a 5 second linear decrease back to baseline and another 3 second quiescent period. Both relative intra- and inter-day reliability of the MFR versus RT relationship were examined using the intra-class correlation coefficients ( $ICC_{2,1}$ ). The standard error of measurement (SEM) was calculated as the square root of the mean square error term from the ANOVA table and expressed in

the units of measurement. The coefficient of variation (CV) was also calculated by expressing the SEM relative to the grand mean (%). **RESULTS:** For intra- and inter-day analyses, 16 and 20 subjects met the inclusion criteria and were included in final analyses, respectively. Both intra- and inter-day reliability statistics are presented in Table 1. **CONCLUSIONS:** The MFR versus RT relationship of the VL demonstrates strong intra- and inter-day reliability during a maximal voluntary contraction in young, healthy men.

	Intra-Day (n = 16)		Inter-Day (n = 20)	
	Slope	Y-Intercept	Slope	Y-Intercept
Mean 1 (SD)	-0.32 (0.12)	30.0 (8.1)	-0.31 (0.10)	30.2 (7.6)
Mean 2 (SD)	-0.31 (0.09)	30.6 (7.3)	-0.30 (0.09)	30.2 (7.9)
Sig.	0.793	0.638	0.677	0.984
ICC	0.802	0.783	0.813	0.800
95% CI	0.518-0.926	0.482-0.918	0.525-0.926	0.486-0.921
SEM	-0.04	3.65	-0.05	4.55
CV	14.2%	12.1%	18.1%	15.1%

**1299** Board #61 May 30 10:30 AM - 12:00 PM

**A Comparison of Motor Unit Control Strategies Between Two Different Isometric Muscle Actions**

Sunggun Jeon, Xin Ye, William Miller. University of Mississippi, University, MS.  
Email: sjeon3@go.olemiss.edu  
(No relevant relationships reported)

The isometric muscle action is primarily responsible for performing two different tasks: attempting to shorten the muscle against an immovable object, and maintaining a fixed posture/joint position while resisting the lengthening inertial imposed by an external load. **PURPOSE:** To compare the motor unit control strategies between the two different tasks with similar mechanical requirements. **METHOD:** Twelve healthy men (Age:  $23.7 \pm 3.9$  years; Weight:  $84.8 \pm 12.1$  kg; Height:  $172.8 \pm 5.7$  cm) and seven women (Age:  $21.1 \pm 1.6$  years; Weight:  $73.4 \pm 15.6$  kg; Height:  $164.3 \pm 3.9$  cm) participated in this study. After the first visit as the familiarization, Visits 2 and 3 were randomly sequenced for force task and position task experimental testing. During both visits, maximal voluntary isometric contraction (MVIC) was measured, followed by the designated submaximal isometric trapezoid contraction task. Specifically, the force task required the participants to gradually increase the force from 0 to 40% MVIC in 4 seconds, held it for 10 seconds, and then gradually decreased the force to 0% in 4 seconds. For the position task, the participants were required to maintain a constant position, and to resist against the pulling force, created by the investigator with the same rate and intensity as those during the force task. Surface EMG signals from the biceps brachii muscle were collected and decomposed into constituent motor unit action potential trains. The relationship between the motor unit recruitment threshold and average firing rate, and between the recruitment and derecruitment thresholds were examined using linear regression analyses. **RESULTS:** Paired samples t-tests showed no significant differences between two tasks for the mean slope coefficient ( $-0.51 \pm 0.34$  vs.  $-0.58 \pm 0.29, p = 0.515$ ) and y-intercept ( $24.80 \pm 12.37$  vs.  $26.59 \pm 9.43, p = 0.589$ ) for the recruitment threshold vs. average firing rate relationship. In addition, the mean slope coefficient ( $1.23 \pm 0.76$  vs.  $1.62 \pm 0.78, p = 0.125$ ) and y-intercept ( $-12.98 \pm 23.54$  vs.  $-18.98 \pm 13.45, p = 0.391$ ) were also not different between two tasks for the relationship between recruitment and derecruitment thresholds. **CONCLUSION:** The motor unit control strategies did not seem to differ between the two submaximal isometric muscle actions.

**1300** Board #62 May 30 10:30 AM - 12:00 PM

**Badminton Players Show A Lower Coactivation And Higher Beta Band Emg-emg Coupling Between Antagonist Muscles**

Lejun Wang<sup>1</sup>, Wenxin Niu<sup>1</sup>, Jingyuan Chen<sup>1</sup>, Shengnian Zhang<sup>2</sup>, Li Li, FACSM<sup>3</sup>, Tianfeng Lu<sup>1</sup>. <sup>1</sup>Tongji University, Shanghai, China. <sup>2</sup>Shanghai University of Sport, Shanghai, China. <sup>3</sup>Georgia Southern University, Statesboro, GA.  
(No relevant relationships reported)

**PURPOSE:** Previous studies have suggested that skilled athletes may show a specific muscle activation pattern with a lower antagonist coactivation level. Based on the point, we hypothesize that the coupling of antagonistic muscles may be different between elite badminton players and non-skilled individuals during exercises. The current work was designed to verify the hypothesis.

**METHODS:** Ten male college students and eight male badminton players performed three maximal voluntary isometric contractions (MVIC) and a set of three maximal concentric ankle dorsiflexion and plantar flexion at angular velocity of  $30^\circ, 60^\circ, 120^\circ$

and 180%. Surface EMG were recorded from the tibialis anterior (TA) and lateral gastrocnemius (LG) muscles during the test. Normalized average amplitude of the integrated EMG and phase synchronization index (PSI) between the EMG of TA and LG were calculated.

**RESULTS:** Antagonist muscle coactivation were significantly lower ( $22.1\% \pm 9.4\%$ ,  $24.7\% \pm 12.8\%$ ,  $22.4\% \pm 9.4\%$ ,  $22.4\% \pm 9.7\%$  for non-players and  $10.7\% \pm 3.7\%$ ,  $10.1\% \pm 4.9\%$ ,  $11.2\% \pm 2.5\%$ ,  $10.6\% \pm 2.5\%$  for badminton players in four angular velocity speed,  $P < 0.05$  for four group comparison) and PSI in beta frequency band were significantly higher ( $0.42 \pm 0.06$ ,  $0.36 \pm 0.13$ ,  $0.36 \pm 0.10$ ,  $0.35 \pm 0.12$  for non-players and  $0.47 \pm 0.15$ ,  $0.47 \pm 0.15$ ,  $0.48 \pm 0.11$ ,  $0.49 \pm 0.14$  for badminton players in four angular velocity speed,  $P < 0.05$  for four group comparison) in badminton players group compared to non-players group during isokinetic ankle dorsiflexion contraction, while no significant difference was found in antagonist muscle coactivation and PSI between two group subjects during ankle plantar flexion.

**CONCLUSIONS:** The decrease of antagonist coactivation may indicate an optimal motor control style to increase the contraction efficiency, while the increase coupling of antagonistic muscles may be related to the compensation of joint stability as a result of the decrease of antagonist coactivation.

**1301 Board #63 May 30 10:30 AM - 12:00 PM**  
**Does Strict Validation Criteria for Individual Motor Units Alter Extrapolation Analyses of the Motor Unit Pool?**

Jesus A. Hernandez-Sarabia, Alejandra Barrera-Curiel, Ryan J. Colquhoun, Jason M. DeFreitas. *Oklahoma State University, STILLWATER, OK.*  
 Email: jesusah@okstate.edu  
 (No relevant relationships reported)

Recent technology allows for motor units (MU) action potentials (AP) to be acquired from multi-electrode surface EMG decomposition. Due to the high yield of MUs, this technology can be used to extrapolate findings for the entire MU pool (e.g. the relationship between mean firing rate (MFR) and recruitment threshold (RT)). However, it is unknown if characteristics of individual MUs affect extrapolation to the pool. **PURPOSE:** To have decomposed MU trains undergo strict validation based on interspike interval (ISI) variability, and to determine if analyses are affected if limited to only the validated MUs. **METHODS:** Five subjects performed 1 maximal ramp contraction of 15 sec. MU APs were obtained using a 5-pin array placed over the vastus lateralis. Two samples of MUs were used for analyses: an original (ORG) and a validated yield (VAL). ORG consisted of MUs that demonstrated >90% accuracy using the Decompose-Synthesize-Decompose-Compare test. VAL consisted of MUs from ORG that met further, strict criteria of ISI variability and histogram shape. All VAL MUs had a coefficient of variation (COV) < 30%, with an ISI histogram demonstrating a unimodal, kurtotic shape, absent of excess (> 2) counts in regions that represent missed or additional firings. Slope and intercept values were calculated for the MFR/RT relationship from ORG and VAL for each subject. Pedhazur's test for comparing regression equations was used to determine if the regression coefficients changed for each subject. **RESULTS:** 54% of the ORG MUs passed the validation. The COVs of the validated MUs ( $M \pm SD$ ;  $22.5 \pm 2.3\%$ ) were significantly ( $p < .001$ ) lower than the discarded MUs ( $26.2 \pm 3.4\%$ ). There were no significant differences in the regression coefficients between the two outputs for any of the subjects (Table 1). **CONCLUSION:** When using the outputs from a high-yield of MUs to extrapolate to the entire MU pool, strict validation criteria of individual MU firings does not alter the outcome of the analyses.

Table 1.  
 Simple regression coefficients of original (O) vs. validated (V) motor units

	Recruitment Threshold vs. Mean Firing Rate					
	Slopes			Intercepts		
	O	V	p	O	V	p
S01	-0.54	-0.73	0.36	40.93	51.22	0.38
S02	-0.21	-0.24	0.33	22.11	23.21	0.91
S03	-0.74	-0.82	0.68	53.35	57.38	0.67
S04	-0.75	-0.67	0.47	53.01	49.64	0.24
S05	-0.25	-0.24	0.92	24.01	24.06	0.70

**1302 Board #64 May 30 10:30 AM - 12:00 PM**  
**Differences In Biomechanical And Electromyographic Strategies Between Young And Old Persons During The Timed Up-and-go**

Lawrence Villanueva, Keri Strand, Jeonghoon Oh, Moataz Eltoukhy, Jordan Strnad, Kevin Posner, Nathaniel Strand, Lauren Catena, Joseph F. Signorile. *University of Miami, Miami, FL.*  
 (Sponsor: Dr. Kevin Jacobs, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** The timed-up-and-go (TUG) is one of the most common tests used to assess functional mobility. Although researchers have examined strategies used by specific groups in completing the turning component of the test, none have analysed electromyographical (EMG) activity. This study compared ground reaction force (GRF) vectors and EMG of the medial (MGas) and lateral (LGas) heads of the gastrocnemius, the vastus medialis (VM) and vastus lateralis (VL) during the turning component of the TUG. **METHODS:** Eight old (OG:  $69.8 \pm 7.3$  y) and 10 young (YG:  $21.5 \pm 2.6$  y) subjects performed three trials of the TUG. Force plates were positioned behind the cone to allow GRF collection, while EMG was simultaneously collected on the MGas, LGas, VM and VL using telemetry. EMG values during the turn were normalized using values during the approach. Subjects were instructed to perform the task as rapidly as possible. **RESULTS:** An ANCOVA covarying for subjects' weight revealed a significant difference in medio-lateral force vectors in the direction of the cone by age for the left ( $p = .033$ ;  $\eta^2 = .348$ ) and right ( $p = .001$ ;  $\eta^2 = .348$ ) leg stance phase. Pairwise comparisons showed the values were higher for the YG versus OG (right:  $Mdiff = 250.2 \pm 106.5$  N; left:  $Mdiff = 97.5 \pm 23.2$  N). These differences were also reflected in the analysis of vertical force to mediolateral force ratios on each side (right:  $p = .023$ ,  $\eta^2 = .298$ ; left:  $p = .005$ ,  $\eta^2 = .419$ ) and pairwise comparisons (right:  $Mdiff = 1.62 \pm .64$ ; left:  $Mdiff = 2.07 \pm .63$ ). Multivariate analysis of the nEMG data for the right and left LGas, MGas, VL, and VM showed a single significant difference with YG having lower utilization than their OG counterparts ( $Mdiff = .397 \pm .149$ ,  $p = .018$ ). **CONCLUSION:** Although the YG showed larger lateral GRF vectors toward the cone than OG, the lack of difference between groups for all but one muscle during the turn indicates that factors other than greater muscle activation appear to have allowed this strategy.

**1303 Board #65 May 30 10:30 AM - 12:00 PM**  
**Knee Proprioception Measurement Reliability and its Relationship to Single Leg Reach Distance**

Megan M. Walters, Cody M. Ballay, Cruz A. Finnicum, Chelsea L. Jentsch, Orion J. Swanson, Daniel R. Richie, Ajit MW Chaudhari, FACSM. *The Ohio State University, Columbus, OH.*  
 (No relevant relationships reported)

Improving knee proprioception is often recommended in rehabilitation after knee injuries. The best technique or tool for measuring knee proprioception is not yet identified. Additionally, evidence suggesting the role of proprioception in mechanics and injury risk is mixed, requiring further investigation. **PURPOSE:** To evaluate the validity and reliability of an inertial measurement unit (IMU) based clinical tool to assess knee proprioception, and to determine the association between proprioception and dynamic function. **METHODS:** Active joint position sense (JPS) was measured using an IMU-based tool (CoreX Therapy Pro, CX) and Biodex System III in 29 healthy participants (18F, aged 22-27y) with no current knee pain or prior knee surgery. For JPS on the Biodex, seated participants extended their knee and then flexed to 30° and held for 5s to learn the position. They extended the knee, and then matched the position as best they could. One practice and 5 trials were recorded. A similar procedure was completed for CX but testing was completed standing on the non-test leg. The anterior component of the Y-balance test was performed with heel down and hands on hips while standing on the test leg. Five recorded trials after 1 practice were averaged and normalized to leg-length. Intra-class correlation coefficients were calculated to establish within-session reliability of each proprioception measurement and Pearson correlation coefficients were used to assess the associations between proprioception and reach distance. **RESULTS:** The middle 3 values of each JPS measurement were averaged. Intra-session reliability of CX ( $ICC(2,k) = 0.800$ ) and Biodex ( $ICC(2,k) = 0.813$ ) were both good. However, agreement between CX and Biodex measurements was poor ( $ICC(2,1) = 0.083$ ). Neither the Biodex ( $r = 0.174$ ) nor CX ( $r = -0.198$ ) correlated with single-leg reach distance. **CONCLUSIONS:** After analyzing the differences between CX and Biodex measurements, we conclude the tools are assessing different aspects of proprioception. Additionally, knee proprioception does not appear to be the primary limiting factor in single-leg reaching. More research should be done to determine test-retest reliability of CX and Biodex and better understand the relationships between knee proprioception and knee function.

THURSDAY, MAY 30, 2019

**1304** Board #66 May 30 10:30 AM - 12:00 PM  
**The Motor Unit Mean Firing Rate versus Recruitment Threshold Relationship is Unaffected by Short-Term Disuse**

Rob J. MacLennan, David Ogilvie, John McDorman, Ernest Vargas, Nathan Becker, Ethan Davis, Michael Sahebi, Matt S. Stock. *University of Central Florida, Orlando, FL.*  
 Email: robjmaclelland@gmail.com

(No relevant relationships reported)

The loss of muscle strength during periods of disuse is rapid. Some investigators have postulated that these changes are due to neural, rather than muscular, adaptations. It is unclear, however, if short-term immobilization of the knee joint affects the voluntary control of motor units. **PURPOSE:** To determine whether the slope and y-intercept of the motor unit mean firing rate versus recruitment threshold relationship is altered by 72 hours of disuse. **METHODS:** Fifteen healthy females (mean  $\pm$  SD age = 21  $\pm$  2 years, body mass index [BMI] = 23.1  $\pm$  2.3 kg/m<sup>2</sup>) voluntarily underwent left knee joint unloading via ambulating on crutches and use of a brace. The brace was worn at all times except during sleep, and compliance was confirmed via accelerometers secured around both ankles. Following two extensive familiarization sessions at the laboratory, testing was performed immediately prior to immobilization (PRE) and 72 hours later (POST). During both testing sessions, participants performed trapezoidal isometric contractions at a torque level corresponding to 50% of their maximal voluntary contraction (MVC). Participants were instructed to increase torque from 0 to 50% in five seconds, maintain 50% MVC for 15 seconds, and decrease torque from 50% to 0 in five seconds. Bipolar surface electromyographic (EMG) signals were recorded from the vastus lateralis. A surface EMG signal decomposition algorithm was used to calculate the mean firing rate (pulses per second [pps]) and recruitment threshold (% MVC) of each detected motor unit. Motor units with decomposition accuracy levels < 90% were discarded. Linear regression was then used to quantify the slope (pps/% MVC) and y-intercept (pps) of each relationship. **RESULTS:** Immobilization had no influence on the linear slope coefficient for the mean firing rate versus recruitment threshold relationship (PRE = -0.362  $\pm$  0.127, POST = -0.399  $\pm$  0.108 pps/%MVC;  $p$  = 0.413,  $d$  = 0.218). Similarly, no change in the y-intercept was observed (PRE = 23.2  $\pm$  2.8, POST = 23.3  $\pm$  4.0 pps;  $p$  = 0.972,  $d$  = 0.009) **CONCLUSION:** Our findings demonstrated that 72 hours of knee joint immobilization in healthy females had little influence on vastus lateralis motor unit control during submaximal contractions.

**Funding:** The De Luca Foundation and the UCF Office of Research's Advancement of Early Career Researchers program

**1305** Board #67 May 30 10:30 AM - 12:00 PM  
**Aging and Altered Brain Activation during Isometric Contractions with the Lower Limb**

Tejin Yoon<sup>1</sup>, Marnie L. Vanden Noven<sup>2</sup>, Sandra K. Hunter, FACSM<sup>3</sup>. <sup>1</sup>Kangwon National University, Chuncheon, Korea, Republic of. <sup>2</sup>Belmont University, Nashville, TN. <sup>3</sup>Marquette University, Milwaukee, WI. (Sponsor: Sandra Hunter, FACSM)  
 Email: tyoon@kangwon.ac.kr

(No relevant relationships reported)

Many daily tasks require maintenance of steady contractions of limb muscles which are more challenging for older adults possibly due to the age-related changes of the brain. **PURPOSE:** The purpose of this study was to determine intensity and patterns of brain activation in healthy old and young adults during isometric target-matching contractions of the ankle dorsiflexors using functional magnetic resonance imaging (fMRI). **METHODS:** Twenty-one young adults (11 males, 24.7  $\pm$  7.9 years) and 24 older adults (12 males, 69.6  $\pm$  6.4 years) performed three sets of 16-s isometric contractions at 10, 30, 50 and 70% of maximal voluntary contraction of the right ankle dorsiflexor muscles while lying supine in a 3.0 T MRI scanner. Each 16-s contraction was followed by 60 s of rest. Force steadiness was quantified as the coefficient of variation (CV=standard deviation/mean $\times$ 100%) of force. Percent signal changes (PSCs, %) of the blood oxygenation level-dependent response for each contraction was extracted using region of interest analysis. Pearson product-moment correlations were used to determine the relationships between the force steadiness and the PSCs. **RESULTS:** Older adults were weaker ( $p$ <0.05) and less steady ( $p$ <0.01) than young adults. A total of 21 cortical and subcortical areas were identified as task-related regions. PSCs in some regions including paracentral lobule (primary motor area of dorsiflexors) and cerebellum increased linearly with contraction intensity and were greater for older adults ( $p$ <0.05). PSCs in precentral gyrus and cerebellum were associated with the force steadiness in older adults ( $r$ =-2.7 and -0.39 respectively,  $p$ <0.05). **CONCLUSION:** Older adults exhibited greater brain activation than young adults while maintaining the same intensity of contraction with the ankle dorsiflexor muscles. In addition, the age-related changes in brain activation were related to the impaired steadiness suggesting that aging alters brain activation when performing target matching submaximal contractions of the distal lower limb muscles.

**1306** Board #68 May 30 10:30 AM - 12:00 PM  
**Acute Effects of Transcranial Direct Current Stimulation on Knee Extensor Torque-Producing Capabilities**

Carlos A. Estrada, Tyler W.D. Muddle, Cameron S. Mackey, Masoud Moghaddam, Jason M. DeFreitas, Bert H. Jacobson, FACSM. *Oklahoma State University, Stillwater, OK.* (Sponsor: Bert H. Jacobson, FACSM)

(No relevant relationships reported)

Transcranial direct current stimulation (tDCS) is a method of neuromodulation aimed to increase cortical excitability. Recently, tDCS has been utilized as a modality treatment in various medical conditions (e.g. stroke rehabilitation); however, few investigations have examined its effect on motor function.

**PURPOSE:** To examine the acute effects of tDCS on torque producing capabilities of the knee extensors.

**METHODS:** Thirty-two recreationally active females (Age = 21.8  $\pm$  2.6; Height = 165.3  $\pm$  6.3cm; Weight = 68.1  $\pm$  11.6kg) participated in this single-blind investigation. Participants were required to report to the laboratory on two separate occasions to receive two randomized conditions, tDCS or sham stimulation. During the initial visit, participants were familiarized with maximal voluntary isometric knee extension (MVIC; 120° knee extension) testing procedures via an isokinetic dynamometer, which was utilized to assess peak torque (PT) and peak rate of torque development (pRTD). Subsequently, participants underwent a 5-minute low-intensity warm-up via a cycle ergometer prior to data acquisition. Participants performed two MVICs with a 2-minute rest period between contractions. Following initial isometric testing procedures, participants were outfitted with a set of commercially available headphones designed to deliver tDCS to the primary motor cortex for a duration of 21 minutes, during which, they performed various low-intensity dynamic movements. Participants then completed an additional series of MVICs identical to pre-testing following "stimulation".

**RESULTS:** Two separate 2x2 (time x condition) repeated-measures ANOVAs were conducted to assess differences in pre- to post-stimulation PT and pRTD within conditions. No differences were observed in PT for either condition ( $p$  > 0.05). pRTD revealed no interaction effect ( $p$  > 0.05); however, a main effect of time was observed ( $F_{1,31} = 9.97$ ,  $p = .004$ ). Follow-up paired-samples t-tests revealed decreases in pRTD from pre- to post-stimulation within the tDCS condition ( $t_{31} = 2.643$ ,  $p = 0.013$ ).

**CONCLUSIONS:** Although tDCS does not appear to alter PT production, our findings suggest that tDCS may negatively affect an individual's ability to rapidly produce force.

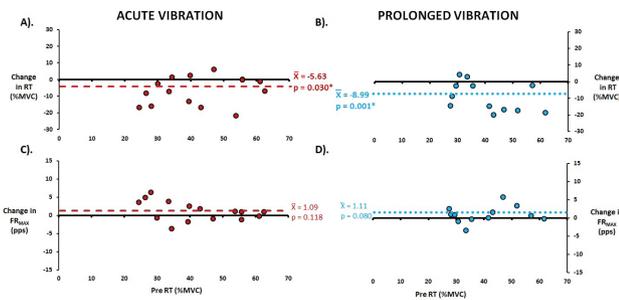
**1307** Board #69 May 30 10:30 AM - 12:00 PM  
**Effects of Brief and Prolonged Vibration on Longitudinally Tracked Motor Units**

Alejandra Barrera Curriel, Ryan J. Colquhoun, Jesus A. Hernandez-Sarabia, Jason M. DeFreitas. *Oklahoma State University, Stillwater, OK.*  
 Email: ale.barrera\_curriel@okstate.edu

(No relevant relationships reported)

Vibration applied to the muscle has been shown to manipulate the sensitivity of muscle spindles by either facilitation (brief vibration less than 25 seconds) or depression (prolonged vibration 20 minutes). These effects have been reported on averaged motor unit (MU) behavior properties, which could result in incorrect interpretations.

**PURPOSE:** To analyze the effects of altered stretch reflex sensitivity on individual motor units that have been longitudinally tracked. **METHODS:** Twenty-four young participants (25  $\pm$  6 years) performed 1 maximal knee extension under 3 conditions: control, brief vibration, and prolonged vibration. Multi-channel EMG was recorded from the vastus lateralis and decomposed in to MU action potential trains. Cross-correlation of action potential shapes were used to longitudinally track the same MUs across the 3 conditions. **RESULTS:** Surprisingly, a significant decrease in recruitment thresholds was seen after both acute (-5.63%;  $p = 0.03$ ) and prolonged (-8.99%;  $p = 0.001$ ) vibration. **CONCLUSION:** It is possible that altering muscle spindle activity results in an altered motor unit recruitment pattern.



VL muscles of both legs were recorded simultaneously during each repetition of the fatiguing bout. The EMG RMS, EMG MPF, MMG RMS, and MMG MPF were normalized to their corresponding maximal isometric voluntary contraction values and torque values were normalized to maximal bilateral isokinetic concentric peak torque values at 180°·s<sup>-1</sup>. The repetitions were normalized to each 10% of the total number of repetitions completed. Four, 2 (right and left VL) x 10 (10-100% of the total repetitions) repeated measures ANOVAs were used to determine mean differences for each neuromuscular parameter. A 1 x 10 repeated measures ANOVA was used to examine torque production. Post-hoc Student Newman-Keuls was used to identify when the neuromuscular and torque values changed from the values at 10% of the total repetitions. **Results:** The results demonstrated no significant interactions involving the right and left VL muscles or main effects for repetitions for any of the neuromuscular parameters. The maximal bilateral peak torque (311.4 ± 51.2 N·m) decreased significantly ( $p < 0.01$ ;  $\eta^2 = 0.688$ ) at 90% of the total repetitions. **Conclusion:** The results of the present study demonstrated no differences between the right and left VL muscles for their patterns of neuromuscular responses during the fatiguing bilateral leg extensions. While peak torque decreased, no changes occurred for any of the neuromuscular parameters across the repetitions. Therefore, the current findings suggested that the decrease in torque production was due to peripheral mechanisms of fatigue and not a decrease in central neural drive to the muscles.

**1308** Board #70 May 30 10:30 AM - 12:00 PM  
**Vastus Lateralis Motor Unit Recruitment Thresholds in Younger Versus Older Men**  
 Ryan Girts<sup>1</sup>, Jacob A. Mota<sup>2</sup>, Kylie K. Harmon<sup>1</sup>, Rob J. MacLennan<sup>1</sup>, Matt S. Stock<sup>1</sup>. <sup>1</sup>University of Central Florida, Orlando, FL. <sup>2</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC.  
 Email: ryangirts@knights.ucf.edu  
 (No relevant relationships reported)

Aging results in a variety of muscular adaptations which may affect the recruitment of motor units. **Purpose:** We sought to determine if younger and older men recruit motor units at similar isometric force levels. **Methods:** Twelve younger (age = 25 ± 3 years, mass = 65.2 ± 8.9 kg, height = 1.72 ± 0.1 m) and twelve older (mean ± SD age = 75 ± 8 years, mass = 78.9 ± 10.2 kg, height = 1.74 ± 0.1 m) men performed trapezoidal isometric contractions of the dominant knee extensors at a force level corresponding to 50% maximal voluntary contraction (MVC). Bipolar surface electromyographic (EMG) signals were detected from the vastus lateralis during each contraction. A surface EMG signal decomposition algorithm was then used to quantify the recruitment threshold of each detected motor unit, which was defined as the isometric force level corresponding to the first firing. Recruitment thresholds were calculated in both relative (% MVC) and absolute (N) terms. Motor units with accuracy levels < 93.0% were not considered for analysis. **Results:** The mean ± SD number of motor units detected was 17 ± 5 for younger and 13 ± 4 for older men. MVC force was significantly greater in younger vs. older men (709.6 ± 197.8 vs. 520.8 ± 121.6 N [ $p = 0.010$ ; Cohen's  $d = 1.15$ ]). The relative median recruitment threshold values were significantly greater for younger (26.6 ± 9.1% MVC) compared to older (15.6 ± 7.9% MVC [ $p = 0.005$ ;  $d = 1.29$ ]) men. Younger men also demonstrated greater median recruitment threshold values when expressed in absolute terms (198.0 ± 99.2 vs. 81.2 ± 43.0 N [ $p = 0.001$ ;  $d = 1.53$ ]). Similarly, large differences in the mean recruitment thresholds were found when expressed in both relative (25.9 ± 7.7 vs. 16.2 ± 7.8% MVC [ $p = 0.005$ ;  $d = 1.27$ ]) and absolute (191.4 ± 87.5 vs. 85.1 ± 44.9 N [ $p = 0.001$ ;  $d = 1.53$ ]) terms. The relative recruitment threshold range was not significantly different between younger (22.6 ± 9.5% MVC) and older (18.5 ± 6.4% MVC [ $p = 0.235$ ;  $d = 0.50$ ]) men. However, the absolute range was considerably larger for younger (167.6 ± 92.4 N) compared to older (95.7 ± 36.5 N [ $p = 0.020$ ;  $d = 1.02$ ]) men. **Conclusion:** Older men tend to recruit motor units at lower force levels. We speculate that motor unit recruitment threshold compression may be a neural adaptation that serves to compensate for denervation and subsequent re-innervation in aged muscle.

**1309** Board #71 May 30 10:30 AM - 12:00 PM  
**Time Course of Changes in Neuromuscular Parameters During Maximal Bilateral Dynamic Muscle Actions**  
 John Paul V. Anders, Corey M. Smith, Ethan C. Hill, Joshua L. Keller, Terry J. Housh, FACSM, Richard J. Schmidt, Glen O. Johnson, FACSM. University of Nebraska- Lincoln, Lincoln, NE.  
 (Sponsor: Terry Housh, FACSM)  
 Email: janders@huskers.unl.edu  
 (No relevant relationships reported)

**Purpose:** The purpose of the present study was to identify the time course of changes in neuromuscular parameters from the vastus lateralis (VL) muscles during fatiguing, bilateral, maximal isokinetic leg extensions. **Methods:** Fifteen men (22.3 ± 3.3 yr) performed consecutive, maximal, bilateral, concentric isokinetic leg extensions at 180°·s<sup>-1</sup> until their peak torque was reduced by 50% (53 ± 17 repetitions). The amplitude (root mean square = RMS) and frequency (mean power frequency = MPF) contents of electromyographic (EMG) and mechanomyographic (MMG) signals from the

**1310** Board #72 May 30 10:30 AM - 12:00 PM  
**Is the Mean Firing Rate versus Recruitment Threshold Relationship Linear?**  
 Kylie K. Harmon, Ryan M. Girts, Robert J. MacLennan, Matt S. Stock. University of Central Florida, Orlando, FL.  
 (No relevant relationships reported)

Advances in surface electromyographic (EMG) signal decomposition now allow investigators to analyze firing rate data for 20-50 motor units per contraction. To simplify data interpretation, some investigators have relied on group mean analysis of the mean firing rate versus recruitment threshold relationship. It is unclear, however, whether this association is consistently linear. **Purpose:** To determine whether the motor unit mean firing rate versus recruitment threshold relationship is strongest when analyzed via linear, quadratic, or cubic regression. **Methods:** Twenty-one men (mean ± SD age = 24 ± 4 years) participated in this study. After determining maximal voluntary contraction (MVC) force of the dominant knee extensors, participants performed trapezoidal isometric contractions at 50% MVC by tracing a visual template displayed on a monitor directly in front of them. Participants were instructed to increase force from 0 to 50% in five seconds, maintain 50% MVC for 15 seconds, and decrease force from 50% to 0 in five seconds. Bipolar surface EMG signals were recorded from the vastus lateralis during each contraction. A surface EMG signal decomposition algorithm was used to calculate mean firing rate and recruitment threshold of each detected motor unit. Motor units with decomposition accuracy levels < 90% were discarded. Polynomial regression was used to determine if each mean firing rate versus recruitment threshold relationship was best fit with a linear, quadratic, or cubic model. Data were interpreted on an individual participant basis. **Results:** Statistically significant ( $p < .05$ ) moderate to strong ( $r^2 = .599-.964$ ) linear relationships existed for all 21 participants. Fourteen of the 21 participants demonstrated relationships that were best fit with a linear model ( $r^2 = .599-.964$ ). Of the remaining seven participants, five were best fit with a quadratic model ( $r^2 = .864-.953$ ) and two were best fit with a cubic model ( $r^2 = .977-.989$ ). **Conclusion:** While moderate to strong linear relationships were found between the firing rate of motor units and their recruitment thresholds for all participants, in certain cases the strength of the association was enhanced when analyzed via a non-linear model. Our findings provide further support for the need to examine motor unit data on a participant-by-participant basis.

**1311** Board #73 May 30 10:30 AM - 12:00 PM  
**Electromyographic Analysis of the Intensity Progression of Mat Pilates Exercises**  
 Paula Finatto. Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil. (Sponsor: Rafael Escamilla, FACSM)  
 Email: paula.finatto@hotmail.com  
 (No relevant relationships reported)

Studies evaluating the electromyographic activation (EMG) of spine flexor muscles during Pilates exercises (PE) concluded that EMG is different among abdominal exercises, even when classified in the same intensity category. **PURPOSE:** To compare EMG of spine extensors, flexors and rectus femoris in seven mat PE among basic (B), intermediate (I) and advanced (A) variations. **METHODS:** The EMG of upper rectus abdominis (URA), lower rectus abdominis (LRA), external oblique (EO), internal oblique (IO), rectus femoris (RF) and multifidus were assessed for the Roll Up (RU), Single Leg Stretch (SLS), Double Leg Stretch (DLS), Hundred (HD), and Rolling Like a Ball (RLB) exercises in B, I, and A. Also evaluated in I and A were Double

Straight Leg Stretch (DLS) and Single Straight Leg Stretch (SLS). EMG results were expressed as a percentage of maximum voluntary isometric contraction. One-way ANOVA with repeated-measures was used ( $\alpha < 0.05$ ) to compare the three variations. **RESULTS:** In HD exercise, LRA and IO EMG was significantly less ( $p < 0.01$ ) in B variation (48.5% and 41.1%, respectively) than I (68.7% and 68.5%, respectively) and A (75.1% and 80.7%, respectively), and EO EMG was significantly greater ( $p < 0.01$ ) in A (63.4%) compared to B (39.8%), while I (54.2%) was equal to A and B. In RU exercise, URA EMG was significantly greater ( $p = 0.04$ ) in A (43.8%) than B (34.9%). In DLS exercise, LRA EMG was significantly less ( $p < 0.01$ ) in B variation (43.7%) than I (53.2%) and A (66.8%), EO EMG was significantly greater ( $p < 0.01$ ) in A (57.7%) than B (36.1%), and IO EMG was significantly greater ( $p < 0.01$ ) in A (73.5%) than B (39.7%) and I (55.5%). In SLS exercise, LRA, IO and OE EMG were significantly less ( $p < 0.01$ ) in B (35.5%, 37.4% and 41.5%, respectively) than A (55%, 52.4% and 61.1%, respectively). In DLS exercise, EO and RF EMG were significantly greater ( $p = 0.04$ ) in A (81.6% and 29.3%, respectively) than I (71.7% and 23.29%, respectively). In SLS and RLB exercises, no significant differences were found among B, I, and A. **CONCLUSION:** The higher URA EMG may be more related to upper limb positions while higher LRA, EO and IO EMG may be more related to lower limb positions and changes greater than 45° of raising or lowering lower or upper limbs seems to be necessary. Supported by Capes and CNPq.

**1312** Board #74 May 30 10:30 AM - 12:00 PM  
**Neural And Contractile Determinants Of Rate Of Force Development: A Preliminary Analysis**

Mitchel A. Magrini, Ryan Colquhoun, Nathaniel Jenkins, Jason DeFreitas. *Oklahoma State University, Stillwater, OK.*  
 (No relevant relationships reported)

Neural and contractile factors have been suggested as important determinants for different phases of the rate of force development (RFD). **PURPOSE:** To examine the influence of rate of muscle activation, motor nerve conduction velocity (CV) and motor unit number estimation (MUNE) of the vastus lateralis on early and late phase RFD. **METHODS:** Fifteen males (age = 23 ± 3 y) completed 2 maximal (MVIC) and rapid (rMVIC) voluntary isometric contractions. Participants were instructed to kick out as hard as possible, and as fast as possible for the MVICs and rMVICs, respectively. The RFD values were calculated during the first 50 ms (nRFD50) and 100 to 150 ms (nRFD100-150) and normalized to maximal force (%MVIC/s). The rate of electromyographic signal rise (RER) was calculated during the first 50 ms of muscle excitation (nRER50) and normalized to the peak-to-peak M-wave amplitude (%MPP/s). MUNE was calculated as a ratio of the ensemble average of the single motor unit potential area to the compound muscle action potential area, and was corrected for alternation. Motor CV (m/s) was assessed as the time (m/s) from maximal stimulation of the femoral nerve to onset of muscle activity. Pearson's correlation coefficients were used to analyze the relationships between the dependent variables. Additionally, stepwise multiple regression was used to examine the degree to which the predictor variables (nRER50, MUNE, Motor CV) explained a significant proportion of the total variance in each RFD phase (nRFD50 and nRFD100-150). **RESULTS:** nRER50 (41.47 ± 25.16 %MPP/s) was significantly related to nRFD50 (249.4 ± 94.4 N) ( $r = .640$ ,  $p = .01$ ). nRFD100-150 was not related to any of the predictor variables. nRER50 was the only significant predictor ( $\beta = .640$ ,  $p = .015$ ), explaining 41% of the variance in nRFD50. **CONCLUSION:** These preliminary data are in agreement with previous research suggesting that the early phase RFD is primarily determined by neural factors. Continued sampling will determine if additional variables significantly contribute to predicting early and late RFD performance. **ACKNOWLEDGEMENTS:** The funding for this study was provided, in part, by the Central States American College of Sports Medicine Student Research Grant.

**1313** Board #75 May 30 10:30 AM - 12:00 PM  
**Examining Quadriceps Muscle Excitability Throughout A Progressive Exercise Test: A Pilot Study**

Emily M. Adamic, Joel T. Greenshields, Jessica A. Freemas, Koichi Kitano, David M. Kocaja, Timothy Mickleborough. *Indiana University, Bloomington, IN.*  
 Email: emadamic@indiana.edu  
 (No relevant relationships reported)

**PURPOSE:** A metabolic threshold occurs during progressive exercise with a non-linear increase in blood lactate. The power output at which this occurs closely corresponds to the ventilatory threshold, a non-linear increase in minute ventilation ( $\dot{V}_E$ ). These factors may affect muscle excitability and thus force generating capacity. Muscle excitability has been shown to decrease after high-intensity whole-body exercise, however it has not been identified when this decrease occurs during progressive exercise. Therefore, the purpose of this study was to examine quadriceps muscle excitability throughout a progressive exercise test.

**METHODS:** Five men (age 23 ± 3.5 years) performed a step-wise cycling test, beginning at 100W and increasing 25W/min until volitional exhaustion. Minute averages of oxygen consumption ( $\dot{V}O_2$ ) and  $\dot{V}_E$  were collected, and heart rate (HR)

and rating of perceived exertion (RPE) were recorded at the end of every minute. M-waves were induced using a stimulating electrode positioned over the femoral nerve and given at a fixed crank angle of 90° while the subject was cycling. During the exercise test, supramaximal stimulations were given every 10 seconds and averaged over the minute. Using a mixed linear model to control for within-subject variance, both absolute and relative (percent decrease) M-wave amplitudes for each minute were compared to the first minute of exercise.

**RESULTS:** Subjects exercised for an average of 10 (± 0.7) minutes.  $\dot{V}_{O_2}$ , HR, and RPE increased significantly each minute in a linear fashion. Ventilatory threshold occurred at minute 7 (± 1 minute). Compared to the first minute of exercise, absolute M-wave amplitude decreased significantly at minute 7 (2.14 ± 2.45mV versus 3.78 ± 2.58mV), whereas relative M-wave amplitude decreased significantly at minute 6 (-20.44% ± 28.53%). After this point, both remained reduced until exhaustion.

**CONCLUSIONS:** These data show that the M-wave may exhibit an excitability threshold corresponding to that of the ventilatory threshold. This could reflect the metabolic state of the muscle, indicating the division between sustainable and unsustainable exercise intensities. Further research should examine the neural response to progressive exercise in relation to peripheral losses of excitability.

**C-33** Free Communication/Poster - Movement Disorders

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

**1314** Board #76 May 30 10:30 AM - 12:00 PM  
**Optimizing Dance Interventions To Improve Motor Function In People With Parkinson'S Disease And Older Adults**

Angela L. Ridgel, FACSM, Jin Hyun Kim, Peter Gates, Robert Melczak, Fred Discenzo, Margaret Busch, Joan Meggitt. *Kent State University, Kent, OH.*  
 Email: aridgel@kent.edu  
 (No relevant relationships reported)

Dance comprises a broad range of techniques and styles, which have been utilized in classes specifically designed for individuals with Parkinson's disease (PD) and healthy older adults. Previous studies have shown that a series of dance sessions can improve balance, posture, and mobility for people diagnosed with PD and healthy older adults. However, these studies have not analyzed the linkage between repetitive movement types and persistent changes in motor skills. In order to begin understanding the causative factors of repetitive movement types that result in improved motor skill performance, the functional relationship between movement features and observed performance improvements needs to be examined. **PURPOSE:** To identify dance movement patterns resulting in the greatest improvement in tests of gait, balance and upper extremity function using partnered and non-partnered dance to music in PD and healthy older adults. We hypothesize that scripted variation in movement will promote improvements in motor performance. **METHODS:** Participants in structured group dance classes were recruited for this study. Performance measures of upper and lower extremity were collected before and after each dance class. Motion capture, video and live observations were used to examine movement patterns. **RESULTS:** Individuals with PD had slower baseline performance in the 9 hole peg test (9HPT) than healthy older adults in both left ( $p = 0.026$ , 33.5 s vs 24.9 s) and right hand ( $p = 0.008$ , 31.2 s vs 26.5 s). There was also a significant improvement in the 9HPT for the left hand after the dance classes in the individuals with PD ( $p = 0.035$ , 3.44 s). Factors that led to observed improvements in mobility and movement execution included: repetition of foundational weight shifts in a separate preparatory exercise, engagement of the spine and arms in counterbalancing movement in the legs, incorporating flexion at the knee into the dance stride, and partnering with a moderately-skilled dancer. Increased amplitude and ease of stride and greater lift in the feet in locomotion were also documented. **CONCLUSIONS:** These preliminary results suggest that repetitive shifts in balance and movement during dance with music can lead to upper extremity motor performance and increased amplitude of movement in the lower extremity in individuals with PD.

**1315** Board #77 May 30 10:30 AM - 12:00 PM  
**Effects Of A Cooling Vest On Dual-task Performance And Fatigability In Persons With Multiple Sclerosis**

Samantha Everett, Chelsea Comeau, Virginia Thomas, Srikant Vallabhajosula. *Elon University, Elon, NC.* (Sponsor: Stephen Bailey, FACSMM)

(No relevant relationships reported)

Fatigue and heat sensitivity are commonly reported symptoms in persons with multiple sclerosis (PwMS). PwMS also often have difficulty performing concurrent cognitive and motor tasks that presents as a dual-task decrement. Heat sensitivity along with a dual-task decrement may hinder activities of daily living and quality of life for PwMS. Though using a cooling vest could help decrease heat sensitivity, it is currently unknown if it improves dual-tasking performance in PwMS. **PURPOSE:** To examine the effects of a cooling vest on cognitive-motor dual-task cost (DTC) and fatigability in PwMS. **METHODS:** 5 PwMS participated in two sessions that were at least 1 week apart. During one session participants wore a sham cooling vest and the other session an actual cooling vest. During each session participants completed a Timed 25-Foot Walk Test (T25FWT), 6 Minute Walk Test (6MWT), T25FWT while performing Serial 3's, and a 6MWT while narrating a story. The type of vest and order of tests was randomized for each participant. Total times for T25FWT and total distances for 6MWT were recorded. DTC, defined as the percent change between single- and dual-task performance, was calculated. Fatigability, defined as the difference between the averages of the first two and the last two lap times of the 6MWT, was calculated. Paired samples t-tests were used to compare DTC during cooling and non-cooling sessions and fatigability during single- and dual-task conditions within each session. **RESULTS:** The mean DTC during the 6MWT for cooling and non-cooling was -4.1% and -6.5%, respectively. The DTC during the T25FWT for cooling was 7.3% and 11.5% for non-cooling. The mean distance walked during 6MWT dual-task increased from 275.5m without cooling to 285.6m with cooling. There was a trend towards significant difference between single- and dual-task fatigability during 6MWT for non-cooling session (Single: 1.6±7.6m; Dual: 6.2±5.3m; p=.051), but not for cooling session (Single: 0.7±3.8m; Dual: 12±16.4m; p=.082). **CONCLUSION:** Preliminary results with lower DTC and no significant difference between single- and dual-task fatigability when using a cooling vest suggests that a cooling vest may have a benefit PwMS while dual-tasking during endurance activities. Further research with a larger sample size is needed to confirm these findings.

**1316** Board #78 May 30 10:30 AM - 12:00 PM  
**Comparing Turn Performance In Parkinsonism**

Sidney Baudendistel, Abigail Schmitt, Ashley Rodriguez, Chris Hass, FACSMM. *University of Florida, Gainesville, FL.* (Sponsor: Chris J Hass, FACSMM)

Email: sbaudendistel@ufl.edu

(No relevant relationships reported)

Turning while walking is one of the main tasks of daily living known to elicit falls in healthy older adults and persons with movement disorders, such as Parkinson's disease. Essential tremor is the most common adult movement disorder; recent work has identified meaningful gait impairments in this population. However, turning performance has not been evaluated in this population. **PURPOSE:** To determine differences in gait patterns between patients with Parkinson's disease and those with Essential Tremor during a turning task and their relationship to reported falls. **METHODS:** 15 persons with Essential Tremor (ET) and 15 persons with Parkinson's disease (PD) age matched within 3 years, performed two 180 degree turns, as part of the Primary Gait Screen, on an instrumented pressure mat. Average time to complete the turn, amount of steps required to turn, and cadence (number of steps/time) of the turn were calculated. Reported falls in the last six months on a categorical scale, (0: No falls, 1: Rarely, 2: Monthly, 3: Weekly, 4: Daily), age at diagnosis, and age at first symptom were collected. Paired t-tests were used to compare measures between groups while a simultaneous multiple regression was performed to analyze potential predictors of falls. **RESULTS:** No significant differences were found between the ET and PD groups ( $p>.05$ ) with the exception of cadence. Those with PD had a significantly higher cadence during the turn than those with ET ( $2.17 \pm .301$  steps/sec vs.  $1.91 \pm .369$  steps/sec,  $p=.042$ ). Using regression to analyze possible predictors, the overall model failed to obtain significance in predicting falls ( $F(6)=1.855$ ,  $p=.134$ ,  $R^2=.336$ ). Only age at evaluation ( $p=.011$ ) and age at diagnosis ( $p=.032$ ) were statistically significant predictors in this model, as age at evaluation increased ( $B=.084 \pm .030$ ,  $Beta=.813$ ) so did falls and as age at diagnosis decreased ( $B=-.058$ ,  $Beta=-.700$ ), falls increased. Average time, number of steps, age at first symptom, and diagnosis (ET or PD) were not significant predictors ( $p>.05$ ). **CONCLUSION:** Surprisingly, turning performance was similar between those with ET and PD, suggesting that gait impairment in ET is more prevalent than clinically recognized. However, turning performance was not predictive of fall frequency.

**1317** Board #79 May 30 10:30 AM - 12:00 PM  
**Neuromuscular Impairment of the Plantar Flexors In Adults With and Without Prader-Willi Syndrome**

Eric J. Shumski<sup>1</sup>, Skylar C. Holmes<sup>1</sup>, Brett K. Post<sup>1</sup>, Steven A. Garcia<sup>2</sup>, Derrick Escano<sup>1</sup>, Daniela A. Rubin, FACSMM<sup>1</sup>, Derek N. Pamukoff<sup>1</sup>. <sup>1</sup>California State University, Fullerton, Fullerton, CA. <sup>2</sup>University of Michigan, Ann Arbor, MI.

Email: ericshumski@csu.fullerton.edu

(No relevant relationships reported)

Muscle weakness is common in individuals with Prader-Willi Syndrome (PWS), but the source of weakness is unclear. **PURPOSE:** The purpose of this study was to compare neuromuscular function, and muscle size and quality of the plantar flexor muscles between individuals with and without PWS. **METHODS:** Ten participants with PWS were matched on sex to 10 obese control and 10 lean control participants. Hoffman (H) reflex and muscle response (M-wave) were obtained from the soleus by stimulating the tibial nerve to determine the H:M ratio. Isometric plantar flexor strength was assessed using an isokinetic dynamometer to find peak torque (PT), early (RTD100) and late (RTD200) rate of torque development. Surface electromyography (EMG) was recorded from the soleus and gastrocnemii during strength assessments to determine early (RER100) and late (RER200) rise in EMG, and early (I100) and late (I200) integrated EMG. EMG data were normalized to peak EMG amplitude collected during the MVIC trial. Strength variables were normalized to lean mass. Ultrasound imaging was used to quantify gastrocnemii cross sectional area (CSA) and echointensity (EI). One-way ANOVA was used to compare dependent variables between groups. **RESULTS:** There were group differences in H:M ratio ( $p=0.03$ ), RTD100 ( $p<0.01$ ), RTD200 ( $p=0.01$ ), RER100 ( $p=0.02$ ), and CSA ( $p<0.01$ ). Post hoc tests indicated that the PWS group had lower H:M ratio ( $0.29 \pm 0.18$  vs.  $0.52 \pm 0.13$ ,  $p=0.03$ ), RTD100 ( $1.49 \pm 0.64$  vs.  $5.19 \pm 3.26$  Nm/kg,  $p<0.01$ ), and RTD200 ( $2.20 \pm 1.05$  vs.  $4.95 \pm 2.48$  Nm/kg  $p<0.01$ ) compared to lean controls. The PWS group had lower RER100 ( $1.07 \pm 1.14$  vs.  $2.84 \pm 1.49$  %MVIC/sec,  $p=0.02$ ) in the soleus compared to obese controls. Obese controls had larger CSA compared to lean controls ( $2527.99 \pm 579.02$  vs.  $1638.55 \pm 354.52$  mm<sup>2</sup>,  $p<0.01$ ) and compared to the PWS group ( $1797.29 \pm 764.77$  mm<sup>2</sup>,  $p=0.026$ ). There were no differences between groups in RER200, I100, I200, or EI. **CONCLUSIONS:** A lower H:M ratio in adults with PWS compared to controls may indicate lower  $\alpha$ -motoneuron excitability. Similarly, lower RTD100 in adults with PWS compared to controls may indicate lower motor unit recruitment and firing rate, which is supported by lower RER100. Conversely, lower RTD200 may be attributed to smaller CSA. Muscle weakness in adults with PWS may originate from neural and morphologic factors.

**1318** Board #80 May 30 10:30 AM - 12:00 PM  
**Impact Of Attention-deficit/hyperactivity Disorder On Gross Motor Skills Among A Group Of Girls Teens**

Laurie Simard<sup>1</sup>, Julie Bouchard<sup>1</sup>, Linda Paquette<sup>1</sup>, Jacinthe Dion<sup>1</sup>, Claudia Verret<sup>2</sup>, Jacques R. Leroux<sup>3</sup>, Alain-Steve Comtois<sup>2</sup>, Tommy Chevette<sup>1</sup>. <sup>1</sup>UQAC, Chicoutimi, QC, Canada. <sup>2</sup>UQAM, Montréal, QC, Canada. <sup>3</sup>HRDP, Montreal, QC, Canada.

Email: laurie.simard@uqac.ca

(No relevant relationships reported)

Scientific literature has shown motor impairment in adolescent boys with Attention-Deficit/Hyperactivity Disorder (ADHD), but little is known about girls with ADHD. **PURPOSE:** The purpose of this study was to evaluate the impact of ADHD on Gross Motor Skills (GMS) of adolescent girls. **METHODS:** GMS of 7 girls with ADHD (mean=15.3 ± 1.8 years old) was compared to 7 control girls (mean=15.1 ± 1.6 years old) using the «Myg & Gym» GMS test battery for Reaction Time, Limb Speed, Agility, Coordination, and Balance. Scores were compared between groups controlling for the following covariates: Age, BMI percentile and presence of Pharmacological Treatment. **RESULTS:** Girls with ADHD showed significantly slower arm and leg limb speed when compared to girls without ADHD (Arm:  $63.43 \pm 9.43$  vs  $88.43 \pm 11.25$  single touch,  $p=0.001$ ; Leg:  $21.14 \pm 3.02$  vs  $25.71 \pm 3.68$  double touches,  $p=0.03$ ). Girls with ADHD showed significantly less hand-eye coordination when compared to girls without ADHD ( $2.8 \pm 1.5$  vs  $7.8 \pm 1.2$  throws,  $p<0.001$ ). Correcting for Age, BMI and Pharmacological Treatment did not affect the differences in GMS outcomes. **CONCLUSION:** It appears that significant differences are present between girls with ADHD when compared to girls without ADHD for GMS functions. Future motor development research should include female participants with ADHD and include an assessment of executive functions. This would help better understand the possible causes of the motor impairment identified in individuals with ADHD.

- 1319** Board #81 May 30 10:30 AM - 12:00 PM  
**Aquatic-based Exercise For Individuals With Parkinson's Disease: A Systematic Review And Meta-analysis Of Randomized Controlled Trials**  
 Lucia Cugusi<sup>1</sup>, Andrea Manca<sup>2</sup>, Marco Bergamin<sup>3</sup>, Andrea Di Blasio<sup>4</sup>, Franca Deriu<sup>2</sup>, Marco Monticone<sup>1</sup>, Giuseppe Mercurio<sup>1</sup>.  
<sup>1</sup>University of Cagliari, Monserrato, Italy. <sup>2</sup>University of Sassari, Sassari, Italy. <sup>3</sup>University of Padova, Padova, Italy. <sup>4</sup>G. d'Annunzio University of Chieti-Pescara, Chieti, Italy.  
 (No relevant relationships reported)

**PURPOSE:** What are the effects of aquatic-based exercise (AqEx) on motor and non-motor symptoms, functional performance and quality of life (QOL) in individuals with Parkinson's disease (IwPD)? Does AqEx have greater effects on these outcomes than other forms of exercise in IwPD? **METHODS:** A systematic review and meta-analysis of randomized controlled trials (RCTs), which enrolled IwPD in supervised AqEx programs > 2 weeks, was conducted. The primary outcomes were motor symptoms and functional performance; the secondary outcomes were non-motor symptoms and QOL outcomes. **RESULTS:** Of the 129 records identified, seven trials met the inclusion criteria and six entered the meta-analysis (159 subjects). One trial assessed the effect of AqEx compared to usual care and found a significant improvement at the Unified Parkinson's Disease Rating Scale Part-III (UPDRS-III, mean difference, MD -4.6, 95% CI -7.5 to -1.7) in favour of AqEx. Six studies compared AqEx with Land-based exercise (LEX) Post-intervention (after an average of 7.2 ± 2.2 weeks of training; 159 subjects). The effect of AqEx was superior to LEX on the Berg Balance Scale (MD 2.7, 95% CI 1.6 to 3.9), the Falls Efficacy Scale (MD -2.1, 95% CI -3.1 to -1.0) and the 39-item Parkinson's Disease Questionnaire (MD -6.0, 95% CI -11.3 to -0.6), with no significant between-groups differences in the other outcomes considered. The significant between-group difference for the Berg Balance Scale was maintained at the follow-up assessment (54 subjects, MD 6.3, 95% CI 2.1 to 10.5). **CONCLUSIONS:** AqEx significantly improves motor symptoms in IwPD. It also has slightly to moderately greater benefits than LEX on balance capacity, postural stability and perceived well-being in IwPD, especially in those presenting with specific functional and mobility impairments. On other outcomes, the benefits of AqEx were similar to those of LEX. **REVIEW REGISTRATION:** PROSPERO CRD42017077370

- 1320** Board #82 May 30 10:30 AM - 12:00 PM  
**Single-Arm Torque Perceptual Deficits in Individuals with Chronic Hemiparetic Stroke**  
 Angelica C. Alberto<sup>1</sup>, Justin Drogos<sup>2</sup>, Ninghe Cai<sup>2</sup>, Neha Reddy<sup>2</sup>, Julius Dewald<sup>2</sup>, Netta Gurari<sup>2</sup>. <sup>1</sup>California State University, Northridge, Northridge, CA. <sup>2</sup>Northwestern University, Chicago, IL.  
 Email: Angelica.Alberto.736@my.csun.edu  
 (No relevant relationships reported)

**Background:** To perform activities of daily living safely and efficiently, an individual with hemiparetic stroke needs to accurately perceive how much force is generated about their joints, i.e., torque perception. We know that individuals with moderate to severe motor impairments post hemiparetic stroke have between-arms torque perceptual impairments. However, a question that has yet to be addressed is whether these individuals have a torque perceptual impairment within their paretic arm and/or non-aretic arm.

**Objective:** To compare single-arm torque perception between individuals with chronic hemiparetic stroke and individuals without neurological impairments (i.e., controls).

**Methods:** Nine individuals with chronic hemiparetic stroke and five similarly-aged individuals without neurological impairments (i.e., controls) partook in the study. By following automated audiovisual cues, each participant generated 25% of their maximum voluntary elbow extension torque for three seconds, relaxed for two seconds, and then matched the remembered torque for one second without receiving feedback on their torque-matching ability. This torque-matching task was performed in each arm.

**Results:** The mean ± standard deviation of the normalized absolute torque matching error was 26.5±18.3% and 28.2±23.3% for the participants with chronic hemiparetic stroke in their paretic and non-aretic arm, respectively, and 19.8±7.1% and 20.1±11.3% for the controls in their dominant and non-dominant arm, respectively. Absolute error was not found to significantly differ depending on the arm tested (p=0.53).

**Conclusions:** Our participants with chronic hemiparetic stroke and controls matched torques similarly in each arm. This result supports the notion that unilateral torque perceptual deficits may not occur in individuals with chronic hemiparetic stroke who exhibit motor impairments during unimanual activities.

- 1321** Board #83 May 30 10:30 AM - 12:00 PM  
**Functional Motor Control Deficits In Fragile X Mental Retardation 1 Gene Premutation Carriers**  
 Seoung Hoon Park<sup>1</sup>, Zheng Wang<sup>1</sup>, Walker McKinney<sup>2</sup>, Evangelos A. Christou<sup>1</sup>, Matthew W. Mosconi<sup>2</sup>. <sup>1</sup>University of Florida, Gainesville, FL. <sup>2</sup>University of Kansas, Lawrence, KS.  
 Email: shpark@ufl.edu  
 (No relevant relationships reported)

Individuals with the fragile X mental retardation 1 (FMR1) gene premutation are at increased risk for fragile X associated tremor/ataxia syndrome (FXTAS). However, it is unknown whether FMR1 gene premutation carriers, with or without FXTAS, exhibit functional motor control deficits compared with healthy individuals. **PURPOSE:** To determine whether FMR1 premutation carriers exhibit impaired ability to perform functional motor tasks. **METHODS:** Eight FMR1 gene premutation carriers (4 with FXTAS and 4 without FXTAS; 58.88±9.25 yrs) and eight age- and sex-matched healthy individuals (60.13±9.25 yrs) performed 1) a constant isometric force control task with the index finger at 20% MVC; 2) a dynamic stance task where a participant continuously swayed anteriorly-posteriorly; and 3) a single step initiation task. We recorded the force from the index finger during a constant contraction task, the center of pressure (COP) during a dynamic stance task, and the time and velocity during a single step initiation task. **RESULTS:** Compared with healthy controls, FMR1 gene premutation carriers exhibited 1) greater force variability (coefficient of variation of force) during a constant force task (1.48±1.02 vs. 0.63±0.37%; p<0.04); 2) less anterior-posterior trajectory distance (4.24±0.71 vs. 5.30±0.42cm; p<0.01) during a dynamic stance task; and 3) greater step duration (0.39±0.14 vs. 0.27±0.04s; p<0.05) and less step velocity (111.07±24.62 vs. 136.42±16.47cm/s, p<0.05) during a single step initiation task. **CONCLUSION:** Irrespective of existence of FMR1-related tremor/ataxia syndrome, FMR1 premutation carriers exhibit functional motor control deficits compared with healthy individuals.

Supported by NIMH R01 Research Project Grant Program (MH 112734), Once Upon a Time Foundation Award, the Kansas Center for Autism Research and Training (K-CART) Research Investment Council Strategic Initiative Grant to Dr. Mosconi, and the NICHD U54 Kansas Intellectual and Developmental Disabilities Research Center Award (U54HD090216).

- 1322** Board #84 May 30 10:30 AM - 12:00 PM  
**The Relationship Between Y Balance Performance & Hip Strength & Recreationally Trained Women.**  
 HAROLDO SANTANA<sup>1</sup>, Gabriel A. Paz<sup>1</sup>, Antonio Brandão<sup>2</sup>, Victor Dos SANTOS JÚNIOR<sup>2</sup>, Kim HÉBERT-LOSIER<sup>3</sup>, Humberto Miranda<sup>1</sup>. <sup>1</sup>UF RJ - Federal University of Rio de Janeiro, RIO DE JANEIRO, Brazil. <sup>2</sup>Physical Assessment and Training Center - CAFT, RIO DE JANEIRO, Brazil. <sup>3</sup>University of Waikato, Tauranga, New Zealand.  
 (No relevant relationships reported)

**PURPOSE:** This study aimed to identify the relationship between the Y Balance Test - Lower Quarter (YBT-LQ) and hip isometric strength and to compare outcomes between preferred and non-preferred limbs in recreationally resistance-trained women.

**METHODS:** Twenty young college females (22.3 ± 2.1 years) with background in regular strength or plyometric training volunteered to participate in this study. Maximal reach distance in each of the three YBT-LQ reach directions (anterior, posteromedial, and posterolateral) and a composite reach score (sum of the three directions) were recorded for the preferred and non-preferred leg and normalized to leg length. A handheld dynamometer was used to measure the maximum voluntary isometric strength of each participant for the hip extensors, flexors, adductors, abductors, and internal and external rotators (N).

**RESULTS:** Significantly lower normalized scores were noted for the preferred (81.2 ± 11.7%) compared to the non-preferred leg (83.6 ± 12.4%) for anterior distance. For the composite score of the YBT-LQ and hip strength measures, associations were weak for hip extension and external rotation; moderate for hip flexion, adduction, and abduction; and strong for hip external rotation ( $r = 0.516, p = 0.059$ ).

**CONCLUSIONS:** The strong association between hip external rotator strength and composite score of the YBT-LQ suggest that strengthening this muscle group might be important for dynamic postural control and the reduction of injury risk factors in recreationally active females.

**1323** Board #85 May 30 10:30 AM - 12:00 PM  
**Effect of Treadmill vs. Recumbent Cross Trainer on Gait and Leg Electromyography after Chronic Stroke**

Nicholas Siekirk<sup>1</sup>, Qin Lai<sup>2</sup>, Victoria Pardo<sup>2</sup>, Sujay Galen<sup>3</sup>, Brad Kendall<sup>4</sup>, Tamara Hew-Butler, FACSM<sup>2</sup>. <sup>1</sup>Georgia Southern University, Statesboro, GA. <sup>2</sup>Wayne State University, Detroit, MI. <sup>3</sup>Georgia State University, Atlanta, GA. <sup>4</sup>Taylor University, Upland, IN. (Sponsor: Tamara Hew-Butler, FACSM)  
 Email: nsiekirk@georgiasouthern.edu  
 (No relevant relationships reported)

A recumbent cross trainer (RCT) relies on similar neural networks as gait. Therefore, neurologically impaired individuals may improve walking ability after exercise on the RCT. **PURPOSE:** The purpose of this investigation was to compare the effects of the RCT and Treadmill (TM) on intra-exercise electromyography and post-exercise spatial-temporal gait parameters. **METHODS:** 34 participants were divided into two groups; stroke (CVA) (10 ± 5 years post-CVA) and age and sex-matched control. Participants completed two 5-minute exercise bouts on both the RCT and TM at an RPE based self-selected cadence. Intra-exercise Mean electromyography (mEMG) values were normalized to maximum voluntary contraction and were recorded bilaterally at the rectus femoris, vastus medialis oblique, semitendinosus, tibialis anterior, medial gastrocnemius, and soleus. Change in joint range of motion was calculated (maximum-minimum degree; ΔROM) from wireless goniometer measures at the hip, knee, and ankle. Gait parameters were evaluated by the Wireless Gait Assessment Tool (WiGAT) immediately following each exercise bout (3 x 10m walk). HR and BP were monitored to ensure the return to pre-exercise levels. **RESULTS:** Stroke (n = 15) and healthy (n = 19) did not differ in age (*Mdn*: 66 years vs. 57 years, respectively) or BMI (Stroke: *M* = 27.02, *SD* = 4.57 vs. Healthy: *M* = 26.46, *SD* = 4.63), *p* > .05. Healthy participants were stronger at all joints, *p* < .025. Preferred TM speed was faster in the healthy condition despite no statistical difference in RPE, *p* < .05. RCT average steps per minute did not differ between the conditions, *p* > .05. RPE did not differ between groups or across exercise modes. The TM elicited a higher mEMG on a majority of the studied muscles in both populations, *p* < .025. TM demonstrated an increased ΔROM in the R knee and both ankles in the healthy population, *p* < .025. There were no statistical differences between the TM and RCT in the CVA's ΔROM. WiGAT determined the RCT decreased the stance percentage (%) and increased swing % on the non-affected leg, *p* < .05. Neither exercise mode modulated the affected-side stance %, affected-side swing %, double support time or bilateral (affected vs. non-affected) stride length, *p* > .05. **CONCLUSION:** Five minute RCT intervention improved non-affected side gait parameters in a chronic CVA population.

**1324** Board #86 May 30 10:30 AM - 12:00 PM  
**Acute Effects of Yoked Prism Lenses on Gait in Individuals with Acquired Brain Injuries**

Nathan Bedel<sup>1</sup>, Melissa McDonald<sup>1</sup>, Susan Durham<sup>2</sup>, Alma Privette<sup>2</sup>, Srikant Vallabhajosula<sup>1</sup>. <sup>1</sup>Elon University, Elon, NC. <sup>2</sup>Brier Creek Vision Care, Raleigh, NC. (Sponsor: Stephen Bailey, FACSM)  
 Email: nbedel@elon.edu  
 (No relevant relationships reported)

Acquired brain injuries (ABI) have been known to lead to a host of neurological impairments including visual imbalances that can greatly impact everyday life. Along with headaches, dizziness, and photophobia individuals with ABI report difficulty with postural alignment, balance, and gait. It has been suggested that common symptoms associated with ABIs are due in part to poor integration of the sensory motor system. Recent research has shown that yoked prisms can alter spatial perception and if used correctly draw the visual midline to its corrected position. **PURPOSE:** To examine the effects of yoked prism lenses on individuals with acquired brain injuries to determine if there is a change in gait. **METHODS:** 13 individuals with ABI (mean age: 43.1 ± 18.1 years) walked 2-4 times at their self-selected speed across a 14' GAITrite walkway under two conditions with current vision correcting prescription: without additional yoked prisms (WOP) and with a yoked prism lens (WP). Spatiotemporal gait parameters consisting of gait speed, stride length, stride width, and single support percent were extracted and averaged across the trials within each condition. Paired samples t-test was used to compare the gait parameters across both the conditions. **RESULTS:** Wearing yoked prism lenses resulted in increased gait speed (WOP: 92.3 ± 25.9 cm/s; WP: 99.1 ± 28.9 cm/s; *p* = 0.007) and stride length (WOP: 102.1 ± 17.7 cm; WP: 108.3 ± 20.0 cm; *p* = 0.035). Stride width (WOP: 10.8 ± 3.8 cm; WP: 10.8 ± 3.0 cm; *p* = 0.855) and single support percent (WOP: 37.0 ± 2.8; WP: 37.3 ± 2.9; *p* = 0.335) did not show significant changes. **CONCLUSION:** When participants with reported ABIs wore yoked prism lenses they may be experiencing better integration of their sensory motor systems including a corrective shift in visual midline which allows for an increase in gait speed and stride length, indicating an overall improvement in gait. Our findings suggest that yoked prism lenses have acute benefits to improve gait in individuals with ABIs. Long-term benefits need to be evaluated.

**1325** Board #87 May 30 10:30 AM - 12:00 PM  
**Effects of Activity-Based Physical Rehabilitation on Locomotor Recovery in Rats after Severe Spinal Cord Injury**

Kinley H. Buckley, Christine F. Conover, Russell D. Wnek, Michael C. Reynolds, Micah Flores, Ean G. Phillips, Dana M. Otzel, Joshua F. Yarrow. Malcom Randall VA Medical Center, Gainesville, FL.  
 (No relevant relationships reported)

Activity-based physical rehabilitation (e.g., bodyweight supported treadmill training (TM) or passive Cycle training) promotes recovery of voluntary locomotor function after moderate-severity spinal cord injury (SCI). However, little evidence supports efficacy of these treatments following severe SCI. **Purpose:** To determine the effects of TM and passive Cycle training on the recovery of voluntary locomotor function in rodents after severe SCI. **Methods:** 16-week old male Sprague-Dawley rats (n=44) received either a T9 laminectomy (SHAM) surgery or T9 laminectomy plus severe (250 kilodyne) contusion SCI using a computer-guided impactor. SCI animals were then stratified into groups that received 1) no training (SCI), 2) TM training (SCI+TM), or 3) Cycle training (SCI+Cycle). TM and Cycle training were initiated 1-week post-surgery and consisted of two 20 min bouts/day, performed 5 days/week for 3 weeks. Hindlimb locomotion was assessed weekly using the BBB Locomotor Rating Scale. **Results:** One-week post-surgery, all SCI animals exhibited locomotor deficits (BBB score < 3 on a 0-21 scale, *p* < 0.01 vs baseline), indicating near-complete hindlimb paralysis. Thereafter, the SCI group spontaneously regained some voluntary hindlimb function (BBB = 6.1 ± 0.993 at week 4, *p* < 0.01 vs week 1). However, SCI animals did not recover the ability to hindlimb weight support in stance or to perform stepping patterns. Similarly, BBB scores improved in the SCI+TM group from week 1 to week 4 (*p* < 0.01), although, hindlimb locomotor recovery was not greater than SCI alone. In contrast, BBB scores did not improve significantly from weeks 1-4 in the SCI+Cycle group. SCI+TM exhibited higher BBB scores than SCI+Cycle at weeks 3-4 (week 4 average: SCI+TM = 8.1 ± 1.025; SCI+Cycle = 4.4 ± 0.561, *p* < 0.05). **Conclusion:** Our findings suggest that neither TM nor Cycle training promoted locomotor recovery after a 3-week time span in male rodents after severe SCI. Additionally, Cycle training may have limited locomotor recovery in our model, given that BBB scores did not improve in SCI+Cycle animals. Future research is needed to determine an alternative treatment that can be used in conjunction with locomotor training to improve ambulatory status after severe SCI.

**C-34** Free Communication/Poster - Posture and Balance

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

**1326** Board #88 May 30 10:30 AM - 12:00 PM  
**Dry Needling Improves Static and Dynamic Balance in Individuals with Chronic Ankle Instability**

Jennifer Mullins, Matthew C. Hoch, Kyle B. Kosik, Nicholas R. Heebner, Philip A. Gribble, Philip M. Westgate, Author J. Nitz. University of Kentucky, Lexington, KY.  
 Email: jennifer.mullins@uky.edu  
 (No relevant relationships reported)

Individuals with chronic ankle instability (CAI) commonly exhibit balance deficits that are associated with dysfunction of the fibularis longus (FL) muscle. Dry needling (DN) is a treatment that targets muscular trigger points and is hypothesized to improve neurophysiological function of treated muscles. The ability of FL DN to improve dynamic and static balance in patients with CAI is unknown. **Purpose:** Examine the effect of FL DN on dynamic and static balance in individuals with CAI. **Methods:** Twenty-five adults with CAI (9 males, 16 females; 26 ± 9.42 years; 173.12 ± 9.85cm; 79.27 ± 18kg) volunteered to participate. Participants completed the Star Excursion Balance Test (SEBT) and postural control measures before and immediately after a single DN treatment to the FL. The anterior, posterolateral, and posteromedial directions of the SEBT were tested in a random order and reach distances were normalized to a percent of leg length. A composite SEBT score was calculated by dividing the normalized, average scores in each direction by three. Postural control was assessed in single-limb stance on a forceplate through time to boundary (TTB) measurements and calculated in the mediolateral and anteroposterior directions under eyes open and eyes closed conditions. A single DN treatment was performed on the FL using a "pistonning" technique. Descriptive statistics (mean change ± SD), paired t-tests, and standardized response mean effect sizes were calculated to compare balance measures before and immediately after the FL DN intervention (*p* < 0.05). **Results:** Following DN, significant improvements were identified in the composite (3.98 ± 4.45%, *p* < 0.001, ES = 0.89), posteromedial (4.85 ± 5.75%, *p* < 0.001, ES = 0.84)

and posterolateral reach directions ( $4.96 \pm 5.49\%$ ,  $p < 0.001$ ,  $ES = 0.90$ ) but not in the anterior reach direction ( $2.11 \pm 5.77\%$ ,  $p = 0.08$ ,  $ES = 0.37$ ). Under eyes-open conditions, TTB improved in the mediolateral ( $0.27 \pm 0.43$ ,  $p = 0.004$ ,  $ES = 0.63$ ) and anteroposterior ( $0.84 \pm 1.43$ ,  $p = 0.007$ ,  $ES = 0.59$ ) directions. However, no significant changes were identified in any TTB measures with eyes closed ( $p \leq 0.20$ ). **Conclusions:** FL DN created immediate improvements in dynamic and static balance in individuals with CAI. Future studies should examine the effects of multiple DN treatments and the mechanism behind this therapeutic effect.

1327 Board #89 May 30 10:30 AM - 12:00 PM

### Postmenopausal Women: Body Composition x Postural Stability

Daniela G m Bueno<sup>1</sup>, Renato A. Souza<sup>1</sup>, Wonder P. Higino<sup>1</sup>, Elisângela Silva<sup>1</sup>, Wagner Z. Freitas<sup>1</sup>, Tamires F. Silva<sup>1</sup>, Manoela S M Valle<sup>1</sup>, Stefani A. dos Reis<sup>1</sup>, Breno L. de Pádua<sup>1</sup>, Flávia R. Gouvêa<sup>1</sup>, Naldleida A. dos Reis<sup>1</sup>, Marcelo T. Navega<sup>2</sup>. <sup>1</sup>Instituto Federal de Educação, Ciência e Tecnologia do Sul de Minas Gerais, Muzambinho, Minas Gerais, Brazil. <sup>2</sup>Universidade Estadual Paulista Júlio de Mesquita Filho - Campus Marília, Marília, São Paulo, Brazil.  
Email: daniela.bueno@ifsuldeminas.edu.br

(No relevant relationships reported)

Several alterations of sensorimotor and motor performance processing occur during the process of normal aging. In women, aging is associated with the onset of menopause, which influences body composition with increased central adiposity, leading to changes in the gynoid to android fat distribution pattern. These changes may alter the center of gravity, compromising body stability and causing risk of falls. **PURPOSE:** The study aimed to analyze the influence of body mass on postural stability in postmenopausal women. **METHODS:** Forty women (age:  $71.2 \pm 5.4$  years, height:  $154.6 \pm 5.8$  cm, weight:  $72.0 \pm 21.2$  kg and BMI:  $28.9 \pm 4.5$  kg/m<sup>2</sup>) were evaluated. According to the body mass, participants were divided into two groups: overweight group (OWG,  $n = 23$ ) and normal weight group (NWG,  $n = 17$ ). Body mass assessment was performed using multiple frequency bioimpedance analysis (MF-BIA) and postural stability was evaluated on the Biodex Balance System (BBS), using Postural Stability Test (PST) at levels of oscillation 8 and 4 at the anterior-posterior (AP) and mid-lateral (ML) directions. Statistical analysis was performed by Shapiro-Wilk normality-test; comparisons between groups by Mann Withney test and correlations by Spearman correlation coefficient. Statistical significance was set at  $p < 0.05$ . **RESULTS:** OWG presented significantly ( $p < 0.05$ ) lower postural stability (AP-PST-8:  $1.32 \pm 0.49$ ; ML-PST-8:  $1.05 \pm 0.50$ ; AP-PST-4:  $2.20 \pm 0.89$ ; ML-PST-4:  $1.78 \pm 0.91$ ) to the NWG for all the variables determined in the BBS (AP-PST-8:  $0.71 \pm 0.34$ ; ML-PST-8:  $0.70 \pm 1.06$ ; AP-PST-4:  $1.35 \pm 0.81$ ; ML-PST-4:  $1.24 \pm 0.84$ ). Also, there was a positive and moderate correlation between BMI with AP-PST 8 ( $r = 0.58$ ), BMI with ML-PST 8 ( $r = 0.45$ ), BMI with AP-PST 4 ( $r = 0.51$ ) and BMI with ML-PST 4 ( $r = 0.46$ ). **CONCLUSION:** These data suggest that overweight predisposes postmenopausal women to greater postural instability.

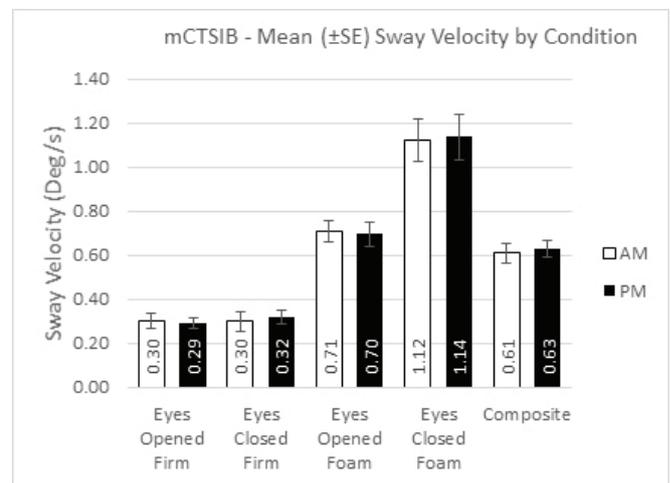
1328 Board #90 May 30 10:30 AM - 12:00 PM

### Diurnal Influence On The Modified Test Of Sensory Integration And Balance (mCTSIB)

Brandon Doan, Kade Carrigan, Sarah Camp, Jeff Pasley. Georgia Gwinnett College, Lawrenceville, GA. (Sponsor: Patrick O'Connor, FACSM)  
Email: bdoan@ggdc.edu

(No relevant relationships reported)

**PURPOSE:** The mCTSIB evaluates sensory integration and balance, which have been shown to degrade due to brain injury and neurological disease. Time-of-day affects sensory integration and balance. The purpose of this research was to investigate diurnal effects on the mCTSIB diagnostic protocol. **METHODS:** The Georgia Gwinnett College Institutional Review Board approved this research protocol. The research participants were 21 healthy women (12) and men (9) with an average age of  $22.4 (\pm 3.5)$  years, height of  $165.9 (\pm 15)$  cm, and weight of  $69.3 (\pm 8.2)$  kg. Participants completed morning mCTSIB trials between 7:00 AM and 10:00 AM and evening trials between 4:00 PM and 7:00 PM. Treatment order was randomized and balanced. Participants were instructed to get a normal night's sleep prior to testing and refrain from caffeine use on the day of testing. Participant sleep, physical activity, and concussion history were recorded by survey. **RESULTS:** No statistically significant mCTSIB differences were detected between time-of-day conditions. See chart below for a summary of average postural sway velocities by balance condition and time of day.



**CONCLUSION:** Based on this investigation, there appears to be no difference in morning compared to afternoon tests of sensory integration and balance among healthy young adults. This is an important finding; possibly informing clinicians that time-of-day is not an important factor to consider when conducting mCTSIB repeated measures or normative comparisons.

1329 Board #91 May 30 10:30 AM - 12:00 PM

### The Effects of Cognitive Load and Postural Demand on Static Balance

Nathan Ward<sup>1</sup>, Kell Grandjean da Costa<sup>1</sup>, John Ramsay<sup>2</sup>, Lee Hancock<sup>2</sup>, Kari L. Loverro<sup>2</sup>, Erika K. Hussey<sup>2</sup>, Alekya Menta<sup>1</sup>, Francesca Railneau<sup>1</sup>, Eduardo B. Fontes<sup>1</sup>, Elizabeth Marfeo<sup>1</sup>. <sup>1</sup>Tufts University, Medford, MA. <sup>2</sup>Natick Soldier Research, Development and Engineering Center, Natick, MA.  
Email: nathan.ward@tufts.edu

(No relevant relationships reported)

A growing body of research indicates that measures of static balance (e.g., postural sway) are influenced under cognitive demands. Similar measures are also impacted under different balance demands (e.g., stable vs unstable stances). However, to date, there is little known about how the difficulty of postural demands impact the relationship between balance and cognition. **PURPOSE:** Within the same individuals, we parametrically compared balance demands and cognitive demands on static balance ability using state-of-the-art inertial sensors. **METHODS:** 34 healthy young adults completed tasks of static balance with and without a cognitive demand (CD). Six wireless inertial sensors (APDM Opals) were attached to the wrists, feet, chest and lower back. The static balance task involved the participants standing for 30 seconds on a firm surface with their eyes closed in three different postural demand (PD) positions: feet apart (Low PD), feet together (Moderate PD), and feet in tandem (High PD). After completing these tasks alone (Low CD), participants were asked to complete these tasks while doing serial seven subtractions from a randomly presented three-digit number (High CD). **RESULTS:** We conducted repeated measures ANOVAs with Cognitive Demand (High vs Low) and Postural Demand (High vs. Moderate vs. Low) on measures of Path Length and Jerk. For Path Length, there was a main effect of CD [ $F(1,32) = 13.19$ ,  $p < .001$ ,  $High = 32.39$ ,  $Low = 18.42$ ] and a main effect of PD [ $F(2,64) = 99.69$ ,  $p < .001$ ,  $High = 62.32$ ,  $Moderate = 8.19$ ,  $Low = 5.71$ ]; however, there was no interaction between these factors. Path Length was longer under High CD relative to Low CD, and for Tandem PD relative to Likewise, for Jerk, there was a main effect of CD [ $F(1,32) = 4.28$ ,  $p < .05$ ,  $High = 22.92$ ,  $Low = 17.36$ ] and a main effect of PD [ $F(2,64) = 28.65$ ,  $p < .001$ ,  $High = 37.08$ ,  $Moderate = 14.07$ ,  $Low = 9.27$ ], but there was no interaction between these factors. **CONCLUSION:** Using two precise measurements of static balance, we observed that performance was impacted by separate cognitive and postural demands. Since these factors did not interact, our results suggest that adding a cognitive task to a balance assessment may have an impact independent of the balance demands.

**1330** Board #92 May 30 10:30 AM - 12:00 PM  
**Relationship Between Physical Function, Diet, And Body Composition With Postural Limits Of Stability**  
 Sarah E. Heaven, Dean L. Smith, Gabrielle A. Volk, Denise Y. Chan, Hannah N. Moland, Victoria E. Warren, Kyle L. Timmerman, FACSM. *Miami University, Oxford, OH.*  
*(No relevant relationships reported)*

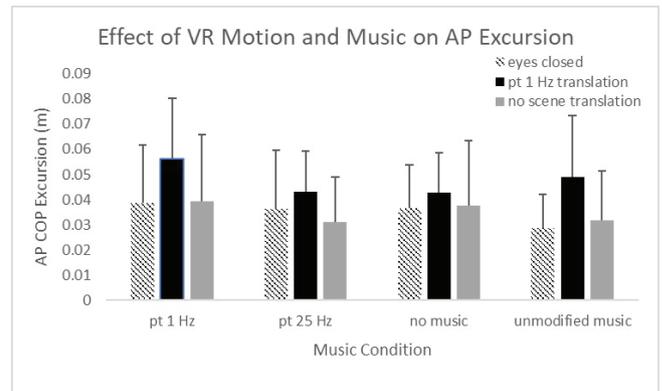
Approximately one out of four older adults will fall each year. Falls are the leading cause of fatal and non-fatal injuries among older adults and represent a significant public health problem. Body composition, diet and physical function are modifiable through lifestyle and may represent potential targets to improve postural stability. However, little is known about the relationships between these variables and limits of stability (LOS) in overweight, older adults. LOS is a reliable test that incorporates maximum center-of-gravity excursion, which is associated with fall risk. **PURPOSE:** To investigate the associations between body composition, physical activity/performance and diet to components of LOS. LOS includes measures of reaction time (RT), movement velocity (MVL), maximum excursion (MXE), endpoint excursion (EXE), and directional control (DCL). **METHODS:** In twenty overweight (body mass index  $\geq 27 \text{ kg/m}^2$ ), older adults ( $\geq 58 \text{ y}$ ), we obtained measures of stability (force plate), habitual physical activity (7-day accelerometry), habitual dietary macronutrient intake (3-day dietary recall), cardiorespiratory fitness (graded exercise test to volitional exhaustion with indirect calorimetry), gait speed from a 4-meter walk test, and body composition (bioelectrical impedance, InBody720). Associations among variables were determined using partial correlations (controlling for age and sex). Statistical significance was set at  $\alpha \leq 0.05$ . **RESULTS:** Subjects (16 female, 4 male) were  $64.2 \pm 4.77$  years old and had a body mass of  $95.34 \pm 15.55 \text{ kg}$ , a body mass index of  $34.7 \pm 4.68 \text{ kg/m}^2$ , and a maximal cycle ergometer  $\text{VO}_2$  of  $15.64 \pm 2.26 \text{ ml/kg/min}$ . Average LOS component values were RT:  $0.784 \pm 0.155 \text{ sec}$ ; MVL:  $4.56 \pm 1.46 \text{ deg/sec}$ ; EPE:  $69.41 \pm 10.6\%$ ; MXE:  $87.24 \pm 9.24\%$ ; and DCL:  $70 \pm 8.85\%$ . Significant partial correlations were noted for DCL and gait speed,  $r = -0.49$ ,  $p = .039$  as well as MVL and height,  $r = -0.60$ ,  $p = 0.008$ . **CONCLUSION:** Height and gait speed from a standard 4-meter walk test were both significantly correlated to postural limits of stability. Prospective studies are needed to examine the influence of gait speed, DCL and lifestyle interventions on fall risk.  
 Supported by a grant from the National Institute on Aging: 1R15AG055923-01.

**1331** Board #93 May 30 10:30 AM - 12:00 PM  
**Aerobic Rumba Training Effects on Static Balance and Lower Limb Power in Older Female Adults**  
 Cristian Andres Yanez, Jaime Granados, Carlos Castillo, Catalina Gutierrez, Manuel Riveros, Jhonatan Peña. *Area Andina Foundation University, Bogota, Colombia.*  
*(No relevant relationships reported)*

**PURPOSE:** The objective of this study was to identify the effects of aerobic rumba training of static balance and power in the lower limbs in elderly women. **METHODS:** Twelve healthy older adult women were randomly assigned to one intervention group (INT,  $n = 6$ ,  $67.16 \pm 5.34$  years), body weight ( $64.88 \pm 9.79 \text{ kg}$ ), average weight lean muscle ( $24$ ,  $83 \pm 2.38\%$ ), body fat ( $38.15 \pm 6.56\%$ ) and a control group (CON,  $n = 6$ ,  $67.66 \pm 5.98$  years), body weight ( $65.3 \pm 12.90 \text{ kg}$ , average weight lean muscle ( $23.56 \pm 2.40\%$ ) and body fat ( $42.76 \pm 6.48$ ). A progressive dance program was carried out over a period of 8 weeks (twice a week, with a total of 16 sessions) (50 minutes per session and 10 minutes of warm-up) The intensity was measured by means of the effort perception scale. The program was taught by a professional aerobic rumba instructor, who dictated the basic steps, with forward, backward, transversal and rotational direction along with the simplest movements of different musical genres. The variables of stabilometry in the orthostatic position were determined, applying the Romberg test in a bipodal and unipodal way with eyes opened and closed for 30 seconds, using a plantar pressure platforms (BTS P Walk). To determine the power variables through the execution of 3 countermovement jump (CMJ), a force platform (BTS 6000) was used. **RESULTS:** Significant correlations ( $r$ ) were found next to the  $p$  value and the effect size (ES) of the intervention group, on the stabilometric variables in the orthostatic position and those of countermovement jump respectively. Distance COP (DCOP,  $p = 0.006$ ,  $r = 0.93$ ,  $ES = 0.5$ ), mean velocity (MV,  $p = 0.007$ ,  $r = 0.93$ ,  $ES = 0.5$ ), lateral side flexion (LSF,  $p = 0.1$ ,  $r = 0.61$ ,  $ES = 0.6$ ), left foot radius (LFR,  $p = 0.02$ ,  $r = 0.87$ ,  $ES = 0.4$ ), right foot radius (RRF,  $p = 0.14$ ,  $r = 0.66$ ,  $ES = 0.0$ ). CMJ performance variables: jump height (JH,  $p = 0.0009$ ,  $r = 0.97$ ,  $ES = 2.3$ ), Peak Power (PP,  $p = 0.02$ ,  $r = 0.86$ ,  $ES = 0.3$ ), peak concentric force (PCF,  $p = 0.01$ ,  $r = 0.90$ ,  $ES = 0.7$ ) and rate of force development (RFD,  $p = 0.009$ ,  $r = 0.92$ ,  $ES = 0.2$ ). **CONCLUSIONS:** the neuromuscular effect in the lower limbs through the stimulation of the aerobic rumba leads to an improvement in the muscle activation, associated to a better control of the center of pressure of the body (COP), together with the static balance and the power like a preventive factor on the risk of falls in older adults.

**1332** Board #94 May 30 10:30 AM - 12:00 PM  
**The Effect of Music on Virtual Reality Induced Postural Sway**  
 Shaquitta Dent, Jefferson W. Streepey. *IUPUI, Indianapolis, IN.*  
 Email: [srdent@iupui.edu](mailto:srdent@iupui.edu)  
*(No relevant relationships reported)*

The use of a moving virtual reality (VR) environment to induce postural sway is well established. The extent to which music presented along with VR motion can enhance sway is unknown. **PURPOSE:** To determine if music, presented in modified and unmodified forms, will affect postural sway while standing in a moving VR environment. **METHODS:** Twenty-eight subjects (15 females; 13 males) aged 18-35 stood barefoot on a balance plate while wearing a VR headset. AP and ML center of pressure (COP) data was collected as the subjects experienced 3 visual conditions (VR scene translating in the AP direction at 0.1 Hz, no translation, and eyes closed) and 4 music conditions (music modified to scale loudness at 0.1 Hz and 0.25 Hz, unmodified music, and no music). AP and ML COP excursions, COP RMS, and COP velocities were calculated. **RESULTS:** A significant interaction effect ( $p = 0.0439$ ) showed that combining scene translation with 0.1 Hz modified music increased AP COP excursion ( $p < 0.05$ ) compared to all conditions except 0.25 Hz modified and unmodified music with scene translation. Main effects ( $p = 0.009$  and  $p < 0.001$ ) showed the 0.1 Hz modified music increased excursion compared to the 0.25 Hz modified and unmodified music conditions and that scene translation increased excursion compared to the other visual conditions. Similar effects were observed for RMS and velocities. **CONCLUSION:** VR induced sway may be enhanced by music presented in a manner to reinforce visual input. These findings could be used to optimize VR-based training protocols to improve postural control.



**1333** Board #95 May 30 10:30 AM - 12:00 PM  
**Comparison of Postural Changes in Esports Athletes in Gaming and Non-Gaming Chairs. A Case Series.**  
 Mark Gugliotti, Pamela Karp, William Werner, Dost Khalique. *NYIT, Old Westbury, NY.* (Sponsor: Gordon Schmidt, FACSM)  
 Email: [mgugliot@nyit.edu](mailto:mgugliot@nyit.edu)  
*(No relevant relationships reported)*

Seventy to eighty percent of the population will experience one episode of neck and low back pain in their lifetime, respectively. Deviations in posture can contribute to this onset of spinal pain. One subgroup of the population that is known to experience similar pain is eSports athletes. It has been shown that 34% of forty recently polled eSports athletes experience neck and back pain when competitively gaming. Concerns have been raised over their sustained aberrant postural positioning during play and its contribution to their pain. **PURPOSE:** To examine postural changes in collegiate eSports athletes while playing in eSports gaming chairs compared to non-gaming chairs. **METHODS:** Four collegiate eSports athletes ( $21.75 \pm 2.06$  years old) were recruited to participate in this observational study. Measurements of three joint angles were performed over four days with sessions lasting one hour. Each day the athletes were randomly assigned to a different chair before the gaming session. The chairs included two commercial gaming brands from different vendors (chairs 1 and 2), an office chair (chair 3), and a standard chair (chair 4). Reflective markers were placed at specific bony prominences to capture both sagittal and coronal postures during play. Motion capture was recorded using two GoPros™ and later analyzed with Kinovea™ software. **RESULTS:** There was a significant difference within group ( $t = -3.38$ ,  $p = 0.03$ ) between the pre and posttest neck angle measure for chair 1 of the commercial brands. Using an ANOVA, significant differences were found between chairs 1 and 2 ( $F(3,28) = 2.6$ ,  $p = 0.028$ ) and chairs 2 and 3 ( $F(3,28) = 2.6$ ,  $p = 0.023$ ).

**CONCLUSION:** The differences found in posture within gaming chairs and non-gaming chairs may impact upon injuries in eSports players. These preliminary results warrant further testing to possibly help reduce injury in eSports athletes.

**1334** Board #96 May 30 10:30 AM - 12:00 PM  
**Effects of Ankle Bracing on Postural Sway**

Mohammed S. Zaman, Adam E. Jagodinsky. *Illinois State University, Normal, IL.* (Sponsor: David Thomas, FACSM)  
Email: mszaman@ilstu.edu  
(No relevant relationships reported)

Ankle bracing can alter postural control strategies during static and dynamic tasks, theoretically through mechanical constraint of the ankle joint and/or sensorimotor reorganization. While a majority of studies have focused on center of pressure (COP) characteristics or clinical tests of balance to explore this theory, fewer studies have investigated sway characteristics of the center of mass (COM). Additionally, the effects of various styles of ankle braces on postural sway remains inconclusive. Assessing the effects of ankle bracing on postural sway could provide additional insight into potential systemic motor adaptations that occur in response to ankle constraint.

**PURPOSE:** Examine effects of lace-up and semi-rigid bracing on postural sway characteristics during a quiet-standing task. **METHODS:** Thirty-five adults between the ages of 18-30yrs (height:  $1.72 \pm 0.1$ m; mass:  $75.49 \pm 18$ kg) participated in the study. Participants performed a single one-minute trial of quiet-standing during each of the following conditions: No brace (NB), lace-up brace (LB), and semi-rigid brace (SRB). A ten-camera motion capture system was utilized to capture lower extremity position. To assess postural sway, mediolateral (ML) and anteroposterior (AP) lower extremity COM trajectories were extracted, and root-mean-square deviation (RMSx, RMSy) and velocity (RMSvx, RMSvy) of the COM were calculated. Repeated-measures ANOVAs were employed to assess differences in postural sway measures across all conditions. **RESULTS:** Analysis revealed a significant main effect for RMSy ( $F = 7.061$ ;  $p < .01$ ). Pairwise comparisons indicated that RMSy was significantly lower in the SRB condition ( $1.770 \pm 1.698$ mm) compared to C ( $2.182 \pm 1.515$ mm) ( $p < .01$ ). **CONCLUSION:** Results from study indicate that subjects exhibited an altered AP postural sway pattern when a semi-rigid brace is applied. These findings align with previous research reporting reduced AP COP excursions with ankle bracing during quiet-standing. Altered sway patterns with ankle bracing appears to support the presence of sensorimotor reorganization, possibly due to altered proprioceptive and/or haptic feedback stemming from greater mechanical constraint of the ankle joint.

**1335** Board #97 May 30 10:30 AM - 12:00 PM  
**Minimal Detectable Change Scores For Measures of Functional Balance in Adolescents With Chronic Ankle Instability**

Mary Spencer Cain<sup>1</sup>, Benjamin M. Goerger<sup>1</sup>, Rebecca J. Ban<sup>2</sup>, Shelley W. Linens<sup>3</sup>. <sup>1</sup>*University of North Carolina at Chapel Hill, Chapel Hill, NC.* <sup>2</sup>*Georgia State University, Atlanta, GA.* <sup>3</sup>*University of Oregon, Eugene, OR.* (Sponsor: Erik Wikstrom, FACSM)  
Email: mscain@email.unc.edu  
(No relevant relationships reported)

Chronic Ankle Instability (CAI) is an issue that can affect individuals with a history of ankle sprains. Improving functional balance is one of the key goals in ankle rehabilitation programs. However, the threshold for defining a meaningful level of improvement for certain assessments has not been determined.

**PURPOSE:** To establish the minimal detectable change (MDC) values for 2 different functional balance assessments in an active adolescent population with CAI. **METHODS:** Forty-three active adolescents with CAI (20 males and 23 females,  $16 \pm 1$  years,  $171.75 \pm 12.05$ cm,  $69.38 \pm 18.36$ kg). CAI inclusion criteria consisted of ankle sprain history, current symptoms of pain, weakness and instability and repeated episodes of giving-way. Participants completed 4-weeks of either strength training, balance board training, combination training (completion of both strength and balance board exercises) or no intervention. Dependent variables were pre and post-intervention scores for two measures of functional balance: side-hop test required participants to hop 30-centimeters medially/laterally for 10 repetitions and figure-of-8 hop test required participants to hop in a figure-of-8 pattern over a 5-meter distance for 2 repetitions. Both tests were completed twice on the involved leg. Hopping ability was measured in time to complete (seconds). A positive change score indicated improvement by a decrease in time needed to perform each test. The MDC with 95% confidence intervals was calculated for each variable [ $MDC = 1.96SD \times (1-ICC)^{1/2} \times (2)^{1/2}$ ]. **RESULTS:** Average pre and post-intervention scores were  $12.55 \pm 4.51$ sec and  $10.06 \pm 2.45$ sec for side-hop and  $14.60 \pm 2.70$ sec and  $13.00 \pm 1.80$ sec for figure-of-8 hop respectively. MDC was 2.60sec for both side-hop and figure-of-8 hop. These values reflect the minimal score necessary to be 95% confident that any measured change surpasses the statistical error associated with the test. Approximately 34.38% of the intervention participants had a clinically meaningful change of  $>2.60$  seconds for side-hop test and 31.25% for figure-of-8 hop test. **CONCLUSIONS:** When these functional

balance tests are used to detect beneficial changes from rehabilitation interventions, these MDC scores should be used as a minimum threshold to detect a true and clinically meaningful change.

**1336** Board #98 May 30 10:30 AM - 12:00 PM  
**Relationship Between Balance And Anterior Talofibular Ligament And Superior Extensor Ankle Retinaculum Thickness**

Brooke Malloy, Adrian Aron, David Farrow, Haily Cook, Elizabeth Smoot, Lindsey Cash, Kristen Jagger, Brent Harper. *Radford University, Radford, VA.* (Sponsor: Lynn Millar, FACSM)  
(No relevant relationships reported)

Ankle sprains are a common injury, with affected individuals often experiencing recurrent symptoms that can progress to chronic ankle instability (CAI). Balance impairments are routinely present in subjects with CAI. Changes in tissue structure of the anterior talofibular ligament (ATFL) and superior extensor ankle retinaculum (SEAR) may occur after an ankle sprain, and may contribute to impaired balance through altered proprioception. **PURPOSE:** To determine if ATFL/SEAR thicknesses were related to dynamic balance in individuals with CAI. **METHODS:** Subjects were 14 males and 15 females (Age =  $24.52 \pm 3.46$  years). Ankle instability was assessed using the Cumberland Ankle Instability Tool (CAIT), with a cut-off score of 25 to define two groups: those with and without CAI. Real-time ultrasound was used to assess ATFL and SEAR thicknesses. Dynamic balance was measured with the Y Balance Test (YBT) and the NeuroCom® motor control and adaptation tests. For subjects with CAI, we analyzed stable versus unstable ankles; for those without CAI, we analyzed right versus left ankles.

**RESULTS:** There was no difference in mean ATFL thickness ( $0.24 \pm 0.03$  vs.  $0.22 \pm 0.04$  cm, respectively,  $p=0.21$ ) or in SEAR thickness ( $0.09 \pm 0.01$  vs.  $0.10 \pm 0.02$  cm, respectively,  $p=0.19$ ) between the stable and unstable ankles in those with CAI. For those without CAI, there was also no difference between the right and left ATFL thickness ( $0.22 \pm 0.06$  vs.  $0.20 \pm 0.04$  cm,  $p=0.14$ ) or SEAR thickness ( $0.09 \pm 0.01$  vs.  $0.09 \pm 0.01$  cm,  $p=0.95$ ). There was no difference in YBT scores in those with or without CAI ( $p=0.21$ ,  $p=0.89$  respectively). Additionally, sway energy for upward or downward forces was comparable between those with and without CAI ( $p=0.15$ ,  $p=0.36$ ). Similarly, composite latencies were also no different ( $p=0.68$ ).

**CONCLUSIONS:** There was no relationship between ligament thickness and balance, supporting a multifactorial CAI rather than dependency upon tissue changes alone. Central nervous system sensory integration, neuromuscular control compensations, or psychosomatic reactions may be the ones affecting the balance more. Likewise, subject perception of ankle instability may not coincide with impaired dynamic balance. Finally, tests used to assess dynamic balance may not be sensitive enough to identify differences caused by CAI.

**1337** Board #99 May 30 10:30 AM - 12:00 PM  
**Lower Limb Impairments In Patients With Knee Osteoarthritis**

Hechmi Toumi<sup>1</sup>, Thomas M. Best, FACSM<sup>2</sup>, Eric Lespessailles<sup>1</sup>. <sup>1</sup>*Orleans University, Service de Rhumatologie, Centre Hospitalier Régional d'Orléans, Orléans, France.* <sup>2</sup>*UHealth Sports Medicine Institute, Department of Orthopedics, Division of Sports Medicine, U of Miami, Coral Gables, FL 33146, USA, Miami, FL.* (Sponsor: Thomas Best, FACSM)  
Email: hechmi.toumi@univ-orleans.fr  
(No relevant relationships reported)

**PURPOSE:**

Self-reported knee pain is a frequent reason of consulting medical doctors. In the setting of knee osteoarthritis (KOA) care, although it has been shown that muscle function is more closely associated with joint pain than the grade of joint space narrowing, its assessment is generally neglected. In addition, knee malalignment and foot imbalance which are recognized potential risk factor for KOA are not systematically considered. The aim of our study was to determine the frequency of foot imbalance and quadriceps strength and activations disorders and their relationship with knee pain.

**METHODS:**

150 patients suffering from knee pain (64 men and 88 women) aged 45-74 years (mean age 58.9, SD = 8.1) underwent quantitative tests of 3D foot scan, quadriceps strength, surface electromyography foot balance during maximal isometric, squat and walking exercises. Inclusion criteria included; radiographic K-L (Kellgren and Lawrence) grades less than 2. Exclusion criteria included: (1) a history of lower limb surgery; and (2) a history of arthrocentesis and acorticosteroid or hyaluronic acid injection within 3 months of study commencement.

**RESULTS:**

3D foot scan showed that 28% of patients had asymmetrical foot print shape during static position (normal stance) in both feet, 32% in the painful leg and 21% in the

non-painful leg. 44% of the subjects had quadriceps weakness (during isometric test, painful limb was significantly weaker). 28% and 17% unequal vastus medialis versus vastus lateralis ratio activation and 18% and 11% delay in Vastus medialis activation during squatting and walking respectively. When analysed by multiple logistic regression, quadriceps strength, vastus medialis /vastus lateralis ratio activation and foot pronation were independently associated with knee pain. Quadriceps strength and vastus medialis/vastus lateralis ratio activation were not associated with foot misbalance.

**CONCLUSIONS:**

The findings indicate that, knee pain is a multifactorial process in which several mechanical factors could be associated—but both weakness of the quadriceps muscles and misbalance in the foot are often altered. We may recommend lower limb biomechanics analysis, muscle activation and 3D foot print to optimise both diagnosis and treatment in patients with knee pain.

**1338 Board #100 May 30 10:30 AM - 12:00 PM Obesity and Falls in Older Women: Mediating Effects of Muscle Quality, Foot Loads and Balance**

Silvia G. R. Neri<sup>1</sup>, Lara A. Harvey<sup>2</sup>, Anne Tiedemann<sup>3</sup>, André B. Gadelha<sup>1</sup>, Ricardo M. Lima<sup>1</sup>. <sup>1</sup>Faculty of Physical Education, University of Brasilia, Brasilia, Brazil. <sup>2</sup>Neuroscience Research Australia, University of New South Wales, Sydney, Australia. <sup>3</sup>Institute for Musculoskeletal Health, The University of Sydney, Sydney, Australia.  
Email: silvia\_grn@hotmail.com  
(No relevant relationships reported)

**PURPOSE:** Obesity is associated with risk of falls in older women. However, it is not certain whether factors commonly associated with obesity and/or falls mediate this risk. This study examined whether muscle quality, foot loads and postural balance mediate the relationship between obesity and falls. **METHODS:** At baseline, 246 female participants underwent obesity screening (BMI≥30kg/m<sup>2</sup>), and had muscle quality (isokinetic dynamometer and DXA), foot loads (pressure platform) and postural balance (force platform) evaluated. Incident falls were recorded at the end of the 18-month follow-up period. To identify mediating factors of obesity and falls, a series of modified Poisson regression analyses were conducted as per Baron and Kenny's 3 step criteria. Each potential mediator was individually assessed for its association with obesity (step 1), and if this association was significant, then each potential mediator was assessed for its association with falls (step 2). If the potential mediator was significantly and independently associated with both obesity and falls, the potential mediator and obesity were both included as independent variables in a model to assess their association with falls (step 3). If the 3 mediating conditions were all met, the intervening variable effect was examined using Freedman and Schatzkin test. Significance level was set at p<.05. **RESULTS:** 204 volunteers (83%) completed the follow-up. Obese participants had an increased risk of falls during the 18-month period (RR= 2.13, 95% CI= 1.39-3.27). The table below presents the mediation analysis of the relationship between obesity and falls. Of the variables analysed, only muscle quality (specific torque) was a significant mediator (t= 4.026, p<.001). **CONCLUSION:** Low muscle quality was identified as a mediator for the relationship between obesity and falls in older women. Thus, the inclusion of muscle strengthening as a part of a falls prevention program may benefit this population.

Assessment of potential mediating factors of obesity and falls. Data are RR (95% CI)			
Potential mediators	Step 1	Step 2	Step 3
<b>Muscle quality</b>			
Knee extensors peak torque (< 88.1 Nm)	1.34 (0.81-2.23)	-	-
Leg lean mass (< 5.0 kg)	0.21 (0.08-0.56)	0.83 (0.47-1.44)	-
Specific torque (< 16.1 Nm.kg <sup>-1</sup> )	2.48 (1.54-3.98)	2.75 (1.78-4.26)	2.37 (1.48-3.79)
<b>Foot loads</b>			
Maximum force (> 848.3 N)	9.92 (5.17-19.04)	1.76 (1.11-2.77)	1.08 (0.58-2.04)
Contact area (> 141.8 cm <sup>2</sup> )	3.28 (2.01-5.36)	1.51 (0.93-2.44)	-
Peak pressure (> 680.0 kPa)	1.20 (0.71-2.02)	-	-
Flat foot (dynamic arch index > 0.28)	1.70 (1.20-2.40)	1.37 (0.86-2.16)	-
<b>Postural balance</b>			
CoP speed (> 1.83 cm/s)	0.99 (0.56-1.74)	-	-
CoP anteroposterior range (> 3.3 cm)	2.03 (1.25-3.30)	1.62 (1.02-2.58)	1.38 (0.87-2.20)
CoP mediolateral range (> 1.8 cm)	1.64 (1.02-2.64)	1.29 (0.80-2.09)	-

**1339 Board #101 May 30 10:30 AM - 12:00 PM Does Movement Strategy Change Directional Balance Reach Test Performance Variability?**

Yo-Rong Chen, Larry R. Munger, Troy Hooper, C. Roger James, FACSM. Texas Tech University Health Sciences Center, Lubbock, TX.  
Email: yo-rong.chen@ttuhsc.edu  
(No relevant relationships reported)

The Directional Balance Reach Test (DBRT) outcome measurement is a composite score (CS) based on the maximum reach distances of three trials in each of three testing directions: anterior (ANT), posterior-medial (PM), and posterior-lateral (PL). Movement strategy, with and without specific movement cues, may alter within trial reach distance performance variability. It may provide different clinical information about individual movement control during DBRT. **PURPOSE:** The purpose of this study was to determine whether movement strategy impacted CS and performance variability in DBRT. **METHODS:** Sixteen subjects (eight males and eight females) were randomly assigned to two groups. Each group performed DBRT on the dominate support (DS) and dominate kick (DK) legs by using personal (P) and specific (S) strategies in different orders (P-S, S-P). The ANT, PM, and PL reach directions were randomized during nine reaching trials. Reach distance was normalized to the subject's leg length. Performance variability of reach distance in each direction was defined by measuring absolute error (AE=[∑<sub>i=1-3</sub>|xi-x̄|]/3). Two-way mixed ANOVAs, strategy(2) x order(2), were used in a preliminary analysis to rule out an order effect in CS. Two-way repeated ANOVAs, strategy (2) x reach direction (3), were used to determine whether these independent variables affected performance variability. **RESULTS:** For CS, there was no main order effect (p>.05). However, there was a significant strategy effect for both legs (p<.001; DS: P=90.01±6.98%, S=82.92±5.97%; DK: P=89.53±7.93%, S=82.82±7.80%). For AE in DS, there was no significant strategy effect, but there was a main direction effect (p =.001, η<sup>2</sup>=.376, Power=.953; ANT=3.48±2.02%, PM=5.18±4.15%, PL=6.05±4.12%). For AE in DK, there was a significant strategy by direction interaction (p =.044, η<sup>2</sup>=.189, Power=.606). Post-Hoc tests revealed a significant strategy effect (p<.05) for PL only (P=4.78±3.10, S=7.33±5.15). **CONCLUSION:** The movement strategy used impacted CS. However, AE was only altered in the PL direction in DK. The DBRT, a closed chain dynamic balance test, may be a novel task for assessing DK leg performance variability.

THURSDAY, MAY 30, 2019

**1340** Board #102 May 30 10:30 AM - 12:00 PM  
**Automated Identification of Postural Control for Individuals with Parkinson's Disease using a Machine Learning Approach**

Yumeng Li<sup>1</sup>, Shuqi Zhang<sup>2</sup>, Christina Odeh<sup>2</sup>, Li Guan<sup>3</sup>. <sup>1</sup>Texas State University, San Marcos, TX. <sup>2</sup>Northern Illinois University, DeKalb, IL. <sup>3</sup>University of Georgia, Athens, GA.  
 Email: yumeng.li@txstate.edu  
 (No relevant relationships reported)

Machine learning is a branch of artificial intelligence that enables computer systems to learn from data and analyze data without being explicitly programmed. Interest in machine learning has grown rapidly in clinical settings because the diagnosis of diseases or disorders can be automated by computer systems with high accuracy and minimum human intervention. However, the use of machine learning to identify postural control patterns for people with Parkinson's disease (PD) is not well established.

**PURPOSE:** The purpose of the study was to develop and validate an automated identification of PD postural control patterns using a machine learning approach. **METHODS:** 12 participants with PD (age = 75.3 ± 6.6 yr, height = 1.71 ± 0.12 m, mass = 83.1 ± 12.4 kg) and 18 healthy controls (age = 83.3 ± 5.5 yr, height = 1.62 ± 0.08 m, mass = 73.1 ± 16.2 kg) were recruited. Participants were instructed to stand on a force plate and maintain still for 2 minutes during eyes-open and eyes-closed conditions. The center of pressure (COP) data were collected at 50 Hz; sway area, linear displacements, total distances, standard deviations of COP positions and average velocities were calculated. 3 supervised machine learning algorithms (i.e., logistic regression (LR), k-nearest neighbors (KNN) and naïve Bayes (NB)) were used to identify PD postural control patterns. All participants were divided into two datasets: 70% for training and 30% for testing.

**RESULTS:** KNN achieved the highest overall accuracy rate (0.90) to identify PD postural control. LR and NB also exhibited satisfactory performance. The overall accuracy of LR ranged was 0.86; and the overall accuracy of NB was 0.81. Though all three models are capable of analyzing small-sample data, model performance to identify PD postural control could be potentially improved by recruiting a larger sample size and exploring other machine learning models in future research. **CONCLUSIONS:** Computer-aided machine learning models successfully identified postural control patterns of PD patients with high accuracy. The use of machine learning may provide a valid and efficient approach to better understand PD postural control features and thus, could be beneficial for the early diagnosis and early intervention in individuals with PD.

**1341** Board #103 May 30 10:30 AM - 12:00 PM  
**Using A Kinect™ Sensor To Develop An Objective Quantification Of The 20s-march Test For Adl Assessment In Older Individuals**

Nobuo Takeshima<sup>1</sup>, Takeshi Kohama<sup>2</sup>, Masanobu Kusunoki<sup>2</sup>, Soichi Okada<sup>3</sup>, Eiji Fujita<sup>4</sup>, William F. Brechue, FACSM<sup>5</sup>. <sup>1</sup>Asahi University, Mizuho, Japan. <sup>2</sup>Kindai University, Kinokawa, Japan. <sup>3</sup>Ukai Hospital, Nagoya, Japan. <sup>4</sup>Institute of Fitness and Sports in Kanoya, Kanoya, Japan. <sup>5</sup>Kirkville College of Osteopathic, Medicine A.T. Still University of Health Sciences, Kirkville, MO. (Sponsor: William F. Brechue, FACSM)  
 Email: takeshima@alice.asahi-u.ac.jp  
 (No relevant relationships reported)

**PURPOSE:** With increasing interest in addressing quality of life of older individuals, tests such as the Functional Independence Measure (FIM) are widely used measures of infirmity and burden of care. However, these scales are largely qualitative and especially problematic when assessing movement-based tasks. While effective, reliable analysis of human movement is technically complicated and expensive; an infrared depth sensor is potentially a low-cost, portable device which may provide a quantitative aspect to clinical testing. Our purpose was to assess the utility of the Kinect™ sensor in providing an objective evaluation of human movement using an oft measured ADL (march-in-place test; MIP). **METHODS:** Community-dwelling older adults living in 6 districts and were users of daycare 3 facilities within 4 prefectures in JAPAN. Men (n= 31) and women (n= 74) between the age of 62 and 93 years, consisting of independent (IG; n = 58) and dependent (DG; n = 47) older adults performing the March test. FIM was administered to all subjects (scored by a physical therapist). On a separate day, subjects completed a 20-s MIP test and joint point coordinate data was recorded with a Kinect™ v2 during the final 10-s of the test. Initial head position is the origin (H (0)) and head position at any time t is H (t). The Euclidean distance |H (t) - H (0)| between these two points (0) was calculated and summed as the maximum moving distance (MMD) max { |H (t) - H (0)| }. **RESULTS:** Age, height, body mass and BMI were similar between groups. MMD was greater (p<0.05) in DG (0.293 ± 0.187m) than IG (0.153 ± 0.102m), and was related to age (r=-0.605, p=0.051). An optimal threshold for MMD identifying frailty was determined by a receiver-operator characteristic curve with a MMD of 0.207m providing the

combination of sensitivity (62%) and specificity (79%). **CONCLUSIONS:** During the 20-s MIP test, the increased MMD observed in DG appears to indicate that staggering during stepping is large. The result seems to represent instability during marching and poor balancing ability in frail adults. The 20-s MIP and associated MMD identifies frailty in the present population with good sensitivity and specificity.

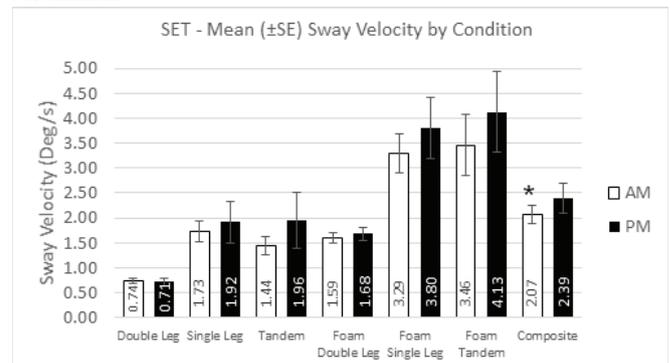
**1342** Board #104 May 30 10:30 AM - 12:00 PM  
**Time-of-day Influence On The Stability Evaluation Test (set)**

Jeff Pasley, Sara Camp, Kade Carrigan, Brandon Doan. Georgia Gwinnett College, Lawrenceville, GA. (Sponsor: Patrick O'Connor, FACSM)  
 Email: jpasley@ggc.edu  
 (No relevant relationships reported)

**PURPOSE:** Postural control is impaired following a concussion and is one diagnostic method used by medical professionals for return-to-play decisions in concussed athletes. Circadian rhythm affects human function, including postural control. The purpose of this research was to investigate time of day variation related to the SET postural control diagnostic protocol on a Neurocom Balance Master.

**METHODS:** The Georgia Gwinnett College Institutional Review Board approved this research protocol. The research participants were 19 healthy women (11) and men (8) with an average age of 21.7 (± 2) years, height of 165.9 (± 15) cm, and weight of 69.3 (± 8.3) kg. The participants completed the SET in the morning (between 7:00 AM and 10:00 AM) for one treatment and in the evening (between 3:00 PM and 7:00 PM) for the other treatment condition. A SET familiarization session was completed and treatment order was randomized and balanced to attempt to account for order effects. Participants were instructed to get a normal night's sleep prior to testing and refrain from caffeine use on the day of testing. Participant sleep, physical activity, and concussion history were recorded by survey.

**RESULTS:** There was less average postural sway during the morning testing for all conditions except for the least challenging balance condition (double-leg firm surface), trending towards larger differences in the more challenging balance conditions (see chart below). The only statistically significant difference (p < 0.05) was for the overall SET composite score, 2.07 (± .19) Deg/s in the AM versus 2.39 (± .30) Deg/s in the PM condition.



**CONCLUSIONS:** While greater sample size, age, athletic specificity and gender range are needed, these results may begin to inform practitioners as to the importance of controlling time-of-day between SET conditions. This may improve accuracy of comparison between baseline and post-injury diagnostic testing which would enable more confident return-to-activity decisions.

**1343** Board #105 May 30 10:30 AM - 12:00 PM  
**Vestibular And Proprioceptive Alteration Influence Postural Instability During Dual Tasks In Adults Diagnosed With HIV**

Leah Hammer<sup>1</sup>, Gabriel Gines<sup>2</sup>, Jonathan Marshall<sup>1</sup>, Martin Rosario<sup>1</sup>. <sup>1</sup>Texas Woman's University, Dallas, TX. <sup>2</sup>Puerto Rico University, Ponce, PR.  
 Email: lhammer@twu.edu  
 (No relevant relationships reported)

**PURPOSE:** People diagnosed with HIV can exhibit impaired postural control as a consequence of infection or from secondary effects of medication. Characterize the role of the vestibular and proprioceptive systems during dual postural control tasks in Individuals with HIV. We hypothesize that postural stability will decrease with the increase of task complexity.

**METHODS:** The study was conducted in San Juan, Puerto Rico at a community-based program, La Perla de Gran Precio. 24 subjects (13 male and 11 female, age average 59.2 ± 1.7 years) participated in the study. Participants had to be diagnosed with HIV

with a CD4 count of >200 cells/uL to enroll in the study. After signing the informed consent and collecting demographic data, a member of the research team placed a lumbar accelerometer on each subject. Each participant was instructed to quiet stand in a static bi-pedal posture on a firm surface or a thick foam pad. Each task took 15 seconds to be performed. The first task was to stand on a firm surface (baseline), the eight remaining balance tasks were performed with a thick balance foam mat (four single and four dual cognitive tasks). For the cognitive dual tasks participants were instructed to count backward 3 numbers at a time.

**RESULTS:** Postural control was measured with Body-worn accelerometers (ACC). The two variables of interest in this study were jerk sway acceleration in an anterior-posterior (A-P) and mediolateral direction (M-L),  $m^2/s^5$ . A MANOVA analysis was used to compare the variables of interest, between baseline (BL) (firm surface eyes open) and single/double tasks. AP sway increased significantly during single (BL  $0.020 \pm .01 m^2/s^5$  versus single task  $0.20 \pm 0.02 m^2/s^5$   $P < 0.005$ ) and dual tasks (BL  $0.020 \pm .01 m^2/s^5$  versus dual task  $0.23 \pm 0.03 m^2/s^5$   $P < 0.005$ ) when visual input was canceled.

**CONCLUSIONS:** Single and dual tasks showed a similar challenge and results regarding increased acceleration and instability. It appears that the vestibular and proprioceptive systems could be impaired in HIV diagnosed people. Because there is no fall history among the participants of this study and these findings, it seems that patients with HIV rely on the visual system to a higher degree to attain postural control.

**1344** Board #108 May 30 10:30 AM - 12:00 PM  
**Age-associated Decline In Directional Dynamic Balance In Community-dwelling Older Women**

Hidehiro Yamamoto<sup>1</sup>, Nobuo Takeshima<sup>1</sup>, Nicole L. Rogers<sup>2</sup>, Michael E. Rogers, FACSM<sup>2</sup>. <sup>1</sup>Asahi University, Mizuho, Japan. <sup>2</sup>Wichita State University, Wichita, KS. (Sponsor: Michael E. Rogers, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** To determine whether there is an age-associated decline in leaning directions of DB in community-dwelling older women. **METHODS:** DB was determined in 558 older women. DB was characterized by limits of stability (LOS) that measured end-point excursion (EXE) and maximum excursion (MXE) of the body's center of pressure, reaction time (RT), mean velocity (MVL), and directional control (DLC). LOS consisted of 8 leaning tests around a center square at 0, 45, 90, 135, 180, 225, 270, and 315 degrees. Average (composite) values for each variable in all directions, as well as for each variable in the forward (0 degrees), backward (180 degrees), right (45 degrees), and left (270 degrees) directions, were analyzed. **RESULTS:** For overall composite scores and the 4 directions, relationships existed between age and RT ( $r = 0.18$  to  $0.34$ ,  $p < 0.001$ ), between age and MVL ( $r = -0.13$  to  $-0.30$ ,  $p < 0.001$ ), age and EPE ( $r = -0.27$  to  $-0.49$ ,  $p < 0.001$ ), age and MXE ( $r = -0.27$  to  $-0.43$ ,  $p < 0.001$ ), and age and DLC ( $r = -0.11$  to  $-0.38$ ,  $p < 0.001$ ). Although age had a significant effect on all balance parameters, there was a higher correlation coefficient with age and composite values compared to the directional results. The influence of age on forward, backward, right, and left directions was not clear. **CONCLUSIONS:** Age had a significant main effect on all balance measures. Balance ability declined in all directions but it is not clear if certain directions are affected differently. Not only was the distance that one can lean without losing balance (EPE and MXE) negatively affected by age, the rate of decline in RT and MVL were also large in all directions. Balance exercise should be designed to address each of these parameters when leaning in the forward, backward, and lateral directions in order to prevent falls.

**1345** Board #107 May 30 10:30 AM - 12:00 PM  
**Is Wobble Board Balance Performance Influenced by Sex and Anthropometric Characteristics?**

Cristina Cortis<sup>1</sup>, Giuseppe F. Giancotti<sup>1</sup>, Philip X. Fuchs<sup>2</sup>, Herbert Wagner<sup>2</sup>, Rubens A. da Silva<sup>3</sup>, Andrea Fusco<sup>1</sup>. <sup>1</sup>University of Cassino e Lazio Meridionale, Cassino, Italy. <sup>2</sup>University of Salzburg, Salzburg, Austria. <sup>3</sup>Université du Québec à Chicoutimi, Saguenay, QC, Canada. (Sponsor: Carl Foster, FACSM)  
 Email: c.cortis@unicas.it  
 (No relevant relationships reported)

It has been demonstrated that balance can be influenced by anthropometric characteristics and sex. However, controversial findings are reported, mainly due to the large variability in subjects tested and methodologies adopted. Therefore, new hi-tech approaches, able to limit this variability, are needed to accurately evaluate balance control. **PURPOSE:** To assess the influence of anthropometric characteristics and sex on computerized wobble board (WB) balance measures. **METHODS:** Forty-eight (women=24; men=24) young (age=24.0±3.0years) adults were selected to cover a wide range of anthropometrics (mass=64.6±11.5kg; height=167.3±8.5cm; body mass index [BMI]=23.0±3.2kg·m<sup>-2</sup>). Subjects performed three 30-second trials per limb on a WB equipped with a triaxial accelerometer. Time (s) spent on the platform keeping it flat

at 0° was collected for subsequent analysis. Pearson's correlation was used to evaluate the relationships between WB values and the anthropometrics (height, mass, BMI). ANOVA was used to examine WB performance differences between sex for dominant and non-dominant limbs ( $p < 0.05$ ). **RESULTS:** The measured anthropometrics did not significantly correlate with the WB performance. Although women (dominant limb=19.2±4.6s; non-dominant limb=19.8±4.9s) presented better balance than men (dominant limb=18.8±3.5s; non-dominant limb=19.1±4.1s), no significant sex differences were observed for both dominant ( $p = 0.73$ ) and non-dominant ( $p = 0.60$ ) limb. **CONCLUSIONS:** Interestingly, anthropometrics and sex did not affect the WB performance. Due to the close relationship previously reported between WB training and ankle muscles activity, it could be hypothesized that the WB performance is affected by their strength, stiffness or activity. WB improvements after training protocol using WB exercises, can be understood as consistent change in performance not affected by other source of variability such as variation in body mass. Therefore, trainable neuromuscular factors should be targeted during training protocols to gain postural control improvements, without controlling the anthropometrics, independently from the sex. From a clinical point of view, during preventive and rehabilitative programs a special attention should be given to the ankle muscles.

**1346** Board #108 May 30 10:30 AM - 12:00 PM  
**Adults Diagnosed with HIV Report Decreased Balance Confidence Compared to Non-Faller Older Adults**

Gabriel Gines<sup>1</sup>, Leah Hammer<sup>2</sup>, Lauryn Deschamps<sup>2</sup>, Jonathan Marshall<sup>2</sup>, Flavia Bayron<sup>3</sup>, Martin G. Rosario<sup>2</sup>. <sup>1</sup>Ponce Health Science University, Ponce, PR. <sup>2</sup>Texas Woman's University, Dallas, TX. <sup>3</sup>University of Puerto Rico, San Juan, PR.  
 Email: gabriel.gines7@gmail.com  
 (No relevant relationships reported)

Individuals diagnosed with HIV often experience balance impairments caused by the virus or medication. These deficiencies due to compensation of the postural control systems might be unperceived for years until the impairments are to advance. **PURPOSE:** Assess perceived balance confidence in people with HIV compared to a group of older adults without an HIV diagnosis. **METHODS:** The study was conducted in San Juan, Puerto Rico at an HIV Rehabilitation Clinic (La Perla de Gran Precio) for the HIV group (HIVG). 24 subjects (13 male and 11 female) participated in the study (age  $59.2 \pm 1.7$  years). To enroll in the study, participants needed an HIV diagnosis with a CD4 count of > 200 cells/uL. The control group (CG) was recruited from the Community Center Complejo Deportivo Carcaño Alicea, Bayamon, Puerto Rico. A total of 25 subjects in the control group (5 males and 20 females) with an age average of  $71.5 \pm 3.6$  years old participated in the study. A member of the research team verbally asked the subjects 16 questions that involved a variety of daily functional activities from the Activities-specific Balance Confidence (ABC) Scale. Each participant was instructed to give a percentage (0-100%) on how confident their balance is while attempting to do these specific functional activities. **RESULTS:** A MANOVA analysis was used to compare ABC scale data between groups. HIVG exhibited significantly reduced balance confidence in six out of sixteen subsets of the ABC scale. Chair and Reach (CG  $81.20 \pm 22.651$ , HIV group  $55.67 \pm 19.680$ ,  $P \leq 0.05$ ), Sweep (CG  $93.60 \pm 9.631$ , HIV group  $76.67 \pm 12.660$ ,  $P \leq 0.05$ ), Crowded Mall (CG  $87.40 \pm 21.704$ , HIV group  $66.67 \pm 12.873$ ,  $P \leq 0.05$ ), Mall (CG  $84.40 \pm 12.189$ , HIV group  $68.00 \pm 17.264$ ,  $P \leq 0.05$ ), Escalator (CG  $77.40 \pm 23.722$ , HIV group  $52.40 \pm 11.995$ ,  $P \leq 0.05$ ), and Icy Sidewalks (CG  $74.40 \pm 26.900$ , HIV group  $43.67 \pm 15.880$ ,  $P \leq 0.05$ ). **CONCLUSIONS:** These results indicate that adults with HIV are likely to have less confidence in their balance with those tasks, which may result from decreased proprioception and also may result in increased fall risk. Clinicians should make an effort to identify perceived balance confidence in early stages of the condition to reduce the risk of fall in these population.

**1347** Board #109 May 30 10:30 AM - 12:00 PM  
**Effect Of The Modified Broström-Gould Surgery On Balance In Chronic Ankle Instability**

Andrew S. Bartlett<sup>1</sup>, Brittney Mazzone<sup>2</sup>. <sup>1</sup>Nazareth College, Penfield, NY. <sup>2</sup>IDoD-VA Extremity Trauma and Amputation Center of Excellence, San Diego, CA; <sup>2</sup>Naval Medical Center San Diego, San Diego, CA, San Diego, CA.  
 Email: abartlet1@naz.edu  
 (No relevant relationships reported)

**Purpose:** Chronic ankle instability (CAI) has a high incidence and impacts individuals ranging from young athletes to sedentary adults. CAI can result from a single ankle sprain or from repeated ankle sprains at the lateral ankle. The main deficits associated with CAI are balance impairments, poor postural control, and recurrent sprains. The modified Broström-Gould surgery is considered when conservative treatment has been ineffective at addressing CAI. This procedure involves the reattachment of the ruptured anterior talofibular and calcaneofibular ligaments, with reinforcement through the

inferior extensor retinaculum. There is a lack of research regarding objective outcome measures for balance following this procedure. The purpose of this report was to assess changes in static and dynamic balance for an individual who underwent the modified Broström-Gould surgery.

**Methods:** A 28 year-old female with right CAI completed pre-testing (two weeks prior to surgery) and post-testing (two months following surgery). Outcome measures included the modified STAR Excursion Balance Test (mSEBT), the Balance Error Scoring System (BESS), and Single Leg Hop Down Test for time to stabilization (TTS) using force plate testing.

**Summary of Results:** Postoperatively, the patient showed improvements in all directions on the mSEBT for the affected and unaffected lower extremities (LE), with greater improvement seen on the affected LE by 22-30%. The patient improved her overall score for the BESS, demonstrating a reduced number of errors on the affected LE from 20 to 15. The Single Leg Hop Down Test revealed a decrease in the average TTS on the affected LE from 1.88 seconds to 1.01 seconds.

**Conclusion:** After completion of the modified Broström-Gould surgery and in conjunction with rehabilitation, the patient showed an improvement in dynamic balance measures, possibly due to increased strength and reduced pain levels following rehabilitation after surgery. Future studies should examine the role of exercise interventions and fitness level in determining patient outcomes following the modified Broström-Gould surgery.

**Disclaimer:** The views expressed herein are those of the author(s) and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense or the United States Government.

**1348 Board #110 May 30 10:30 AM - 12:00 PM**  
**Validation Of The Tekscan Strideway Plantar Pressure Mat Compared To A Force Platform**

Rachael A. Ard, Jake A. Melaro, Alex M. Carnall, Alexis K. Nelson, Sarah E. Blackmore, Victoria A. White, Max R. Paquette, Douglas W. Powell, FACSM. *University of Memphis, Memphis, TN.*  
 Email: rachael.a.ard@gmail.com  
 (No relevant relationships reported)

Force platforms represent the criterion method of assessing external force applied to an athlete during a given task. However, force platforms have several characteristics that may limit their use in sport and clinical environments including limited portability. Therefore, a need exists for portable equipment with high validity to measure load-related variables such as vertical force. **PURPOSE:** To validate vertical force measured using the Tekscan Strideway Plantar Pressure system compared to a force platform. **METHODS:** Five participants performed three 10-second quiet standing trials in each of eight weighting conditions. Increased weighting was achieved by increasing load during a deadlift. Vertical ground reaction force was measured independently using a plantar pressure mat (PPM, 500 Hz, Tekscan Strideway Plantar Pressure Mat, Boston, MA) and a force platform (FP, 1000 Hz, AMTI, Watertown, MA). Custom software (MATLAB, MathWorks, Natick, MA) was used to analyze vertical force data from the PPM and FP. FP data were downsampled to 500 Hz and the average force across the final 5 seconds of each trial was calculated. A correlation analysis was conducted to determine the strength of agreement between the PPM and FP. A paired samples t-test was conducted to compare mean force values measured using the PPM and FP. Cohen's d effect sizes were calculated to determine the meaningfulness of differences between the FP and PPM. **RESULTS:** No differences in vertical force were observed between the PPM and FP were observed ( $p = 0.483$ ; PPM:  $227.9 \pm 64.7$  N/kg; FP:  $237.5 \pm 57.9$ ). A small effect size ( $d = 0.15$ ) suggests the small differences were likely not meaningful. A high level of agreement ( $r = 0.959$ ) was observed between the PPM and FP. **CONCLUSIONS:** These data demonstrate that vertical force measured using the Tekscan Strideway plantar pressure system are comparable to the more expensive criterion method of a strain gauge-based force platform measures. Moreover, the Strideway platform is mobile providing a solution for non-laboratory based assessments of vertical forces. Further research should evaluate the validity of the Strideway plantar pressure system during more dynamic activities such as jumping and landing and for different force-related variables.

**C-35 Free Communication/Poster - Disability**

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

**1349 Board #111 May 30 9:30 AM - 11:00 AM**

**Should We Stick with Step Counts after Incomplete Spinal Cord Injury? A Case-Control Investigation**

Whitley J. Stone, Amanda J. Wakeman, Braden A. Younkun, Dustin W. Davis, Matthew J. Garver, H Scott Strohmeier. *University of Central Missouri, Warrensburg, MO.* (Sponsor: Thomas Scott Lyons, FACSM)  
 (No relevant relationships reported)

Step count is a common metric or criterion to prescribe physical activity. Step activity benchmarks were designed to reflect an overall daily energy expenditure, but this objective measure is exposed to error when gait is impaired. Individuals with functional limitations are known to expend more energy during locomotion when compared to non-impaired controls (CON).

**PURPOSE:** The primary goal was to evaluate metabolic cost per step for someone with an incomplete spinal cord injury (iSCI) when compared to a CON. A secondary goal was to evaluate estimated daily energy expended between the individuals to determine if step count is an appropriate metric for activity recommendations for those with functional limitations. **METHODS:** This case-control study included a participant with an iSCI and an age-, sex-, height-matched CON. Participants completed a 6-minute walk (6MWT) and timed walks at slow, moderate, and fast paces (matching the step monitor's intensity benchmarks) while wearing a portable metabolic cart. Relative oxygen consumption ( $VO_2$ ) was determined using a 15-breath moving average. Daily step activity was recorded during the 7-day period between sessions. Stride length was determined using 3D motion analysis. **RESULTS:** Differences were observed between participants for average 6MWT  $VO_2$  (iSCI=21.5 ml/kg/min; CON=28.18 ml/kg/min), step length (iSCI: 0.36m; CON: 0.73m), energy expenditure during the 6MWT (iSCI: 0.34kcal/m; CON: 0.09kcal/m), and daily step activity (iSCI: 2616, CON: 9890). Estimated energy expended from walking for iSCI and CON was 336 kcal/day and 735 kcal/day, respectively, when extrapolating  $VO_2$  from paced walks to data retrieved from the step monitor. **CONCLUSION:** Supporting previous literature, it is likely inappropriate to standardize activity recommendations based on step metrics for those with functional limitations. Unrealistic expectations may heighten perceived barriers, undermine mobility related self-efficacy, and discourage adoption or adherence. Exercise prescription based on energy expenditure goals may serve as an alternative means to individualize recommended daily activity. Future research should attempt to establish new recommendations based on functional status for those outside of the typical gate norm.

**1350 Board #112 May 30 9:30 AM - 11:00 AM**

**The Effects of 8-weeks Structural Exercise-Based Intervention on Autism Spectrum Disorders**

Qiang Ye, Haolei Xue, Yuqin Ji. *Nanjing Sport Institute, Nanjing, China.*  
 Email: yeqiang@nsi.edu.cn  
 (No relevant relationships reported)

Lack of physical activity reduces the effects of interventions and brings more health risks for individuals with ASDs (Autism Spectrum Disorders). Accumulating evidences indicate exercise program integrated varied types of exercises in a structured framework would achieves maximum gains in fitness for them. However, most of existed studies focused on one special exercise type to reduce the autism-specific impairments.

**PURPOSE:** to observe fitness changes with a 8-weeks structured exercise-based intervention for ASDs.

**METHODS:** The subjects were 6 adolescents with ASDs between the ages of 11-14 yrs (male = 5, female = 1) were recruited. They were mild-moderate and severe ASD patients according scores from the Social Responsiveness Scale. The intervention program was seen in Tab1. The Physical fitness was measured by body composition analysis with indicators, including fat mass (FM), body mass index (BMI) etc. The mental fitness was evaluated by Autism Treatment Evaluation Checklist (ATEC). Data comparisons were made using paired t-test.

**RESULTS:** The overall weight of the subjects decreased about 2.4%, and significant decrease happened in FM at 11.7% ( $27.35 \pm 14.36$  vs.  $24.16 \pm 13.78$  Kg,  $p < 0.05$ ). Among 4 subclasses of ATEC, significant decrease happened in Communication ( $18.50 \pm 3.42$  vs.  $12.00 \pm 3.46$ ,  $p < 0.01$ ) and Sociability ( $25.00 \pm 6.38$  vs.  $15.75 \pm 6.40$ ,  $p < 0.01$ ). Average total score of subjects was in moderate category, while was in severe category before the intervention.

**CONCLUSION:** Structured exercise-based intervention efficiently manage weights, prompts speech and communication skills, enhances sensory ability, and improves health behaviors through whole environmental construction. It is a feasibly alternative intervention for ASDs.

Supported by the the Natural Science Fund for Colleges and Universities in Jiangsu Province (17KJA330001).

Content	Aerobic exercise	Resistance exercise	Neuromuscular exercise
Type	Outdoor walking	Jogging over circles	Playing Paper plane
Frequency (times/week)	3	3	2
Intensity	50%~75% HR <sub>max</sub>	10-15RM	50%~75% HR <sub>max</sub>
Time (min)	60	4 sets (2-3 mins interval), 30	30

**1351 Board #113 May 30 9:30 AM - 11:00 AM**  
**Does The Severity Of Autistic Symptoms Influence The Effects Of An Exercise Intervention Program?**

Sharon Kinsella<sup>1</sup>, Craig Coffey<sup>1</sup>, Damien Sheehan<sup>1</sup>, Avery Faigenbaum, FACSM<sup>2</sup>. <sup>1</sup>Institute of Technology Carlow, Carlow, Ireland. <sup>2</sup>The College of New Jersey, Ewing, NJ. (Sponsor: Professor Avery Faigenbaum, FACSM)  
 Email: sharon.kinsella@itcarlow.ie

*(No relevant relationships reported)*

**PURPOSE:** The purpose of this study was to examine if improvements in training-induced fitness levels are related to the severity of autistic symptoms in children with autism.

**METHODS:** A total of 26 children (7.88 years ± 2.27) with a diagnosis of autism, were recruited for this study. Prior to and on completion of the exercise intervention, the children's fitness levels were assessed using the Modified Eurofit Physical Fitness Battery, which included a 20m Sprint, Stork Balance test, Standing Broad Jump, Sit & Reach and a Hand Grip Strength Test. The exercise intervention was 8 weeks duration with three 1-hour sessions per week. The exercises included push and pull upper and lower body exercises, incorporating fundamental movement skills, through games aimed at the interests of the children. The severity of autism symptoms was assessed using the Gilliam Autism Rating Scale (GARS), completed by their teacher. Based on this rating, the children were divided into low, moderate or high groups, in terms of their autism symptoms. A spearman's correlation was undertaken between the GARS score and the overall percentage change in fitness levels for each child within the 3 categories.

**RESULTS:** The results of the study demonstrated that children who had the greatest symptoms of autism (high group) demonstrated the greater correlation to change in fitness levels (r=1.0, p < 0.01) with a mean percentage change in fitness levels of 285.93% ± 322.16. In comparison the moderate and low groups only had a correlation of r= 0.35 (p > 0.05) and r= 0.592 (p < 0.05) and their overall mean percentage changes in fitness levels were 26.87% ± 33.79 and 65.93% ± 114.79.

**CONCLUSIONS:** The results of this study suggest that exercise programs for children with autism appear to be most effective for participants with more severe autistic symptoms.

**1352 Board #114 May 30 9:30 AM - 11:00 AM**  
**Wrist-worn Actigraph Cut-points For Classifying Activity Intensity In Spinal Cord Injury**

Akhila Veerubhotla, Dan Ding. *University of Pittsburgh, Pittsburgh, PA.*  
 Email: ALV47@pitt.edu

*(No relevant relationships reported)*

Physical activity (PA) recommendations are often made in terms of intensity, frequency, and duration. Accelerometer-based devices are increasingly used by users to track their own PA behaviors and by researchers to examine the association of habitual PA and health indicators. There are well-recognized accelerometer cut-points to estimate time spent in sedentary, lightweight, and moderate-to-vigorous (MVPA) intensities of PA, but such estimation is often dependent on the population, sensor placement, and activities that were used to derive the cut-points. Limited work has been done to derive accelerometer cut-points for people with spinal cord injury (SCI). Many of these individuals use wheelchairs for mobility and rely on their upper extremities for almost all PA.

**PURPOSE:** To derive wrist-worn accelerometer cut-points for classifying activity intensity in people with SCI using a range of daily activities and exercise.

**METHODS:** Thirty-one subjects with SCI who use a manual wheelchair for primary mobility wore an accelerometer-based ActiGraph device on their wrist and performed 18 activities of daily living and exercise at different intensities for 10 minutes each. The criterion intensity was obtained from a portable metabolic cart. Activity counts from the Actigraph was correlated with the criterion to derive cut-points using linear regression. Data from 80% of the subjects was used to derive cut-points using an iterative process with 1000 iterations while the derived cut-points were tested for accuracy on the remaining 20% of the subjects. Cut-points were also tested on data from 14 subjects in a separate study following a similar protocol.

**RESULTS:** Accelerometer cut-points derived for people with SCI yielded an overall accuracy of 84.3% with 98%, 82.3% and 65.8% accuracy for classifying sedentary, light and MVPA activities, respectively, when tested on the 20% subjects, and an overall accuracy of 86.9% with 94.7%, 86.6% and 74.7% for the three intensities, respectively, when tested on the 14 subjects in the other study.

**CONCLUSION:** The high accuracy of the cut-points particularly for classifying sedentary behavior may be very useful tool for interventions aiming at reducing sedentary behavior in this population.

Supported by a VA Merit Review Grant.

**1353 Board #115 May 30 9:30 AM - 11:00 AM**  
**Acute Effects of Upper Limb Vibration Exercise on Physiological Measures for Wheelchair Users**

Sarah Bass<sup>1</sup>, Theresa Crytzer, PT, DPT, ATP<sup>2</sup>, Alicia Konntz, Ph.D.<sup>2</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>Human Engineering Research Laboratory, Pittsburgh, PA.

Email: srb94@pitt.edu

*(No relevant relationships reported)*

Strong upper limb(UL) musculature is essential for people with spinal cord injury (SCI) to perform vital activities of daily living(ADL's). The benefits of UL resistance training for manual wheelchair users (MWU) include gains in muscle strength, endurance, decreased pain and improved performance of ADL's. Studies in non-SCI populations have shown the potential for vibration to enhance training benefits.

**PURPOSE:** The purpose of this study was to determine the acute physiological effects of heart rate (HR), blood lactate (BL), power output and ratings of perceived exertion (RPE) during upper limb vibration training compared to standard dumbbell training.

**METHODS:** Thirteen MWU with SCI below T2 were recruited. Participants completed two training protocols: using a Galileo vibrating dumbbell (VT) at 30hz and a standard dumbbell (DT). For VT, the participant held the dumbbell in a static position for 45-60 seconds. For the DT, participants completed 10 repetitions of each exercise. Training protocols were completed in separate study visits. Heart rate was collected throughout both trainings. Ratings of perceived exertion for each exercise were measured after completion of the exercise. Power output from a Wingate test and blood lactate were collected before and after each protocol and were examined using a two-way repeated measures ANOVA. A dependent t-test was used to examine RPE and heart rate for each exercise between training sessions.

**RESULTS:** Participants average (STD) age, height and weight were 48 (10) years, 175(6) cm and 83 (17) kg respectively. There were no significant differences in the physiological measures (BL: p = .868, Power: p =.815, HR p =.116-.949) except for RPE shown in Table 1.

Table 1. RPE Results

Exercise	Mean (std)		p-value
	VT	DT	
Side Flies	13.9 (1.7)	11.62 (1.4)	.002
Straight Arm Row	13.1 (2.8)	10.8 (2.0)	.032
Bicep Curls	12.7 (2.8)	11.9 (1.4)	.387
Triceps Extensions	13.2 (1.7)	10.9 (1.6)	.005
Front Raise	15.1 (2.5)	11.8 (1.1)	.001
Bent Over Rows	13.1 (2.3)	12.0 (1.8)	.058

**CONCLUSION:** All but two of the exercises were perceived by participants to be more difficult with vibration compared to a standard dumbbell. A long-term study with additional participants is needed to examine the training benefits of vibration in SCI.

**1354** Board #116 May 30 9:30 AM - 11:00 AM  
**Differences in Exercise Effects from Static versus Dynamic Standing in Non-Ambulatory Children with Cerebral Palsy**

Åsa B. Tornberg<sup>1</sup>, Victor Hansson<sup>2</sup>, Andreas Jakobsson<sup>2</sup>, Katarina Lauruschkus<sup>1</sup>. <sup>1</sup>Department of Health Sciences, Lund University, Lund, Sweden. <sup>2</sup>Centre for Mathematical Sciences, Lund University, Lund, Sweden.  
 Email: asa.tornberg@med.lu.se  
 (No relevant relationships reported)

**PURPOSE:** To compare the metabolic adaptive effects to four months of two types of structured training regimes, static standing (StS) versus dynamic standing (DyS), on cardiopulmonary and metabolic parameters among non-ambulatory children with cerebral palsy (Na-CP).

**METHODS:** Eighteen Na-CP participated in an exercise intervention study with a crossover design, comparing four months of StS to four months of DyS. During StS, the Na-CP were encouraged to exercise according to standard care recommendations in Sweden including daily supported StS for 30-90 minutes. During DyS, daily exercise for at least 30 minutes at a speed between 30 to 50 rpm in an Innowalk (Made for movement, Norway) was recommended. We assessed adaptive effects from the exercise programs through indirect calorimetry during 30 minutes of StS and DyS. Exercise test to evaluate StS was performed in a standing frame and to evaluate DyS using an Innowalk (Made for movement, Norway). An airtight mask covering the mouth and nose was worn in order to measure breath-by-breath  $\text{VO}_2$ ,  $\text{VCO}_2$  and VE (Oxycon Mobile, Jaeger, Germany). Heart rate was recorded continuously throughout the test (Polar T1, Polar, Finland). As many of the variables were linearly correlated, we used robust Principal Component Analysis (rPCA) to determine the components carrying most information. A multidimensional Shapiro-Wilk test indicates that the data can be well described as being multivariate normal distributed, allowing the use of a Hotelling  $T^2$  test.

**RESULTS:** In a multidimensional statistical analysis of metabolic exercise effects, oxygen consumption, carbon dioxide production, and ventilation were concluded to carry most information and additionally, seen to be statistical different between StS and DyS reviling a p-value for the two groups having different means of  $4.6 \cdot 10^{-3}$ .

**CONCLUSIONS:** A highly statistically significant difference was found in the metabolic adaptation, described as  $\text{VO}_2$ ,  $\text{VCO}_2$  and VE, to StS versus DyS.

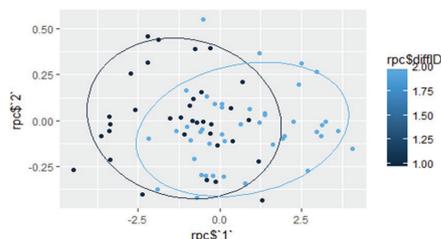


Figure. Shows the two most relevant components (rpc1 and rpc2), computed using Robust PCA (RPCA). The dark points are the differences of the second and first measurement for StS, the lighter points, are the same difference for DyS. A multidimensional Shapiro-Wilk test was used to define the 95% confidence level ellipses to be drawn.

**1355** Board #117 May 30 9:30 AM - 11:00 AM  
**Effects of Inpatient Multicomponent Occupational Rehabilitation on Physical Activity Levels**

Marius S. Fimland, Martin Skagseth, Tom IL Nilsen, Lene Aasdahl. Norwegian University of Science and Technology, Trondheim, Norway.  
 Email: marius.fimland@ntnu.no  
 (No relevant relationships reported)

**PURPOSE:** To assess whether inpatient multicomponent occupational rehabilitation, including physical activity (PA), increases the PA level of participants more than an outpatient program without PA, and whether changes in PA are associated with future work outcomes. **METHODS:** 265 participants were included in one of two randomized clinical trials. Participants had been sick listed 2 to 12 months with a musculoskeletal, psychological or general/unspecified diagnosis. We measured PA by questionnaires at the start of the programs, and at 3, 6 and 12 months of follow-up. Between-group differences in PA were assessed using linear mixed models. Associations between change in PA and future work outcomes were assessed by logistic and linear regression. **RESULTS:** There was no difference in change in PA between the inpatient and outpatient programs during 12 months of follow-up. We did not find any associations between the amount of PA and future work outcomes. However, intensity of PA was positively associated with return to work (RTW); participants reporting

increased vigorous PA had an odds ratio (OR) for RTW of 4.1 (95% confidence interval [CI] 1.1 to 15.7) whereas participants reporting consistently high intensity of PA had an OR of 3.1 (95% CI 1.0 to 9.7), compared to participants reporting low intensity PA. **CONCLUSION:** Inpatient occupational rehabilitation, including PA, did not increase PA-level in the follow up period more than a less comprehensive program without PA. The amount of PA was not associated with future work outcomes. However, vigorous PA showed a positive association with RTW.

**1356** Board #118 May 30 9:30 AM - 11:00 AM  
**Sedentary And Physical Activity Patterns In Adults With Intellectual Disability**

Guillermo R. Oviedo<sup>1</sup>, Nauris Tamulevicius<sup>2</sup>, Casimiro Javierre<sup>3</sup>, Núria Massó-Ortigosa<sup>4</sup>, Myriam Guerra-Balic<sup>1</sup>. <sup>1</sup>FPCEE-Blanquerna (URL), Barcelona, Spain. <sup>2</sup>FPCEE-Blanquerna (University of TampaURL), Tampa, FL. <sup>3</sup>Universitat de Barcelona, Barcelona, Spain. <sup>4</sup>Facultat de Ciències de la Salut-Blanquerna (URL), Barcelona, Spain.  
 Email: guillermorubeno@blanquerna.url.edu  
 (No relevant relationships reported)

**Introduction:** Adults with intellectual disabilities (ID) present higher health risks due to their extremely low physical activity (PA) levels. It is important to enhance our knowledge about PA levels and sedentary time (ST) among this specific population.

**Purpose:** This study describes and compares PA levels and ST of active (AG) and a non-active (NAG) groups of adults with ID versus a group of adults without ID (AWID).

**Method:** Thirty-seven participants from an AG with ID, 29 participants from a NAG with ID and 31 adults AWID participated in this study. An informed consent and a health screening questionnaire were completed by each participant and each legal guardian. Height and weight were obtained to calculate BMI. PA and ST levels were assessed with ActiGraph accelerometers for 7 consecutive days. A chi-square test of independence was performed to examine the relation between groups and ID levels. Variables of age and anthropometry were analyzed by using a one-way analysis of variance (ANOVA). Total PA and PA levels of each group were compared by using a one-way analysis of covariance (ANCOVA).

**Results:** The AG performed higher values of moderate to vigorous PA compared to the NAG ( $p = 0.018$ ), but, similar to the group of AWID. The group of AWID spent less time in ST and more time in light PA than both groups of adults with ID (all  $p < 0.001$ ). The participants of the AG did not demonstrate less ST than the NAG.

**Conclusion:** When assessing PA levels in ID participants, it was observed that participants presented large amounts of sedentary behaviors in both groups. The participants of the AG, despite participating in PA programmes did not demonstrate less ST. We believe that, by including well designed and structured PA programmes into their workdays, as well as incorporating breaks to reduce bouts in ST and total ST, could be of great help to increase daily PA levels in adults with ID. **Partially supported by:** MEC (DEP2017-86862-C2-1-R)

Table 1  
Participants' characteristics, anthropometry indices and PA data.

Variables	Adults without ID (n = 31)	Active Group w/ ID (n = 37)	Non-Active Group w/ID (n = 29)	p-value
	Mean (SD)	Mean (SD)	Mean (SD)	
<b>Characteristics</b>				
Age (years)	43 (11)	41 (11)	46 (12)	.196
Gender (male/female)	14/17	22/15	17/12	
<b>Level of ID</b>				
Mild	--	11	7	.613
Moderate	--	26	22	
<b>Anthropometry</b>				
Height (cm)*	167.90 (7.79)	160.43 (10.87)	162.03 (9.30)	.017
Weight (kg)	73.64 (12.04)	70.07 (13.55)	74.24(12.52)	.350
BMI (kg/m <sup>2</sup> )	26.08 (3.71)	27.38 (5.00)	28.56 (6.35)	.174
<b>PA data<sup>†</sup></b>				
Total PA (counts•min <sup>-1</sup> )*, **	316.86 (78.71)	306.86 (85.71)	236.54 (107.90)	<b>.002</b>
ST (mins•day <sup>-1</sup> )*, **	513.71 (81.88)	614.98 (106.77)	615.04 (80.57)	<b>&lt;.001</b>
LPA (mins•day <sup>-1</sup> )*, **	252.39 (69.78)	117.37 (39.57)	136.69 (49.92)	<b>&lt;.001</b>
MPA (mins•day <sup>-1</sup> )*, **	33.92 (17.35)	37.48 (26.29)	25.26 (19.87)	.069
VPA (mins•day <sup>-1</sup> )*, **	0.69 (1.08)	1.24 (0.99)	0.67 (0.45)	<b>.044</b>
MVPA (mins•day <sup>-1</sup> )*, **	34.61 (17.08)	38.72 (26.64)	25.95 (20.58)	.059
Sedentary bouts >1 min*, **	99.76 (43.64)	123.34 (20.13)	124.69 (20.79)	<b>.022</b>
Sedentary Breaks/ Sedentary Hour	11.26 (2.16)	11.64 (1.80)	12.37 (2.15)	.206
Accelerometer wearing time (mins•day <sup>-1</sup> )	800.72 (76.14)	771.08 (111.52)	777.68 (73.10)	.416

Note: values are means (Standard Deviation).  
Abbreviations: ID (intellectual disability); BMI (body mass index); PA (physical activity); ST (sedentary time); LPA (light physical activity); MPA (moderate physical activity); VPA (vigorous physical activity); MVPA (moderate to vigorous physical activity).  
† n = 35 for active group w/ID; n = 28 for non-active group w/ID.  
Statistically significant values are showed in bold (p ≤ .05).  
\* Significant difference (p ≤ .05) between adults without ID vs Active Group w/ID.  
\*\* Significant difference (p ≤ .05) between adults without ID vs Non-Active Group w/ID.  
\*\*\* Significant difference (p ≤ .05) between Active Group w/ID vs Non-Active Group w/ID.

**1357** Board #119 May 30 9:30 AM - 11:00 AM

**The Fitness Effects Of A School-based Exercise Program On Children With Autism.**

Craig Coffey, Sharon Kinsella, Damien Sheehan. *Institute of Technology Carlow, Carlow, Ireland.* (Sponsor: Avery Faigenbaum, FACSM)  
Email: Craig.Coffey@itcarlow.ie  
(No relevant relationships reported)

**PURPOSE:** To examine the effects of a school-based exercise program on the fitness level of elementary school children who attend an autism class.  
**METHODS:** A total of 35 (7.66 years ± 2.1) children with a diagnosis of autism were recruited for this study. Prior to and on completion of the exercise intervention the fitness levels of the children was assessed using the Modified Eurofit Physical Fitness Battery, including a 20m Sprint, Stork Balance test, Standing Broad Jump, Sit & Reach and a Hand Grip Strength Test. The exercise program was 8 weeks duration, with

the children partaking in 3, 1-hour supervised sessions per week. The intervention was comprised of push and pull upper and lower body exercises and incorporated fundamental movement skills. These movements were achieved through games aimed at the interests of the children and were adapted to each child's specific needs through the use of visual aids using an iPad. The data were analysed using paired t-tested.

**RESULTS:** All variables except Hand Grip strength significantly improved (p < 0.05) over the eight-week period. 20m sprint times improved (p < 0.05) by 0.46s ± 1.36. The Stork balance test significantly improved (p < 0.05) by 17.82s ± 38.86. The standing broad jump significantly increased (p < 0.05) by 14.54cm ± 20.29. The Sit and Reach score significantly increased (p < 0.05) by 3.05cm ± 4.51. No significant (p > 0.05) change was noted in the Hand Grip strength which increased by 0.38psi ± 1.38.

**CONCLUSIONS:** These preliminary findings indicate that an 8-week school-based exercise intervention can significantly improve selected fitness variables in children with autism.

**1358** Board #120 May 30 9:30 AM - 11:00 AM

**The Examination of Judo on Physical Activity and Sleep in Children with Autism Spectrum Disorder**

Paola M. Rivera<sup>1</sup>, Justine Renziehausen<sup>1</sup>, Kayla Baker<sup>1</sup>, Nicholas Leahy<sup>1</sup>, Jeanette Garcia<sup>1</sup>, Lei Xu<sup>2</sup>. <sup>1</sup>University of Central Florida, Orlando, FL. <sup>2</sup>East Carolina University, Greenville, SC.  
(No relevant relationships reported)

**PURPOSE:** The aim of this study was to examine the effects of an 8-week judo program on moderate-to-vigorous physical activity (MVPA), sedentary behavior (SB), and sleep quality in children with Autism Spectrum Disorder (ASD).

**METHODS:** Participants included 15 children (ages 8-17, with a formal diagnosis of ASD). The sample participated in an 8-week judo program (45 minutes, 1X week), with measures taken at baseline and at the end of the 8-weeks. In order to assess activity levels and sleep quality, participants were instructed to wear Actigraph GT9X Accelerometers for 7 days and nights, only removing the device during water-based activities. Non-parametric paired t-tests were conducted to compare differences in MVPA, SB, and sleep quality (i.e. sleep efficiency, total sleep time, number of awakenings, and wake after sleep onset) pre and post judo. Chi-square tests compared the number of participants who met sleep and MVPA recommendations.

**RESULTS:** Results indicate participants spent a significantly greater percentage of time in daily MVPA (8% vs 4%, p=0.05) following the program, however, actual MVPA minutes per day did not reach statistical significance (74.46 vs. 48.58 minutes per day, p=0.1) There was a significant increase in total sleep duration (572.56 vs 333.8, p=0.008) following the program, and although not statistically significant, a trend existed for improved sleep efficiency (92% vs 88%, p=0.1). There was an increase in the number of participants meeting MVPA (53% vs 27%) and sleep recommendations (40% vs 7%), although results were not statistically significant.

**CONCLUSIONS:** Improvements in MVPA and sleep quality were observed following the 8-week judo program, although statistically significant findings were limited due to the small sample size. Future studies should include larger samples of youth with ASD, over a longer intervention period.

**1359** Board #121 May 30 9:30 AM - 11:00 AM

**A Community-based Running Program Enhances Gait Parameters in Children and Young Adults with Developmental Disabilities**

Jilda Vargus-Adams, Jennifer Angeli, Micah Garcia, Ana Livecchi, Jason Long, Madison Peck, Sarah Schwab. *Cincinnati Children's Hospital Medical Center, Cincinnati, OH.* (Sponsor: Kevin Ford, FACSM)  
(No relevant relationships reported)

**PURPOSE:** This study aimed to substantiate the efficacy of a voluntary 10-week running program for children and young adults with developmental disabilities. We hypothesized that the running intervention would positively influence temporal-spatial parameters (TSPs) of gait. **METHODS:** Sixteen children and young adults with developmental disabilities, ages 7-24 years (M=15.3 ± 4.4 years) enrolled in a "Sit to Fit" training program. Participants engaged in group running practices in an outdoor community setting, twice weekly for 10 weeks. Training sessions followed a time-based progression of walk-run intervals with a gradual increase (~15%) in total run time each week. At the conclusion of the training, all participants completed a 5K race. TSPs of gait were measured one month prior to program start and repeated within one month of program conclusion, using the GAITRite Portable Walkway System (CIR Systems Inc. Clifton, NJ). Participants completed the Six Minute Walk Test at a self-selected speed on a walking loop that included the GAITRite mat. Each participant walked across the mat 6-10 times. TSPs were averaged across all trials for each visit. Analysis included cadence (steps/minute), normalized walking velocity (leg length/second), stride length (cm), and step width (cm). Descriptive statistics, effect size (mean change score/mean standard deviation), and a two-tailed paired t-test for each TSP were computed. **RESULTS:** Cadence (mean difference 7.25 steps/min, p<0.05), walking velocity (mean difference 0.14 leg length/sec, p<0.05), and stride

length (mean difference 8.16 cm,  $p < 0.05$ ) increased significantly following the 10-week training period. We calculated a moderate effect size for stride length ( $d = 0.50$ ), small to moderate effect sizes for cadence ( $d = 0.38$ ) and walking velocity ( $d = 0.26$ ), and negligible effect size for step width ( $d = 0.06$ ). **CONCLUSION:** A community-based running program contributed to improved gait mechanics in a cohort of children with mobility impairments. Others have shown that walking ability gains are associated with improved bipedal gross motor skills like running. The results of this study indicate that the reverse may also be true: running was associated with gains in walking ability in children and young adults with developmental disabilities.

**1360** Board #122 May 30 9:30 AM - 11:00 AM  
**Flourishing and Physical Activity in Adolescents With and Without Autism Spectrum Disorder**  
 Stephanie M. McCoy, Kristen Morgan. *University of Southern Mississippi, Hattiesburg, MS.*  
 (No relevant relationships reported)

Autism spectrum disorder (ASD) is characterized by behaviors that can negatively affect daily life. However, little is known about the effects of physical activity (PA) participation on measures of flourishing (i.e. resilience in functioning) as well as excessive arguing and behavioral conduct problems in those with ASD vs. typically developing (TD) youth. **PURPOSE:** To compare measures of flourishing, excessive arguing, and behavioral conduct problems in youth with ASD compared to TD peers and determine if physical activity participation mediates these differences. **METHODS:** Analyses included 22,873 youth (51% male) aged 10 to 17 years (mean  $13.8 \pm 2.3$  yrs) from the 2016 National Survey of Children's Health. Youth were grouped into those with ASD ( $n = 656$ ), and TD ( $n = 22,217$ ). Outcome variables included measures of flourishing (finishing tasks, staying calm, showing interest in new things), excessive arguing, and behavioral conduct problems. Logistic regression models, adjusted for age, race, gender, SES, ASD severity, and medication assessed the odds of each outcome comparing ASD to TD. Further analyses examined whether participation in PA ( $\geq 4$  d/wk) mediated the relationships between ASD and outcome variables. **RESULTS:** Within youth with ASD, only 31% engaged in regular PA ( $\geq 4$  d/wk) vs. 51% of TD youth. In adjusted models, those with ASD were 58% less likely to finish tasks ( $OR = 0.42$ ;  $p < 0.001$ ), and 65% less likely to stay calm when faced with a challenge ( $OR = 0.35$ ;  $p = 0.009$ ) compared to TD youth. Additionally, those with ASD were 3.48 times more likely to argue excessively ( $OR = 2.98$ ;  $p < 0.001$ ), and 5.54 times more likely to experience behavioral conduct problems ( $OR = 5.54$ ;  $p < 0.001$ ) compared to TD youth. After adjustment for PA, relationships were slightly attenuated for flourishing ( $OR = 0.46$ ,  $p = 0.001$ ;  $OR = 0.38$ ,  $p = 0.014$ ), excessive arguing ( $OR = 2.80$ ;  $p < 0.001$ ), and behavioral conduct problems ( $OR = 5.10$ ;  $p < 0.001$ ). ASD was not associated with showing interest in learning new things. **CONCLUSIONS:** Those with ASD were significantly less likely to flourish, and more likely to experience behavioral conduct problems and argue excessively compared to TD youth. However, PA attenuated these relationships. These findings suggest that regular PA may increase positive flourishing behaviors and decrease negative behaviors.

**1361** Board #123 May 30 9:30 AM - 11:00 AM  
**Age-related Changes In Para-athletics And Racing Wheelchair Performance**  
 Julien Schipman, Pasquale Gallo, Andy Marc, Juliana Antero, Jean-françois Toussaint, Adrien Sedeaud, Adrien Marck. *INSEP, France, France.*  
 (No relevant relationships reported)

**PURPOSE:** How aging affects para-athletics performance? During the last decades, following the motto "Citius, Altius, Fortius", all the para-athletic categories have significantly increased their performance levels. Such an improvement is not only reached by highly optimized prosthetics, but also by a gradual improvement on training, of nutrition, and recovery methods. Few studies have investigated the performance determinants in para-athletics. We studied the effect of age on maximal performances for racing wheelchair- and para-athletes. **METHODS:** We collected data on the 53,554 results from previous international competitions between 2009 and 2017 for women and men para-athletics and racing wheelchair disciplines for a total of 472 sport disciplines (considering impairment types for each discipline). We fitted maximal performance by age through the validated Moore equation for each para-athletics and racing wheelchair disciplines. **RESULTS:** We found a similar age-related pattern in maximal performance between able-bodied, para-athletes and wheelchair athletes. However, the age of peak performance varies according to sex, impairment type and discipline. The top 100 best performances include a large age range (from 15 years to 55 years) in each discipline suggesting that performance haven't probably been optimized yet for most elite racing wheelchair and para-athletes. Maximal performance differences appear for running disciplines between the two categories: in sprinting disciplines para-athletes are faster than wheelchair athletes. To the contrary, para-athletes are slower than wheelchair athletes in endurance discipline, and the difference increases with distance **CONCLUSIONS:** Data reveal that only a few

disabilities classes contributed to the maximal performance both in para-athletes and racing wheelchair discipline. Further studies will contribute to increase knowledge about age-related changes in para-athletes and racing wheelchair athletes.

**1362** Board #124 May 30 9:30 AM - 11:00 AM  
**Comparison Of Physical Activity Levels During Therapeutic Camp Activities In Youth With Disabilities**  
 Vincenzo G. Nocera, Tyler J. Kybartas, Angela J. Wozencroft, Dawn P. Coe, FACSM. *The University of Tennessee, Knoxville, Knoxville, TN.*  
 Email: vnocera@vols.utk.edu  
 (No relevant relationships reported)

Youth with disabilities have limited opportunities to engage in leisure time physical activity (PA). Outdoor therapeutic recreation (TR) camps provide diverse PA opportunities that include structured (dramatic, functional, game, constructive) and unstructured (free time) activities that have the potential to benefit these individuals cognitively and physically. However, little is known about the PA levels during these activities. **Purpose:** To compare the PA levels of youth attending an outdoor TR camp, across various activity contexts. **Methods:** Youth ( $n = 25$ ;  $14.6 \pm 3.9$  y) with disabilities attending an overnight TR camp, participated in the study. PA was assessed using ActiGraph GT3X or GT3X+ accelerometers worn on the wrist during camp activities. Participants engaged in 14 activities of varying contexts based on the primary skill addressed, creating five distinct areas. Gross/Functional activity involves simple motor activities (e.g., yoga, ropes course). Game play is activity that involves set rules (e.g., sports, games). Dramatic play includes pretend play (e.g., theatre, team building activities). Fine/constructive play involves manipulation of objects for creative purposes (e.g., science experiments, cooking). During free time, the youth choose their activities (e.g., playground activity, hang out in cabin). The mean vector magnitude [VM; counts per minute (counts·min<sup>-1</sup>)] of individual activities was used to calculate the PA level of each area. One-way ANOVAs were used to determine differences in VM for each area as well among individual activities within an area. **Results:** There were no differences ( $p = .999$ ) in the mean VM for any area: Gross/Functional ( $2601.4 \pm 1648.9$  counts·min<sup>-1</sup>), Game ( $2599.3 \pm 1551.9$  counts·min<sup>-1</sup>), Drama ( $2569.3 \pm 1420.9$  counts·min<sup>-1</sup>), Fine/Constructive ( $2601.3 \pm 1552.29$  counts·min<sup>-1</sup>), and Free Time ( $2557.9 \pm 1398.8$  counts·min<sup>-1</sup>). Additionally, there were no differences ( $p = .999$ ) among activities within each domain. **Conclusion:** The results revealed a consistent level of PA across all areas of activity. These findings suggest the activities offered in this outdoor TR program provide an opportunity for youth with disabilities to accumulate PA that may also benefit them cognitively and physically.

**1363** Board #125 May 30 9:30 AM - 11:00 AM  
**Recreational Ballroom Dance and Multiple Sclerosis**  
 Linda B. Piacentine<sup>1</sup>, Alice F. Yan<sup>2</sup>, Alexander V. Ng, FACSM<sup>1</sup>.  
<sup>1</sup>Marquette University, Milwaukee, WI. <sup>2</sup>University of Wisconsin-Milwaukee, Milwaukee, WI.  
 Email: linda.piacentine@marquette.edu  
 (No relevant relationships reported)

Multiple Sclerosis (MS) symptoms include fatigue, pain, spasticity, sensory changes, motor dysfunctions, postural instability, sexual and bladder dysfunctions, as well as cognitive impairments and depression. Despite the known benefits of exercise in mitigating symptoms in persons with MS, adherence to physical activity recommendations is low and often MS patients are sedentary. Recreational ballroom dancing is a fun form of exercise, or physical activity, in which partners can support each other while learning basic to more complex dance steps. **PURPOSE:** This study investigated the physical and psychological changes perceived by persons with MS who participated in a novel structured ballroom dance intervention. A secondary purpose was to gather suggested improvements for the intervention with the aim of promoting physical activity among persons with MS. **METHODS:** Community-dwelling persons with MS ( $n = 13$ ) participated in a ballroom dance pilot intervention which met twice/week for 8 weeks. Dances included rumba, foxtrot, waltz, salsa, swing, and tango. One week after program completion, participants were invited to one-hour focus group sessions. The focus groups were audiotaped and transcribed verbatim. Thematic analysis was completed using NVivo qualitative analysis software. **RESULTS:** Four major themes emerged, which identified several benefits of ballroom dance among participants: (1) Physical and Psychological Benefits: Ballroom dance improved their perceived symptoms including improved strength, endurance, coordination, and balance, along with less fatigue and depression; (2) Positive Social Support: Ballroom dance provided positive social support and was a fun date night activity with their partners; (3) Improved Confidence: The dance intervention built confidence in future exercise and lifestyle change; and (4) Barriers to Exercise Removed: Ballroom dancing removed barriers for exercise specific to MS patients. Participants noted difficulty with classes late in day and at inconvenient locations. **CONCLUSIONS:** Recreational ballroom dancing was well-tolerated and

was perceived to be beneficial for promoting positive physical and psychological changes in people with MS. Future interventions could be improved regarding times and locations.

**C-36 Free Communication/Poster - Physical Activity Assessment and Measurement Methods**

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

**1364 Board #126 May 30 9:30 AM - 11:00 AM  
Accelerometer-Based Activity Classification Algorithm for Toddlers: Machine Learning Approach**

Soyang Kwon<sup>1</sup>, Pinky Sindu<sup>2</sup>, Katherine Nickle<sup>1</sup>, Patricia Zavos<sup>1</sup>, Albert Sugianto<sup>2</sup>, Mark V. Albert<sup>2</sup>. <sup>1</sup>Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, IL. <sup>2</sup>Loyola University Chicago, Chicago, IL.  
Email: [skwon@luriechildrens.org](mailto:skwon@luriechildrens.org)  
(No relevant relationships reported)

**PURPOSE:** To develop activity classifiers based on accelerometer data to recognize toddler's eight distinct activities: walking/running, climbing up/down, standing, crawling, sitting, lying down, being carried, and riding a stroller/wagon.  
**METHODS:** Twenty-four toddlers aged 13 to 35 months (50% girls) performed various prescribed activities during free play in a commercial indoor playroom, while wearing Actigraph wGT3X-BT accelerometers on the hip and wrist. Their activities were video recorded. The video data were annotated and synchronized with accelerometer data. Five machine learning classifiers, including random forest, support vector machine, decision tree, K-nearest neighbors, and logistic regression, were trained and tested. Classifier performance was evaluated using subject-wise cross-validation.  
**RESULTS:** Activity classifiers were developed based on 1,011 two-second window accelerometer signal clips from the 24 participants. Of the five classifiers tested, the random forest classifier presented the highest overall accuracy (69% for hip and 55% for wrist). Overall, hip data showed higher accuracy than wrist data. Based on the hip random forest classifier, 91% of "walking/running" activities and 84% of "sitting" activities were correctly identified. However, 35% of "being carried" activities and 30% of "standing still" activities were misclassified as "walking/running". Only 8% of "stroller/wagon ride" activities were misclassified as "walking/running".  
**CONCLUSIONS:** This pilot study demonstrates that the machine learning approach can be used to detect toddler's "walking/running" activities at a high level of sensitivity. However, the algorithm developed in this pilot study often misclassified "standing still" or "being carried" as "walking/running". "Stroller/wagon ride" was less frequently misclassified as "walking/running". Overall, hip data demonstrated higher accuracy than wrist data in detecting key activities for toddlers. Future research should follow to refine the algorithms and test external validity.

**1365 Board #127 May 30 9:30 AM - 11:00 AM  
Thresholds of Sedentary Behavior in Children Based on Various Measures**

Ying Gao, Eero A. Haapala, Anssi Vanhala, Martti Melin, Arja Sääkslahti, Merja Rantakokko, Arto Laukkanen, Arto J. Pesola, Timo Rantalainen, Taija Finni. *University of Jyväskylä, Jyväskylä, Finland.*  
Email: [ying.y.gao@jyu.fi](mailto:ying.y.gao@jyu.fi)  
(No relevant relationships reported)

**PURPOSE:** To investigate the classification accuracy of estimates of energy expenditure (EE), accelerometry (ACC), muscle EMG, and heart rate (HR) for sedentary and non-sedentary activities in children. The agreement of directly measured value of metabolic equivalent of task (MET) with commonly used adult MET value was assessed.  
**METHODS:**  $\dot{V}O_2$ , HR, triaxial ACC and thigh muscle EMG were simultaneously recorded from 35 healthy 7-12 year-old children, who performed 3 pre-determined sedentary and 5 non-sedentary tasks in a random order. Mean values of the concurrent 2 minutes epochs from the measures for each activity were analyzed. Resting EE (REE) was determined during 30 minutes rest in supine position. Adult-estimated MET (METa,  $\dot{V}O_{2 \text{ tasks}} / \dot{V}O_{2 \text{ estimated for adult}}$  in 3.5ml/kg/min) and REE-based measured MET (METr,  $\dot{V}O_{2 \text{ tasks}} / \dot{V}O_{2 \text{ REE}}$ ) were calculated. Mean amplitude deviation (MAD) was computed for ACC and EMG was normalized to mean muscle activity during self-paced walking. The classification accuracy of METr, METa, HR, ACC and EMG for SB was investigated by receiver operating characteristic (ROC) curves, the area under

the ROC curve (AUC) with (95% confidence interval (CI) and optimal cut-points with sensitivity (Se) and specificity (Sp) for METr, METa, HR, ACC, and EMG were computed.  
**RESULTS:** METa was 28.5% lower than METr in any activity ( $p < 0.001$ ). Measured REE in children was  $5.0 \pm 0.8$  ml/kg/min. Figure 1 shows the ROC curves with AUC and its 95%CI for METr, METa, HR, MAD and EMG. The optimal cut-points for SB was 1.3 for METr (Se=80% Sp=80%), 1.9 for METa (Se=80% Sp=82%), 104 beats/min for HR (Se=78% Sp=82%), 0.003g for MAD (Se=83% Sp=89%) and 13% for EMG (Se=81% Sp=94%).  
**CONCLUSIONS:** The SB threshold based on adult METs ( $\leq 1.5$  METs) did not appear to be appropriate for children. All of the used indicators had reasonable classification accuracy with appropriate sensitivity and specificity for sedentary and non-sedentary activities in children.

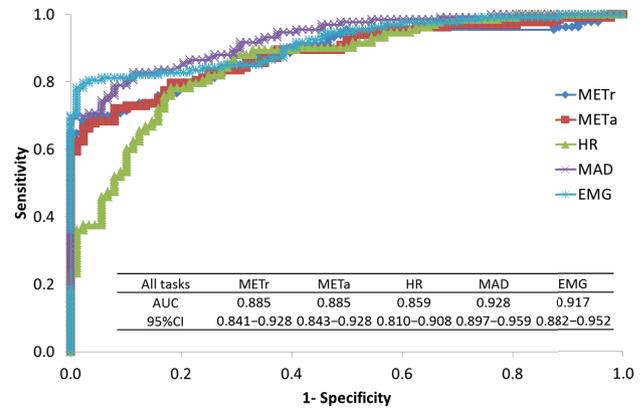


Figure 1. Receiver operator characteristic curves for classifying of "sedentary" and "non-sedentary" activities among METr, METa, HR, MAD and EMG. The tasks included lying down, sitting quietly, sitting while playing mobile game, standing quietly, standing while playing mobile game, walking on a treadmill at 4km/h and 6km/h, and walking over ground.

Funding OKM/59/626/2016.

**1366 Board #128 May 30 9:30 AM - 11:00 AM  
Associations Among School Day Sedentary Behavior, Physical Activity, and Motor Skills: A Compositional Data Analysis**

Ryan D. Burns, Youngwon Kim, Wonwoo Byun, Timothy A. Brusseau, Jr. *University of Utah, Salt Lake City, UT.*  
Email: [ryan.d.burns@utah.edu](mailto:ryan.d.burns@utah.edu)  
(No relevant relationships reported)

**PURPOSE:** A novel analytic approach, Compositional Data Analysis (CoDa), has recently been used to analyze physical activity data. CoDa assumes co-dependence among physical activity compositional parts within a time-constrained data analytic framework, which makes it appropriate for assessing and analyzing physical activity behavior during school hours. The purpose of this study was to examine the relationships among school day sedentary times (SED), light physical activity (LPA), and moderate-to-vigorous physical activity (MVPA) with gross motor skills in children using Compositional Data Analysis (CoDa).  
**METHODS:** Participants were 409 children (Mean age = 8.4±1.8 years) recruited across five low-income schools. Gross Motor Skills were assessed using the Test of Gross Motor Development - 3rd Edition (TGMD-3) and physical activity was assessed using accelerometers. Isometric Log Ratio coordinates (ILRs) were calculated quantifying the relative proportion of percent of the school day (%) spent in SED, LPA, and MVPA. The associations of the ILRs with the TGMD-3 scores were estimated using general linear mixed effects models adjusted for age, BMI, and estimated  $VO_{2 \text{ peak}}$ .  
**RESULTS:** A higher proportion of the school day spent in %MVPA relative to %SED and %LPA significantly associated with higher TGMD-3 total scores ( $\gamma$ MVPA = 14.44,  $P = 0.012$ ). This relationship was also observed for the ball skills subtest scores ( $\gamma$ MVPA = 16.12,  $P = 0.003$ ). A 5% reallocation in % of time spent in SED and LPA to MVPA was independently associated with a 0.48 and 1.74-point increase in ball skills scores, respectively, after controlling for the potential confounders of age, BMI, and estimated  $VO_{2 \text{ peak}}$ .  
**CONCLUSIONS:** Replacing %SED and %LPA with %MVPA during school hours may be an effective strategy for improving gross motor skills, specifically ball skills, in low-income elementary school-aged children.

THURSDAY, MAY 30, 2019

**1367** Board #129 May 30 9:30 AM - 11:00 AM  
**Validity Of Objectively-measured And Self-reported Sedentary Behavior Across Three Trimesters Of Pregnancy**

Bethany Barone Gibbs<sup>1</sup>, Melissa A. Jones<sup>1</sup>, Joshua L. Paley<sup>1</sup>, Kara M. Whitaker<sup>2</sup>, Christopher P. Connolly<sup>3</sup>, Janet M. Catov<sup>1</sup>.  
<sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>University of Iowa, Iowa City, IA. <sup>3</sup>Washington State University, Pullman, WA.  
 Email: bbarone@pitt.edu  
 (No relevant relationships reported)

**PURPOSE:** Sedentary behavior (SED), low intensity behavior in a seated, reclining, or lying posture, is a potential risk factor for poor pregnancy outcomes. We evaluated the validity of commonly used methods to assess SED across three trimesters of pregnancy. **METHODS:** This cohort study of pregnant women measured objective and self-reported SED during each trimester including: 7 days (valid if ≥4 days with ≥ 10 hr) of thigh-worn activPAL micro3 (criterion) and waist-worn Actigraph GT3X and self-report from the Global Physical Activity Questionnaire (GPAQ; modified SED question in hr/day and relative Likert scale) and the Pregnancy Physical Activity Questionnaire (PPAQ; SED subscale, hr/day only). SED hr/day and percent time in SED (SED%) from activPAL were compared to GT3X, GPAQ, and PPAQ using paired t-tests and Pearson's *r*. Correlations were rated as: <0.5 poor; 0.5-0.69 moderate, 0.7-0.89 good, and ≥0.9 excellent. **RESULTS:** Fifty-eight women (mean age 32 ± 5 yr; pre-pregnancy BMI 25 ± 6 kg/m<sup>2</sup>; 76% white) provided three trimesters of valid activPAL data. Compared to activPAL, GT3X SED was similar in the 1<sup>st</sup> and 2<sup>nd</sup> trimester, slightly lower in the 3<sup>rd</sup> (p=0.03), and moderately correlated (Table). Self-reported SED was systematically lower by GPAQ and higher by PPAQ (all p<0.001); correlations with activPAL were poor-to-moderate (GPAQ) or poor (PPAQ). SED% was slightly higher by GT3X vs. activPAL in the 1<sup>st</sup> trimester (p=0.04), but otherwise similar, with moderate correlations throughout pregnancy. GPAQ (Likert) underestimated %SED (p<0.01) from activPAL in the 1<sup>st</sup> and 2<sup>nd</sup> trimesters, but not the 3<sup>rd</sup>, and had poor-to-moderate correlations. **CONCLUSIONS:** Compared to activPAL, waist-worn GT3X resulted in only moderate correlations with SED and SED% across pregnancy, though differences in mean estimates were minimal. Self-report questionnaires had large absolute error and were poorly correlated to SED hr/day during pregnancy; GPAQ SED% was the best self-report method.

**Table. Sedentary behavior (SED) in hr/day, percent time in SED (SED%), and correlations (r) between activPAL and GT3X, the Global Physical Activity Questionnaire (GPAQ), and the Pregnancy Physical Activity Questionnaire (PPAQ)**

	1 <sup>st</sup> Trimester (<14 weeks)		2 <sup>nd</sup> Trimester (20-22 weeks)		3 <sup>rd</sup> Trimester (32-34 weeks)	
	mean (SD)	r	mean (SD)	r	mean (SD)	r
<b>SED hr/day</b>						
activPAL3	9.66 (1.55)	-	9.50 (1.23)	-	9.46 (1.26)	-
GT3X	9.50 (1.38)	0.62***	9.08 (1.39)	0.58***	9.08 (1.28)*	0.54***
GPAQ	5.80 (0.30)***	0.50***	5.87 (0.33)***	0.27*	6.08 (0.41)***	0.36**
PPAQ	12.25(0.65)***	0.37**	13.2 (0.63)***	0.27	11.87 (0.57)***	0.24
<b>SED%</b>						
activPAL3	0.64 (0.10)	-	0.63 (0.09)	-	0.63 (0.09)	-
GT3X	0.66 (0.08)*	0.66***	0.64 (0.08)	0.64***	0.64 (0.08)	0.66***
GPAQ - Likert	0.57(0.21)**	0.44***	0.55 (0.25)**	0.52***	0.60 (0.21)	0.45***
PPAQ	n/a		n/a		n/a	

\*p<0.05; \*\*p<0.01 \*\*\*p<0.001

**1368** Board #130 May 30 9:30 AM - 11:00 AM  
**Dog Walking Intensity And Its Contribution To Owners' Total Moderate-to-vigorous Physical Activity**

Caitlin Rajala, Robert T. Marcotte,, Greg J. Petrucci, Jr., Connor Saleeba, Katie Becofsky Potter. *University of Massachusetts, Amherst, MA.*  
 Email: crajala@umass.edu  
 (No relevant relationships reported)

Approximately half of American households own a dog, and dog ownership is associated with higher levels of physical activity (PA). These increased PA levels are assumed to be dog-related, but there is limited scientific evidence to support this assumption. Though dog walking is classified as moderate intensity PA (3 METS) in the PA compendium, few studies have used objective PA measures to track intensity during dog walking bouts. **PURPOSE:** To 1) determine the % of daily accelerometer-estimated moderate-to-vigorous PA (MVPA) minutes that are accumulated during self-reported dog walking bouts, and 2) quantify the % of dog walking minutes that qualify as MVPA. **METHODS:** Thirty-three healthy dog owners (30 female; BMI 27.2±5.3; age 45.2±15.3) wore an ActiGraph GT3X+ accelerometer on their right hip for 7 days. Dogs were a mean age of 5.85±3.7 (size: 11 small, 12 medium, 9 large). Participants were asked to maintain their normal routine, log leisure-time activity with and without their dog, and ActiGraph on/off periods. T-tests were used to compare differences in MVPA for dog age (<7 vs. >7) and size (med/large vs. small). **RESULTS :**Thirty-three

participants averaged 56.62 ±31.1 min/day in MVPA. An average 42.12 ±25.25% of this time was spent dog walking. Of time spent dog walking, 65.19 ±26% was MVPA. There was no significant difference in % of MVPA min/day attributable to dog walking or % of dog walking in MVPA based on dog age or size (p≥0.4). Combined ActiGraph and self-report data provides context for participants' PA, and further insight for investigation (Figure 1). **CONCLUSION:** The sample demonstrated large variability, with some participants accumulating almost all MVPA from dog walking, and others accumulating little or none. Two-thirds of dog walking minutes were MVPA, but also varied by individual. Variations were not explained by dog size or age. Given the prevalence of dog ownership in America, further investigation into how dog ownership affects PA is warranted.

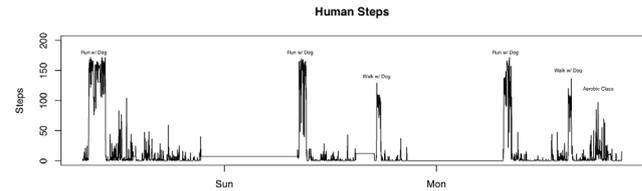
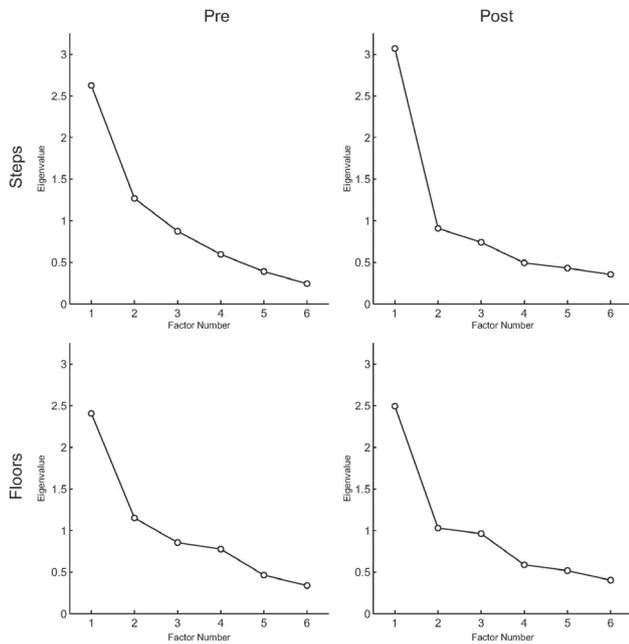


Figure 1. Combined ActiGraph and self-reported data of sample participant.

**1369** Board #131 May 30 9:30 AM - 11:00 AM  
**Unidimensionality and Internal Consistency Reliability of Step Counts and Floors Climbed in 4<sup>th</sup>-5<sup>th</sup>Grade Students**

Amelia A. Miramonti, James A. Bovaird, Lisa Franzen-Castle, Michelle Krehbiel. *University of Nebraska - Lincoln, Lincoln, NE.*  
 Email: amelia.miramonti@unl.edu  
 (No relevant relationships reported)

**PURPOSE:** To determine if weekday and weekend days step counts and floors climbed are unidimensional and internally consistent indicators of physical activity 4<sup>th</sup>- and 5<sup>th</sup>-grade students. **METHODS:** Students in 4<sup>th</sup> and 5<sup>th</sup> grade (n = 83, age [mean ± SD]: 10.1 ± 0.6 years) at two Title I schools participated in a 12-week after-school program focused on nutrition, cooking skills, and physical activity. At the beginning (T1) and end (T2) of the program the students wore commercial activity trackers for six days, including two weekend days. Unidimensionality and internal consistency reliability (Cronbach's coefficient α) of the six daily step counts (ST) and floors climbed (FL) values were analyzed at T1 and T2. Days with ST < 500 were excluded. Complete ST data was available for 67 (T1) and 68 (T2) students and complete FL data was available for 41 students at both T1 and T2. Principal axis factoring (initial, unrotated solution) was used to confirm unidimensionality. **RESULTS:** Both ST and FL at T1 and T2 were unidimensional based on visual inspection of the scree plots (Figure 1) and interpretability of the factors. Variance explained by the first factor was 32.9% (T1) and 42.0% (T2) for ST and 30.2% (T1) and 31.5% (T2) for FL, respectively. Coefficient α was 0.74 (T1) and 0.80 (T2) for ST and 0.69 (T1) and 0.68 (T2) for FL. **CONCLUSIONS:** In this sample of 4<sup>th</sup>-5<sup>th</sup> grade students step counts and floors climbed are unidimensional indicators of physical activity. Step counts across six days are a reliable indicator of physical activity in 4<sup>th</sup> and 5<sup>th</sup> grade students, but the lower reliability of floors climbed suggests these data should be interpreted with caution.



1370 Board #132 May 30 9:30 AM - 11:00 AM

**Sleep Like a Baby: A Case Study Examining Objectively-Measured Newborn and Parental Sleep Patterns**

Alexander H.K. Montoye, FACSM<sup>1</sup>, Laura C.K. Montoye<sup>1</sup>, Christopher P. Connolly<sup>2</sup>. <sup>1</sup>Alma College, Alma, MI. <sup>2</sup>Washington State University, Pullman, WA.  
Email: montoyeah@alma.edu  
(No relevant relationships reported)

**PURPOSE:** To determine sleep patterns of a newborn and his parents during the first months following birth.  
**METHODS:** A family expecting a child in May 2018 agreed to be in the study. Both parents wore a wrist-worn sleep tracking device (GA) on their non-dominant wrist while sleeping at night. The newborn was fitted with a calf-worn sleep tracking device (SP), which was fitted just before the final feeding prior to bed time. The GA recorded sleep (total, light, deep) and wake (time, number) data, and the SP recorded sleep (total, stirring) and wake (time, number) data during the night. Number of feedings during the night were also documented by parents. Sleep tracking started on the second night following the baby's birth and continued for four months. Month-by-month comparisons of sleep variables were compared using repeated-measures ANOVA. Additionally, comparisons of parents' sleep patterns to a control condition (four months of GA data) a year previously was conducted using paired-samples t-tests. **RESULTS:** Newborn's total sleep time increased progressively by month (month 1: 338.4 vs. month 4: 445.4 minutes/night) and number of feedings decreased significantly from month 1 (1.9 feedings/night) to months 2-4 (0.3-0.7 feedings/night). Time stirring (5.3-14.1 minutes/night) and time awake (15.2-18.0 minutes/night) were not significantly different among months. For both parents, the first month post-birth resulted in significant differences in wake variables compared to control (mother: +71.8 minutes awake/night, +2.6 awakenings/night; father: +25.7 minutes awake/night, +1.8 awakenings/night). Differences from control persisted for all four months for the mother and non-significantly trended for the father. Sleep variables were not significantly different among months 2-4 for the mother or father. Total sleep time was not different for either parent following birth compared to control, although the mother had significantly more deep sleep (+38.7 to +51.8 minutes/night) and significantly less light sleep (-50.6 to -84.9 minutes/night) during all four months, while the father's were not different from control. **CONCLUSIONS:** The first month following childbirth resulted in substantial changes to newborn and parental sleep patterns, which largely seemed to reach a "new normal" in month 2.

1371 Board #133 May 30 9:30 AM - 11:00 AM

**Assessment of Machine Learning Performance for the Detection of Activity Type in Military Training**

Elliott Fullerton, Katherine Brooke-Wavell, Paul Sanderson, Dale Eslinger, Massimiliano Zecca. *Loughborough University, Leicester, United Kingdom.*  
Email: e.fullerton@lboro.ac.uk  
(No relevant relationships reported)

Recognition of activities performed during military training may benefit the identification and quantification of factors that may predispose to the high prevalence of injury. There is evidence to suggest that the use of machine learning classifiers along with features from accelerometry data can achieve accurate activity recognition; however, there is no evidence to this application within military activities. **PURPOSE:** To develop and determine the accuracy of decision tree (DT), support vector machine (SVM), k-nearest neighbour (KNN) and ensemble bagged tree (EBT) models to classify military training type activities. **METHODS:** 15 male participants (mean ± SD: age: 25.9 ± 3.0 height: 177.9 ± 6.8cm body mass: 80.9 ± 8.7 kg) completed three sessions that consisted of performing military activities (walking, running, marching, weighted marching, halt to attention, countermovement jump and sedentary) with a low cost accelerometer (Axivity AX3, UK) mounted on the distal third of the medial tibia. Accelerometer data were segmented into two-second windows with a 50% overlap to introduce activity variance. Raw data along with filtered (butterworth, chebyshev and elliptic) were processed through a variety of features and classifiers (DT, SVM, KNN, EBT). Models were trained (80%) and hold-out validated (20%) using the classification learner within MATLAB (MathWorks Ltd, UK). Accuracy was determined by the percentage of true values during validation. **RESULTS:** 40,207 two second episodes of activities were recognized (1340 minutes). Hold-out validation accuracy for the EBT model and raw data (no improvement through filtering) was 0.96 (95% confidence interval (CI), 0.96- 0.96). Other models demonstrated good validation accuracies [DT - 0.90 (95% CI, 0.88- 0.91), SVM - 0.94 (95% CI, 0.93-0.95) and KNN - 0.91 (95% CI, 0.90-0.92)]. Validation accuracy was moderate to excellent (>80%) for walking and excellent (>90%) for all other activities. **CONCLUSIONS:** All machine learning models (especially EBT) provided excellent classification accuracy with the use of a tibial mounted accelerometer. These low-cost sensors and models thus offer potential for characterising military activity and examining relationships of activity parameters with injury. Supported by EPSRC and Loughborough University Studentship 1814563

1372 Board #134 May 30 9:30 AM - 11:00 AM

**Cross-cultural Adaptation and Validation of the Arabic Version of the Rapid Assessment Of Physical Activity**

Bader A. Alqahtani, Aqeel M. Alenazi. *Prince Sattam Bin Abdulaziz University, Alkharij, Saudi Arabia.*  
(No relevant relationships reported)

Measuring physical activity (PA) is a challenge especially with lack of validated questionnaires for specific populations such as Arabic population. Rapid Assessment Physical Activity (RAPA) is an easy to administer, valid and reliable measure. However, this questionnaire is in English and has not been translated or culturally adapted for Arabic speakers. **PURPOSE:** The aim of the study was to cross-culturally adapt the Rapid Assessment of Physical Activity (RAPA) for Arabic speaking people and examine the test-retest reliability and the construct validity in Saudi older adults. **METHODS:** A total of 46 older adults (67% male, mean age 71 ± 5 years) were included in this study. The original RAPA was translated into Arabic following standardized guidelines including the following steps: forward translation, synthesis of the translation, backward translation, expert committee and testing the pre-final version. Test-retest reliability was assessed over two testing visits occurring one week apart, and analyzed using weighted Kappa (K). The construct validity between RAPA and Short Physical Performance Battery (SPPB) and Timed Up and Go (TUG) was examined by Spearman's rank correlation coefficient. A weighted K value of > 0.7 for the reliability and a value of greater than or equal to 0.3 for the construct validity were considered acceptable for physical activity measurements. **RESULTS:** Data from the RAPA shows, about 9 (19.6%) of participants were categorized as sedentary, 12 (26%) as underactive, 7 (15%) as regular underactive, 13 (28%) as regular underactive, 5 (11%) as regular active. About half of the subjects (52%) reported that they did not participate in flexibility or strength activities. For the test-retest reliability, the weighted K was 0.87 (95% CI=0.76-0.98), which indicates very good reliability. There was a significant correlation between the Arabic version of RAPA and the SPPB (Spearman  $\rho = 0.536, P < 0.001$ ), and the TUG test (Spearman  $\rho = -0.435, P < 0.01$ ). **CONCLUSIONS:** The Arabic version of the Rapid Assessment of Physical Activity questionnaire adapted for Saudi older adults provides an easy, valid and reliable way to measure physical activity. Researchers in Saudi Arabia can use this questionnaire to quickly assess PA levels because of short time required to complete and its suitability to the Saudi culture.

THURSDAY, MAY 30, 2019

**1373** Board #135 May 30 9:30 AM - 11:00 AM  
**A Comparison of Two Algorithms for Generating ActiLife Equivalent Activity Counts**  
 John M. Schuna, Jr., *Oregon State University, Corvallis, OR.*  
 Email: John.Schuna@oregonstate.edu  
 (No relevant relationships reported)

Previous algorithms have been developed to approximately replicate ActiLife software's activity counts when used with raw acceleration data from physical activity accelerometers.

**PURPOSE:** To compare a new algorithm based upon two cascaded infinite impulse response filters (ALG1) to an existing algorithm (ALG2; Brond, Andersen, & Arvidsson [2017]) for generating activity counts from raw acceleration data.  
**METHODS:** Sixteen adult participants (19-81 yrs; 56-85 kg) completed a series of simulated free-living activities (e.g., walking, climbing stairs, eating, sitting down, brushing teeth, etc.) while wearing an accelerometer on their right wrist initialized at a sampling frequency of 32 Hz. These activity data are publicly available (<https://archive.ics.uci.edu/ml/machine-learning-databases/00283/>) within the UCI Machine Learning Repository. Activities varied in duration but averaged 155 seconds each. Vector magnitude activity counts/second (cps) were calculated using ALG1, ALG2, and ActiLife for each participant. Equivalence testing (equivalence margin:  $\pm 5\%$  error from ActiLife cps) was used to compare mean cps values from ALG1 and ALG2 with those from ActiLife (criterion). Correlations and mean absolute errors for ALG1 and ALG2 with ActiLife cps were also quantified. Correlation magnitudes were compared between algorithms using Meng's z-test.  
**RESULTS:** Mean error (% error from ActiLife [ $M = 65.4$  cps]) for ALG1 (1.7%; 99%CI: 0.8 to 2.7%) and ALG2 (-1.0%; 99%CI: -2.2 to -0.2%) was small and indicates both algorithms provided equivalent estimates to those obtained from ActiLife. Correlations for ALG1 ( $r = 0.992$ ) and ALG2 ( $r = 0.987$ ) with ActiLife cps were strong; however, the ALG1 correlation was of a significantly greater magnitude than the ALG2 correlation ( $p = 0.025$ ). Moreover, mean absolute error was smaller for ALG1 (4.9 cps) than for ALG2 (6.4 cps).  
**CONCLUSION:** Mean vector magnitude cps values from ALG1 and ALG2 were comparable to those generated by ActiLife. Estimates from ALG1 appear to be more strongly correlated with ActiLife cps and have smaller absolute errors than ALG2. Additional research is needed to evaluate the performance of each algorithm for generating estimated ActiLife activity counts with acceleration data collected at other body locations (e.g., waist, chest, ankle, etc.).

**1374** Board #136 May 30 9:30 AM - 11:00 AM  
**Validity Of Self-report Methods For Measuring Physical Activity And Sitting Time In Chilean Workers**  
 Pia Martino, Nicolas Aguilar. *Universidad de La Frontera, Temuco, Chile.* (Sponsor: Wendy J Brown, FACSM)  
 Email: pia.martino@ufrontera.cl  
 (No relevant relationships reported)

**PURPOSE:** to test the validity of a single question (SQ) for measuring sitting time (ST) and the GPAQ for measuring physical activity (PA) and ST in workers using the ActivPAL  $\mu$  (AP) as reference.

**METHODS:** Workers wore an AP for 7 days to measure ST, standing and walking time (WT). The volunteers answered the SQ: How many hours each day do you typically spend sitting down while doing things like visiting friends, driving, reading, watching television, or working at a desk or computer on (a) an usual weekday, (b) usual weekend day?. They also answered the GPAQ that measures PA (at work, leisure and travel) and ST. Reliability of the SQ was tested with intraclass correlation (ICC). Validity was tested using correlation, mean bias and limits of agreement (LoA), and kappa to assess agreement between AP and both the SQ and GPAQ.  
**RESULTS:** 91 workers (50.6% male) provided valid data. For AP, mean wear time was  $16.2 \pm 1.17$  h/day; on average, participants spent  $9.0 \pm 1.87$  h/day in ST, with no difference by sex ( $p = 0.052$ ) or week and weekend days ( $p = 0.066$ ). Mean standing time was  $5.1 \pm 1.47$  h/day, with women standing more than men ( $5.4 \pm 1.33$  vs  $4.8 \pm 1.55$ ,  $p = 0.044$ ). WT was  $2.1 \pm 0.71$  h/day on average, with no differences by sex ( $p = 0.96$ ), but more WT on week than weekend days ( $2.2 \pm 0.82$  vs  $1.9 \pm 0.88$  h/day,  $p > 0.001$ ). For the SQ, the ICC for ST was 0.53 for a usual day, 0.36 for weekdays and 0.45 for weekend days. The SQ showed fair correlation with AP on a usual day ( $r = 0.24$ ) and week days ( $r = 0.23$ ), but poor for weekend days ( $p = 0.17$ ), with mean biases of about -2 h/day when compared with AP. When ST was categorized into tertiles, agreement was significant but poor between the SQ and AP (46.1%,  $k = 0.19$ ,  $p = 0.019$ ). The GPAQ showed fair correlation with AP for measuring PA ( $r = 0.39$ ) with mean bias of -5.7 h/day (LoA: -14.5, 3.0 h/day). Moderate correlation was observed between the GPAQ and AP for PA at work ( $r = 0.41$ , mean bias: -4.3 h/day; LoA: -11.1, 2.6 h/day). The GPAQ question for ST showed fair correlation with AP ( $r = 0.37$ , mean bias: -2.7 h/day, LoA: -10.2, 4.8 h/day). When categorized into tertiles, agreement between GPAQ and AP was fair for both ST ( $k = 0.22$ ) and PA ( $k = 0.22$ ).

**CONCLUSION:** Both instruments showed fair to moderate validity and poor ability for correctly classifying individuals into tertiles of ST and PA when compared with the AP.  
 Funded by DIUFRO14-003

**1375** Board #137 May 30 9:30 AM - 11:00 AM  
**Rapid Assessment Of Physical Activity And Yale Physical Activity Survey Convergent Validity For Cancer Survivors.**

Amerigo Rossi<sup>1</sup>, Alyssa Graham<sup>1</sup>, Carol Ewing Garber, FACSM<sup>2</sup>, Dennis YS Kuo<sup>3</sup>, Nicole Nevadunsky<sup>3</sup>. <sup>1</sup>Long Island University Brooklyn, Brooklyn, NY. <sup>2</sup>Teachers College, Columbia University, New York, NY. <sup>3</sup>Montefiore Medical Center, Bronx, NY.  
 Email: amerigo.rossi@liu.edu  
 (No relevant relationships reported)

**PURPOSE:** The Rapid Assessment of Physical Activity (RAPA), a simple physical activity survey containing nine questions with accompanying images, may be a valid method for assessing underserved populations. The purpose of this study was to evaluate the convergent validity of the RAPA and Yale Physical Activity Survey (YPAS) for socio-culturally diverse endometrial cancer survivors.  
**METHODS:** Fifty-nine endometrial cancer survivors were approached during their gynecologic oncology follow-up appointments. The 52 survivors who agreed to participate were administered the nine-item RAPA, which requires approximately 3 minutes to complete, and 35-item YPAS, which requires approximately 15 minutes to complete. The RAPA is scored by stratifying respondents into one of five groups; group 1 was sedentary, groups 2 - 4 engaged in insufficient activity of progressively higher volumes, and group 5 achieved the recommended targets for aerobic physical activity. The YPAS provided Energy Expenditure (EE) and Summary Indices. Kendall Rank Correlation Coefficients ( $\tau$ ) were analyzed to evaluate the convergent validity between the RAPA and YPAS. Data are presented as mean  $\pm$  standard deviation. Statistical significance was set *a priori* at  $p < 0.05$ .  
**RESULTS:** Mean age ( $64 \pm 10$  yrs) and Body Mass Index ( $34 \pm 8$  kg·m<sup>-2</sup>) indicated an older, mostly overweight and obese sample. Mean time since diagnosis was  $2.6 \pm 1.7$  years. The sample was socio-culturally diverse, with 31% non-Hispanic black, 31% non-Hispanic white, 29% Latina, and 8% other race/ethnicity. Forty-two percent reported having earned a college degree, and 11% reported not having graduated high school. According to the RAPA results, 4% of the participants were sedentary, 44% were insufficiently active, and 52% were active (27 out of 52). The five RAPA categories were significantly correlated to the YPAS Summary Index ( $\tau = 0.34$ ,  $p = 0.001$ ) and the YPAS Energy Expenditure Index ( $\tau = 0.23$ ,  $p = 0.016$ ). Although there were significant correlations between measures, the strength of the associations was not large. **CONCLUSIONS:** There was convergent validity between the RAPA and YPAS questionnaires, but with relatively weak strength of association. Further research should be conducted to validate each measure with an instrumented criterion, such as accelerometry, among cancer survivors.

**1376** Board #138 May 30 9:30 AM - 11:00 AM  
**Validation of Apple Watch for Estimating Moderate-to-Vigorous Physical Activity in Children**  
 Sunku Kwon, Youngwon Kim, Wonwoo Byun. *The University of Utah, Salt Lake City, UT.*  
 Email: sunkukwon@gmail.com  
 (No relevant relationships reported)

Identifying accurate instruments for assessing physical activity (PA) is crucial for surveillance and promotions of PA in children. Apple Watch has been appeared as one of the most popular wearable devices that are designed to monitor individual's PA. However, little knowledge is available whether it provides an accurate estimate of time spent in moderate-to-vigorous PA (MVPA) in children. **PURPOSE:** To examine the validity of Apple Watch 3 in measuring MVPA in children using a portable indirect calorimetry system (Cosmed K5) as a criterion measure. We hypothesized the estimate of MVPA from Apple Watch would be comparable with that from Cosmed K5 for simulated free-living activities. **METHODS:** 20 school-age children (girls: 45%; age:  $9.7 \pm 2.0$  yrs, BMI:  $16.3 \pm 3.2$  kg/m<sup>2</sup>) were fitted with an Apple Watch 3 on their dominant wrist and Cosmed K5 portable indirect calorimetry. All participants performed sedentary (i.e., sitting, watching TV), light PA (i.e., slow walking, playing with toys), and MVPA (i.e., brisk walking) over a 45-minute period. We calculated MET<sub>RMR</sub> by dividing obtained VO<sub>2</sub> values from Cosmed K5 by child's predicted resting metabolic rates using the age- and sex-specific Schofield equations. We used  $\geq 3$  MET<sub>RMR</sub> as a cut-off value to define a criterion measure of MVPA time (i.e. Cosmed K5) against which Exercise Time from Apple Watch was compared. Pearson's correlation coefficient and mean absolute percent error (MAPE) were calculated, and equivalence test using SAS Proc Mixed procedure was performed to examine whether the Apple Watch's Exercise Time is comparable to MVPA time from Cosmed K5.  
**RESULTS:** The Exercise Time from Apple Watch showed a moderate correlation ( $r$

= 0.35,  $p = 0.13$ ) and relatively high MAPE ( $30.2 \pm 4.9\%$ ) in relation to MVPA time from Cosmed K5. The 90% confidence interval of the Apple Watch's Exercise Time was from 16.7 to 22.9 min, which was not completely included within the zone of equivalence defined as  $\pm 10\%$  of the values of Cosmed K5 (22.8 to 27.9 min); this indicates non-equivalence between Apple Watch and Cosmed K5. **CONCLUSION:** Apple Watch showed poor agreement with Cosmed K5 for estimating MVPA time in this convenient sample of children. Subsequent research is needed to further examine the validity of Apple Watch monitor for quantifying various intensities of PA under free-living conditions.

**1377** Board #139 May 30 9:30 AM - 11:00 AM  
**Multi-phased Step Detection Algorithm For A Wrist-worn Triaxial Accelerometer**  
 Aston K. McCullough, Catrine Tudor-Locke, FACSM.  
*University of Massachusetts Amherst, Amherst, MA.* (Sponsor: Catrine Tudor-Locke, PhD, FACSM)  
 Email: mccullough@umass.edu  
*(No relevant relationships reported)*

**Purpose:** To test a multi-phased, signal pattern-specific step detection (SD) algorithm for a wrist-worn triaxial accelerometer  
**Methods:** Adults [N=30; age: 37(11); female: 65%; BMI: 25.4(3.8)] wore accelerometers while engaged in 5-minute activity bouts (see Table 1), and hand-tallied steps were simultaneously recorded as the ground truth. Phase 1—Raw signals sampled at 60Hz were downloaded and processed by: 1) low-pass filtering, 2) calculating the bandpass filtered vertical accelerations (VA) in gravity seconds (gs), and 3) calculating the integrated area under the curve for the VA time series. For all activities, the VA peak heights (VAPH) that minimized SD error relative to the ground truth were determined by brute force. Phase 2—Signal features for each activity (triaxial vector magnitude, signal variability, and device angle) were passed to a k-means clustering algorithm, which grouped all activities into 3 clusters. Phase 3—A Random Forest (RF) algorithm was used to estimate VAPH for each cluster using activity signal features as inputs, and the cross-validated root-mean-square (RMS) for the RF-determined VAPH were calculated. Phase 4—RF-determined VAPH were applied to the original VA time series for SD. Bias (mean difference) and accuracy (median absolute percentage error) were calculated to evaluate SD performance. Sign tests were used to check for significant bias ( $p < 0.05$ ).  
**Results:** SD performance is shown in Table 1. RMS for the VAPH ranged from 0.011 to 0.019gs across clusters. Bias and accuracy were acceptable for most ambulatory activities and seated non-ambulatory activities, but not for non-ambulatory upper body activities and slow walking.  
**Conclusions:** A signal pattern-specific algorithm provides reasonable step estimates for a wrist-worn accelerometer across ambulatory and non-ambulatory activities. Further research is needed to optimize SD during non-ambulatory upper body activities and slow walking.  
**Funding:** NIH-NIA-5R01AG049024

	Observed Steps (steps/min) <sup>a</sup>	Estimated Steps (steps/min) <sup>a</sup>	Vertical Acceleration Peak Heights (gs) <sup>b</sup>	Bias (steps/min) <sup>c</sup>	MdAPE (%) <sup>d</sup>
<b>Activity</b>					
<b>Seated</b>					
Rest	0(0)	0(0)	[0.059; 0.057]	<1	-
Computer Work	0(0)	0(0)	[0.059; 0.059]	<1	-
Movie Viewing	0(0)	0(0)	[0.071; 0.070]	<1	-
<b>Standing</b>					
Laundry	6(8)	29(19)	[0.085; 0.059]	23*	633
Vacuuming	48(13)	33(22)	[0.017; 0.025]	-15*	39
Stair Stepping	93(15)	94(20)	[0.035; 0.036]	<1	11
Self-paced corridor walking	112(16)	104(34)	[0.033; 0.036]	-7	19
<b>Treadmill</b>					
0.5mph	52(19)	15(24)	[0.012; 0.017]	-37*	86
1.0mph	72(15)	60(37)	[0.022; 0.023]	-12	38
1.5mph	87(13)	78(39)	[0.029; 0.029]	-8	34
2.0mph	97(9)	110(31)	[0.034; 0.032]	12	20
2.5mph	107(8)	110(37)	[0.034; 0.033]	3	24
3.0mph	115(7)	122(27)	[0.033; 0.032]	7	10
3.5mph	123(7)	116(18)	[0.029; 0.031]	-7*	5
4.0mph	132(7)	118(16)	[0.024; 0.026]	-14*	5
4.5mph	143(8)	129(10)	[0.028; 0.026]	-13*	8

**Table 1.** Bias (mean difference) and accuracy (MdAPE) for the hand-counted (observed) algorithm-determined (estimated) steps/minute. Abbreviations: gravity seconds (gs), median absolute percentage error (MdAPE), min (minute).  
<sup>a</sup> Mean (Standard Deviation)  
<sup>b</sup> Vertical Acceleration peak height thresholds are the average best observed versus algorithm-derived values for step detection [observed; estimated]  
<sup>c</sup> Negative values indicate underestimation of steps/min relative to the observed steps/min while positive values show overestimation. Asterisks indicate significant bias ( $p < 0.05$ ), as determined by a two-sided sign test  
<sup>d</sup> Note: By definition, MdAPE values are not available for conditions wherein the observed step counts are equal to zero

**1378** Board #140 May 30 9:30 AM - 11:00 AM  
**Using Heart Rate to Predict Energy Expenditure: A Validity Generalization Study**  
 Zezhao Chen<sup>1</sup>, Xiaofei Wang<sup>2</sup>, Hai Yan<sup>1</sup>, Xiong Qin<sup>1</sup>, Jingyuan Zhu<sup>1</sup>, Weimo Zhu, FACSM<sup>1</sup>. <sup>1</sup>University of Illinois at Urbana Champaign, Champaign, IL. <sup>2</sup>Tsinghua University, Beijing, China.  
 Email: zchen106@illinois.edu  
*(No relevant relationships reported)*

Physical activity (PA) plays a critical role in preventing chronic diseases. Heart rate has been frequently used to predict PA energy expenditure (PAEE). While a number of prediction equations has been developed, their generalizability has not been confirmed. **PURPOSE:** To examine the validity generalization of heart rate prediction equations for PAEE. **METHODS:** Key words such as “energy metabolism,” “energy expenditure,” “heart rate,” “heart rate determination,” “prediction,” and “equation,” were searched in the scientific databases including PubMed, Web of Science, Google Scholar etc. Eligibility criteria was restricted to studies that predict PAEE using heart rate. The validity generalization model (Pearlman, Schmidt, & Hunter, 1980) was utilized for the analysis. Four components including sample size, observed validity coefficients, test reliability coefficients, and criterion reliability coefficients were summarized and examined from each study. When test and criterion reliability coefficients were not reported, the information was derived from the literature. The percentages of variance accounted for “by artifacts” were computed. **RESULT:** 98 validity studies were screened and 27 studies (M±SD: Sample size = 45±13; Validity coefficients = .70±.13; Test reliability coefficients = .83±.03; & Criterion reliability coefficients = .95±.02) were analyzed to determine the degree of validity generalization using heart rate to predict PAEE. The percentage of variance accounted

for “by the artifacts” was only at 65%. Thus, the needed “75% decision rule” was not met. The estimated “90% credibility value” for the true validities was at .55, and the estimated average true validity was at .69. **CONCLUSION:** The validity to use heart rate predicting PAEE did not appear to be generalizable and these heart rate prediction equations should be used with caution, especially when it is used for another population.

**1379** Board #141 May 30 9:30 AM - 11:00 AM  
**Aerobic Exercise Training and Blood Lipids-Lipoproteins Among Healthy Adults: A Methodological Umbrella Review**

Lucas P. Santos<sup>1</sup>, Angélica T. De Nardi<sup>1</sup>, Lucinéia O. Pfeifer<sup>1</sup>, Nórton L. Oliveira<sup>2</sup>, Yin Wu<sup>3</sup>, Daniel Umpierre<sup>1</sup>, Linda S. Pescatello, FACSM<sup>3</sup>. <sup>1</sup>Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil. <sup>2</sup>Hospital de Clínicas de Porto Alegre, Porto Alegre, Brazil. <sup>3</sup>University of Connecticut, Storrs, CT. (Sponsor: Linda Pescatello, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** Meta-analyses (MA) that have examined whether aerobic exercise training (AET) affects blood lipids-lipoproteins have yielded conflicting findings. Since methodological characteristics and completeness of reporting may influence interpretation and generalizability of MA results, we sought to assess the quality of these parameters in published MA that examined the blood lipids-lipoproteins response to AET. **METHODS:** We used search terms related to AET and blood lipids-lipoproteins in six databases to find MA published in English, Portuguese, or Spanish. The MA included trials that: (1) enrolled adults with no established disease; (2) compared AET to a non-exercising, non-dieting arm (CONTROL); and (3) measured lipids-lipoproteins pre- and post-intervention. Study selection and data coding were conducted in duplicate. Methodological quality was assessed using a modified exercise-specific version of Assessing the Methodological Quality of Systematic Reviews 2 (AMSTAR2). **RESULTS:** Seven MA qualified for our umbrella review, with a total of 8,721 subjects (mean 1,245.8±602.2, range 393 to 2,024). Of these, five reported the number of AET groups for lipids-lipoproteins analysis (mean 10.3±8.3, range 2 to 35). Effect sizes (ES) for AET versus CONTROL ranged from +0.9mg/dL to -8.5mg/dL for total cholesterol, 0 to +4.6mg/dL for high-density lipoprotein, 0 to -10.1mg/dL for low-density lipoprotein, and 0 to -13.7mg/dL for triglycerides. Only one of 20 items on the modified AMSTAR2 was fully satisfied by all MA which was the reporting of the Population, Intervention, Comparator, and Timing (PICOT). Meanwhile, most MA lacked a *priori* study design (n=6, 85.6%), failed to explore the relationship between features of the exercise interventions and ES (n=4, 57.1%), and interpreted results without discussing risk of bias (n=5, 71.4%). **CONCLUSION:** Overall, included MA showed low adherence to current methodological standards, which may partially explain the disparate findings of the effects of AET on blood lipids-lipoproteins. Future MA following current methodological standards that explore possible effect modifiers are needed to more precisely estimate the influence of AET on lipids-lipoproteins.

**1380** Board #142 May 30 9:30 AM - 11:00 AM  
**Regression Equation To Predict Body Fat In Elderly Women Using Body Circumference Measures**

ELIANE C. GONCALVES. *Multivix and Unip, VITORIA, Brazil.*  
 Email: elianecgc@hotmail.com  
 (No relevant relationships reported)

**Purpose:** The purpose of this study was to develop and validate an equation to estimate body composition in elderly women above 60 years of age using body circumference measures. **Methods:** The sample consisted of 60 women individuals with an average age of 68.23 ± 5.84 years, 63.97 ± 10.65kg, 1.542 ± 0.52m from the Vitoria metropolitan area. The group was split into two subgroups: a regression group (n=50) used to develop the equations and a validation group (n=10) used for cross reference. A multiple linear regression was used to develop the equation. Both equations were compared using the Student's *t* test for paired samples. The reliability of the equations was analyzed by the *Blant and Altman* method. **Results:** The regression group had the following descriptive metrics: age 67.62 ± 5.87 years, body weight 64.27 ± 11.11kg, height 1.53 ± 0.11m; and percent body fat 41.73 ± 5.69%. The validation group had the following descriptive metrics: 71.3 ± 4.8 years, body weight 62.49 ± 8.34kg, 1.55 ± 0.53m; and percent body fat 41.75 ± 4.04%. Body circumferences variables were used to develop equations to predict body fat. Using the stepwise selection criteria, the following equation was developed: % body fat = 0.343 (hip) + 0.289 (waist) - 0.0714 (handle)<sup>2</sup>. Several parameters validated the strength of the equation: R<sup>2</sup> = 0.997; EPE = 3.29; EPE ≤ 3.5%; and validation of the model based on the partial significance (F) of the subset of variables that showed the strongest effect. **Conclusion:** It is possible to develop an accurate and specific equation to estimate of body fat percent in elderly women using circumference measurements. The more important is that is easy to use by health professionals.

**1381** Board #143 May 30 9:30 AM - 11:00 AM  
**Is Cadence A Better Predictor Of The Walk-to-run Transition Than Speed And/or The Froude Number?**

Colleen J. Sands, Scott W. Ducharme, Elroy J. Aguiar, Christopher C. Moore, Zachary R. Gould, Catrine Tudor-Locke, FACSM. *University of Massachusetts Amherst, Amherst, MA.* (Sponsor: Catrine Tudor-Locke, FACSM)  
 (No relevant relationships reported)

Preliminary evidence suggests that a cadence of 140 steps/min is associated with the walk to run transition (W2R). However, this cadence threshold does not take into consideration leg length. Alternatively, the Froude number is used to compare the similarities of locomotion across individuals by incorporating leg length, and provides a theoretical prediction of the W2R at a value of 0.5. Additionally, the W2R has been shown to occur at an estimated speed of 2.09 m/s. If supported, a W2R cadence value could be used to identify running in free-living accelerometer-based data sets. **PURPOSE:** To examine whether 140 steps/min is a more accurate predictor of the W2R than a Froude number of 0.5 or a speed of 2.09m/sec. **METHODS:** Twenty-eight healthy adults (20 men, 8 women; age=22.6±1.9 years, height=172.5±11.8 cm, weight=79.3±18.8 kg) completed a treadmill protocol consisting of 5-minute bouts during which speed increased by 0.5 mph per trial from 0.5-6.0 mph. Participants could choose to run or walk each bout, and the protocol was terminated following the first bout at which the participant chose to run. The analytic sample consisted of two bouts for each participant (the running bout, and the bout immediately preceding walking) to identify the W2R transition. Cadence was derived by dividing directly-observed step counts (hand-tally) by 5 minutes. Froude numbers were calculated as  $Froude = v^2 / (gd)$ , where  $v$  = walking velocity,  $g$  = gravity, and  $d$  = leg length. W2R sensitivity, specificity and overall accuracy were calculated. **RESULTS:** 140 steps/min predicted the W2R with a sensitivity of 85.7%, a specificity of 100%, and an overall accuracy of 92.9%. A Froude number of 0.5 predicted the W2R with a sensitivity of 35.7%, a specificity of 96.4%, and an overall accuracy of 66.0%. A speed of 2.09 m/s predicted the W2R with a sensitivity of 14.3%, a specificity of 96.4%, and an overall accuracy of 55.4%. **CONCLUSION:** A cadence of 140 steps/min was a more accurate predictor of the W2R than the traditionally supported Froude or speed values. Given the high sensitivity, specificity and overall accuracy values, 140 steps/min may be used to identify running behaviors in free-living accelerometer-based data.

**1382** Board #144 May 30 9:30 AM - 11:00 AM  
**Validation Study of Inbody Band2 and Agreement Between Inbody Band2 and Omron 306 in Adults**

Phoebe Monnier Manalang<sup>1</sup>, Mr. Guy Danhoff<sup>1</sup>, Dr. Robert T. Davidson<sup>2</sup>, Dr. Andrew Elvington<sup>1</sup>. <sup>1</sup>Missouri Baptist University, St. Louis, MO. <sup>2</sup>Logan University, St. Louis, MO.  
 Email: phoebe@daywaneti.com  
 (No relevant relationships reported)

Activity trackers (AT) continue to be one of the top fitness trends as the wearable market continues to diversify. As new features of AT's emerge, the need for evidence-based research is needed for reporting the reliability and validity of existing devices. **Purpose:** The purpose of this study was to assess the validity and reliability of the single frequency bio-impedance analysis (SF-BIA) device, InBody Band2 (IB2) compared to the Omron HBF-306c (O306c). **Methods:** A total of 54 individuals participated in the reliability and validation study (23 males and 31 females; average age 45.27 years). Each instrument provided percent body fat (%BF). The Pearson correlation, Bland-Altman analysis, t-test and one-way ANOVA were used to determine significance of relationship between the two SF-BIA devices and reliability of the IB2. **Results:** A Pearson's product-moment correlation was run to assess the relationship between measurements of %BF in adults using the IB2 and O306c. Analysis showed a statistically significant and a strong positive correlation between the instruments,  $r(49) = 0.91$ ,  $p < 0.01$ . The mean difference (i.e., IB2 - O306c) was -0.11 with a 5.85 upper confidence line and a lower confidence line of -2.92. No proportional bias or statistical difference between the IB2 and O306c was found. Examination of the residuals obtained from multiple linear regression indicated there was not a statistical difference between the measurements of the IB2 and O306c ( $t = -1.5$ ). The one-way repeated measures ANOVA determined that the IB2 measurements of %BF did not result in statistically significant changes,  $F(1.683, 84.141) = 1.690$ ,  $p = 0.195$ , partial  $\eta^2 = 0.01$ . The IB2 showed excellent reliability with repeat measurements differing by 0.125 (95% CI, 0.14 to 0.39). **Conclusions:** Findings indicate that the estimates of %BF obtained from the IB2 did not exceed estimates from O306c. Overall the measurements were equivalent. IB2 showed excellent reliability.

**1383** Board #145 May 30 9:30 AM - 11:00 AM  
**Comparing ActiGraph Data Processing Methods For Measuring Sedentary Behavior In Older Adults With COPD**

Katelyn Webster, Ronald Dechert, Janet Larson. *University of Michigan, Ann Arbor, MI.*  
 Email: katewebs@umich.edu  
 (No relevant relationships reported)

Accelerometers, such as the ActiGraph (AG), are commonly used for measuring sedentary behavior, but the ActivPAL (AP) has been validated as the gold standard. The use of various AG processing methods, including filters and non-wear time algorithms, influences sedentary time estimates. The optimal combination of AG filter and non-wear algorithm may depend on the population being studied. **PURPOSE:** To perform a secondary data analysis to identify which AG filter and non-wear algorithm produce estimates of sedentary time that have the strongest agreement with AP-measured sedentary time in a sample of 34 older adults with chronic obstructive pulmonary disease (COPD). **METHODS:** Participants wore AG and AP monitors concurrently for 7 consecutive days. Each participant's AG data was processed using six different methods, using all possible combinations of two filters (normal and low frequency extension) and non-wear algorithms with three different minimum lengths (60 minutes, 90 minutes, and 120 minutes). The Bland-Altman method was used to assess concordance in sedentary behavior time (minutes per day) between AP and each of the six AG estimates. **RESULTS:** Concordance correlation coefficients between AP-measured sedentary time and AG-measured sedentary times range from 0.388 to 0.511 (see table). The AG low frequency extension filter with the 60-minute non-wear algorithm resulted in the highest concordance correlation, along with a low mean difference between sedentary minutes per day measured by the two devices. **CONCLUSIONS:** Although concordance correlations showed moderate agreement, the AG measures of sedentary time are reasonably accurate if the appropriate filter and non-wear algorithm are used. This analysis provides evidence supporting the combination of the AG low frequency extension filter with the 60-minute non-wear algorithm as the optimal method of processing AG data to measure sedentary time in older adults with COPD.

Processing Method (Filter & Non-Wear Algorithm Length)	Concordance Correlation (SE)	Mean Difference AP-AG (SD)
Normal & 60 min.	0.409 (0.149)	-12.9 (114.7)
Normal & 90 min.	0.388 (0.146)	-20.8 (119.7)
Normal & 120 min.	0.409 (0.139)	-36.5 (117.0)
Low Frequency Extension & 60 min.	0.511 (0.132)	4.4 (106.3)
Low Frequency Extension & 90 min.	0.490 (0.134)	-2.2 (112.4)
Low Frequency Extension & 120 min.	0.510 (0.129)	-12.9 (109.3)

**1384** Board #146 May 30 9:30 AM - 11:00 AM  
**Accuracy of Activity Trackers during Treadmill Walking Versus Outdoor Walking**

Merrill D. Funk<sup>1</sup>, Ivan A. Figueroa<sup>2</sup>, Jose L. Gamez<sup>2</sup>, Murat Karabulut, FACSM<sup>2</sup>. <sup>1</sup>*Southern Utah University, Cedar City, UT.* <sup>2</sup>*University of Texas Rio Grande Valley, Brownsville, TX.*  
 Email: merrillfunk@hotmail.com  
 (No relevant relationships reported)

Establishing the accuracy of devices that measure daily activity is important in controlled lab settings and in real-life settings. **PURPOSE:** To assess the accuracy of a pedometer and 6 popular activity trackers at measuring steps while walking on a treadmill and walking outside. **METHODS:** Twenty-three college students (Mean±SD; 22.2±3.9yrs; 24.9±4.1kg/m<sup>2</sup>, 11 male) walked 500 steps at 3mph on a treadmill while wearing 7 different activity trackers (Pedometer (PED), Blaze (BLA), Charge HR (CHR), Alta (ALT), Flex (FLE), Zip (ZIP), One (ONE)). During a second visit, participants wore the devices while walking 400 meters at 3mph outside. Steps were counted by a trained researcher using a hand tally counter. Mean Absolute Percent Error (MAPE) values were calculated for each device relative to the tally counter and were correlated between each of the devices and the tally counter using Pearson correlations. Significance was set at p<0.05. Mean bias scores were calculated between the step counts for each device and the tally counter. **RESULTS:** MAPE values were significantly correlated between the treadmill and outdoor protocol for the PED (r=0.634, p<0.001). The remaining devices were not correlated between protocols (p>0.05). The treadmill protocol produced underestimations in step counts for 5 devices (mean bias±SD: PED = -1.4±41.5steps; BLA = -35.3±70.8; CHR = -3.9±51.9; ALT = -86.5±74.4; FLE = -16.9±71.6) and slight overestimations for 2 devices (mean bias±SD: ZIP = 2.1±3.5; ONE = 0.3±2.2). The outdoor protocol produced step count overestimations for all devices. MAPE values were approximately twice as large

or greater for all devices in the outdoor protocol compared to the treadmill protocol except for the PED (MAPE±SD: 4.0±7.2 treadmill vs. 3.5±5.2 outdoor). Besides the PED, the ONE was the most accurate during the treadmill protocol (MAPE±SD: 0.3±0.3) and the ZIP was the most accurate during the outdoor protocol (MAPE±SD: 14.7±6.6). **CONCLUSION:** The step counting devices in this study performed better in the controlled laboratory setting compared to the outdoor setting with a device worn on the waist producing the best results in each trial. These findings indicate that step counts in real-life settings from commercial activity devices may produce significant error.

**1385** Board #147 May 30 9:30 AM - 11:00 AM  
**The Accuracy Of A Smartphone To Measure Laboratory And Free-living Physical Activity**

Nicola K. Thomson<sup>1</sup>, Lauren McMichan<sup>2</sup>, Eilidh Macrae<sup>1</sup>, Julien Baker<sup>1</sup>, David Muggeridge<sup>3</sup>, Chris Easton<sup>1</sup>. <sup>1</sup>*University of the West of Scotland, South Lanarkshire, United Kingdom.* <sup>2</sup>*University of Strathclyde, Glasgow, United Kingdom.* <sup>3</sup>*University of the Highlands and Islands, Inverness, United Kingdom.* (Sponsor: Professor Jason Allen, FACSM)  
 Email: nikki.thomson@uws.ac.uk  
 (No relevant relationships reported)

Accelerometers worn on the wrist or hip can be used to measure physical activity (PA) levels in free-living populations. Most modern smartphones also contain an inbuilt accelerometer but the capacity of this technology to accurately measure parameters of PA needs to be further established. **PURPOSE:** The primary objective of this study was to assess the validity of a popular smartphone to count steps and estimate energy expenditure (EE) during laboratory-based PA. A second objective was to compare free-living daily step counts measurements from the smartphone with a waist-worn accelerometer commonly used in research studies. **METHODS:** Healthy adults (n=20, 28 ± 5 yrs) took part in a single laboratory trial and a free-living trial (n=16, 42 ± 17 yrs). Participants wore the smartphone and accelerometer in a waist-mounted pouch continuously during both trials. Laboratory trials comprised 5 min bouts of treadmill walking and jogging. Step counts were manually counted (MC) and EE was measured using indirect calorimetry (IC). The estimates of PA parameters from the smartphone and accelerometer were compared to each other and to the gold standard measures (MC and IC) using the concordance correlation coefficient (CCC) with the thresholds: almost perfect >0.90; substantial >0.8 - 0.9; moderate 0.65 - 0.8; poor <0.65. Levels of agreement are expressed as mean bias with 95% limits of agreement (LOA). **RESULTS:** Compared to MC (700 ± 98 steps), the smartphone (703 ± 97 steps; CCC 0.992; mean bias 3 steps, LOA -19 to 25 steps) and accelerometer (675 ± 133 steps; CCC 0.76; mean bias -25 steps, LOA -179 to 129 steps) provided accurate measurements of step count. Compared to IC (8 ± 3 kcal·min<sup>-1</sup>), the smartphone (6 ± 1 kcal·min<sup>-1</sup>) underestimated EE with poor agreement between methods (CCC = 0.48; mean bias -1.9 kcal·min<sup>-1</sup>, LOA -5.6 to 1.8 kcal·min<sup>-1</sup>). During free-living, the smartphone (7990 ± 4673 steps·day<sup>-1</sup>) substantially underestimated step count compared to the accelerometer (9085 ± 4647 steps·day<sup>-1</sup>; mean bias -1095 steps·day<sup>-1</sup>, LOA -4780 to 2591 steps·day<sup>-1</sup>). **CONCLUSION:** The smartphone provided accurate measurements of step count during a controlled laboratory walking trial but substantially underestimated PA in comparison to an accelerometer during a period of free living. Supported by a grant from the Digital Health and Care Institute.

**1386** Board #148 May 30 9:30 AM - 11:00 AM  
**Temporal Relationships Between The Act24 And A Monitor-based Method For Estimating Energy Expenditure Over A 24 Hour Period**

Nicholas R. Lamoureux<sup>1</sup>, Paul R. Hibbing<sup>2</sup>, Charles E. Matthews<sup>3</sup>, Gregory J. Welk, FACSM<sup>1</sup>. <sup>1</sup>*Iowa State University, AMES, IA.* <sup>2</sup>*University of Tennessee, Knoxville, TN.* <sup>3</sup>*National Cancer Institute, Bethesda, MD.* (Sponsor: Greg Welk, FACSM)  
 Email: nr11@iastate.edu  
 (No relevant relationships reported)

The ability to quantify physical activity (PA) behavior and energy expenditure (EE) remains an important metric in public health and fitness research. While monitor-based methods remain popular, they cannot provide the context needed to understand relationships between PA, sedentary behavior, and sleep. The ACT24 is a promising online, self-guided recall survey that enables activities to be summarized and processed by day, activity or time. **PURPOSE:** To compare EE estimates from the ACT24 with estimates from the established Sensewear armband (SWA) across full days as well as at the minute-by-minute level. **METHODS:** 91 adults (36% male, mean±SD age 26.0±10.2 years) wore a SWA for 24 hours and completed the ACT24 the following morning. The compendium of physical activities was used to quantify self-reported activity levels based on ACT24 responses. To compare overall relationships, estimates of total daily EE from the

SWA and ACT24 were correlated, and the mean absolute percent error (MAPE) of the ACT24 estimate was calculated relative to the SWA values. To assess the potential for contextualizing monitor data, data from Act24 were temporally matched with the SWA files and similar correlation and descriptive analyses were performed and averaged across individuals.

**RESULTS:** The daily estimates were highly correlated  $r = 0.88$ ,  $p < 0.0001$  and similar in magnitude for total daily EE (SWA: 2929 +/- 1106kcal; ACT24: 2902 +/- 950kcal) with a group level MAPE of 13.6%. The associations of temporally matched estimates revealed individual correlations ranging from  $r = 0.08$  to  $r = 0.93$  (mean of  $r = 0.54 \pm 0.15$ ). The individual MAPE values for the temporally matched data ranged from 0.02% to 56.1% (mean MAPE = 14% +/- 11.6%).

**CONCLUSION:** Previous-day recalls such as ACT24 may be useful alternatives to questionnaires or wearable devices for assessment of daily activities over 24-h periods. The robust export options also enable data to be temporally matched with other data sources to provide contextual information to be merged with monitor data. The results reveal good overall agreement between the two methods at both the group and individual level and provides a promising way to investigate PA context; however, additional research is needed to understand the factors influencing error between report-based and monitor-based methods.

**1387** Board #149 May 30 9:30 AM - 11:00 AM

**The Comparison of Using the Preferred or Non-Preferred Wrist When Measuring Physical Activity**

Bryce T. Daniels, Kaitlyn M. Gallagher, Michelle Gray, Erin K. Howie. *University of Arkansas, Fayetteville, AR.*  
Email: bxd013@uark.edu

(No relevant relationships reported)

People who participate in regular physical activity (PA) have a decreased risk of chronic diseases and premature death. A dramatic decrease of PA occurs from adolescence to young adulthood. With serious implications on health, PA is a critical behavior to measure. However, inconsistencies exist on how to measure PA. When using accelerometers, differences between the preferred (arm most commonly used to perform daily tasks of living, P) or non-preferred (NP) wrist may result in different estimates of PA. **PURPOSE:** The purpose of this study was to compare the P and NP wrist measured PA using commonly used research accelerometers during structured daily college activities and free-living (FL) conditions of college students. **METHODS:** 30 college students (15 females and 15 males) completed 7 lab tasks including shooting a basketball (BB), relaxing on a couch (Relax), hitting a racquetball (RB), walking up and down stairs (WUS), walking on an inclined surface (WUI), walking while using a smart phone (WSP), and using a laptop (COM). An accelerometer was placed on each wrist and the right hip. After the tasks, the students completed one week of FL conditions wearing an accelerometer on each wrist. Accelerometer counts from the P and NP wrists were compared using *Wilcoxon signed-rank tests* for the lab activities and a paired *t tests* for the FL conditions with  $\alpha$  at 0.05. **RESULTS:** P and NP total counts per minute (tCPM) from the respective accelerometer were significantly different for BB, COM, RB, Relax, WSP, and WUS. The FL conditions showed no significant differences between the P and NP wrist. All means, standard deviations, and p-values are displayed in Table 1. **CONCLUSION:** Researchers should be aware of differences between the P and NP wrist in PA measurements during structured activities. Though for FL conditions, less concern should be placed on the P or NP wrist. Findings suggest that future studies should further investigate wrist placement and tightness of the device on the wrist.

Table 1

Condition	P tCPM	NP tCPM	p-value
BB	37,624.1 (5,194.6)	35,0789 (5,420)	<b>0.010</b>
COM	1,183.4 (1,077.2)	1,522.0 (884.7)	<b>0.004</b>
RB	25,719.0 (4,318.3)	20,715.8 (5,405.3)	<b>&lt;0.001</b>
Relax	1,276.0 (1,065.6)	1,783.1 (1,385.6)	<b>0.037</b>
WSP	7,895.4 (2,457.4)	10,450.9 (2,736.5)	<b>&lt;.001</b>
WUI	10,290.8 (6,522.5)	10,304.4 (7,472.6)	0.894
WUS	12,477.6 (2,820.7)	13,225.2 (3,050.1)	<b>0.009</b>
FL	3,015.2 (665.5)	2,897.2 (671.2)	0.092

**1388** Board #150 May 30 9:30 AM - 11:00 AM

**Device-specific Cadence (steps/min) Thresholds For Metabolic Intensities of Walking**

Marcos A. Amalbert-Birrie<sup>1</sup>, Christopher C. Moore<sup>1</sup>, Aston K. McCullough<sup>1</sup>, Scott W. Ducharme<sup>1</sup>, Zachary R. Gould<sup>1</sup>, Colleen J. Sands<sup>1</sup>, Elroy J. Aguiar<sup>1</sup>, John M. Schuna, Jr.<sup>2</sup>, Tiago V. Barreira<sup>3</sup>, Stuart R. Chipkin<sup>1</sup>, Catrine A. Tudor-Locke, FACSM<sup>1</sup>.

<sup>1</sup>University of Massachusetts Amherst, Amherst, MA. <sup>2</sup>Oregon State University, Corvallis, OR. <sup>3</sup>Syracuse University, Syracuse, NY. (Sponsor: Catrine Tudor-Locke, FACSM)

Email: mamalbertbir@umass.edu

(No relevant relationships reported)

In studies where steps are directly observed, walking cadences of 100 steps/min and 130 steps/min have emerged as thresholds for absolutely-defined moderate (MOD; 3 metabolic equivalents [METs]) and vigorous (VIG; 6 METs) intensities, respectively. However, there is limited information regarding device-specific cadence thresholds provided for guidance.

**PURPOSE:** To estimate device-specific cadence thresholds for MOD and VIG in 61-85 year old adults.

**METHODS:** Thirty-seven healthy older adults (62.3% women; age=68.5±4.6 years; BMI=26.3±3.8 kg/m<sup>2</sup>) walked on a treadmill for 5-min bouts. The first bout was conducted at 0.5 mph. Speed increased in 0.5 mph increments until participants reached 75% of their age-predicted maximum heart rate, started to run, or reported a Borg Rating of Perceived Exertion > 13. Cadence (steps/min) was measured across all speeds with multiple devices: ActiGraph GT9x (hip and wrist), activPAL (thigh), StepWatch (ankle), Fitbit Zip (waist), and Garmin vivoactive® 3 (wrist). Oxygen uptake was measured with indirect calorimetry and converted to METs. Receiver Operator Characteristic (ROC) analysis was used to determine optimal cadence thresholds associated with MOD and VIG intensity using Youden's index.

**RESULTS:** Device-specific cadence thresholds for MOD and VIG intensity are presented in Table 1. The optimal device-specific cadence thresholds were associated with very good to excellent classification accuracy for both intensities (AUC > 0.8). Except for the wrist-worn ActiGraph, which had relatively lower specificity for identifying thresholds, optimal cadence thresholds for all devices ranged from 86-104 steps/min for MOD and 125-140 steps/min for VIG intensity.

**CONCLUSION:** Device-specific cadence thresholds appear to be acceptable indicators of MOD and VIG walking intensities.

**FUNDING:** NIH-NIA-5R01AG049024

Table 1: Device-specific cadence thresholds by intensity

Device	Absolutely-defined Intensity	Cadence (steps/min)	Specificity (%)	Sensitivity (%)	AUC	AUC 95% CI
ActiGraph (Waist)	MOD	86	86	83	0.90	0.86-0.94
	VIG	140	100	75	0.89	0.68-1.00
Fitbit Zip (Waist)	MOD	93	77	93	0.91	0.87-0.95
	VIG	136	97	100	0.98	0.96-1.00
ActiGraph (Wrist)	MOD	39	77	82	0.83	0.78-0.89
	VIG	63	86	100	0.94	0.88-1.00
vivoactive® 3 (Wrist)	MOD	96	82	90	0.92	0.88-0.96
	VIG	133	97	100	0.97	0.95-0.99
StepWatch (Ankle)	MOD	104	93	79	0.92	0.89-0.96
	VIG	125	91	75	0.87	0.70-1.00
ActivPAL (Thigh)	MOD	101	85	85	0.92	0.89-0.96
	VIG	138	99	75	0.90	0.72-1.00

AUC = Area Under the Curve

CI = Confidence interval

**1389** Board #151 May 30 9:30 AM - 11:00 AM  
**The Accuracy of Activity Trackers Measuring Energy Expenditure while Walking**  
 Melissa Renee Cook, Alyne L. Williams, Douglas Bernardes Oliveira, Christi Wolgemuth, Whitney Yoder. *Indiana Wesleyan University, Marion, IN.*  
 Email: melissa.cook@indwes.edu  
 (No relevant relationships reported)

**PURPOSE:** Activity trackers are becoming increasingly popular worldwide. As a result, the market has expanded with different brands that produce a variety of activity trackers varying in function and ability. Consumers who purchase these devices rely on the functions that are advertised, especially when cost, exercise, and lifestyle choices are considered. The purpose of this study was to assess the accuracy of the energy expenditure function of three popular activity trackers (1, 2, and 3).

**METHODS:** A sample was drawn from students attending Indiana Wesleyan University. Of those eligible, a total of 35 participants completed the study. Each participant wore the three devices and walked on a treadmill for 10 minutes at 3.0 mph with no incline. To assess accuracy, a t-test was used to compare the total energy expenditure measurement obtained from each device to the indirect calorimetry measurement obtained, which is considered the gold standard of energy expenditure. Correlations were calculated to analyze the relationships between the activity trackers. **RESULTS:** All three activity trackers overestimated energy expenditure ( $p < .05$ ) when compared to the indirect calorimetry measurement. Activity tracker 1, 2, and 3 overestimated by 37, 22, and 4 kcalories, respectively. Activity tracker 1 ( $r = 0.667$ ), 2 ( $r = 0.570$ ), and 3 ( $r = 0.568$ ) had a moderate correlation to the indirect calorimetry measurement.

**CONCLUSIONS:** Based on the findings of this study, consumers who purchase one of these devices will read an overestimated energy expenditure. Purchasing activity trackers can be expensive so doing research on which one is the most accurate is essential for consumers.

### C-37 Free Communication/Poster - Carbohydrate Metabolism

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

**1390** Board #152 May 30 10:30 AM - 12:00 PM  
**Muscle Glycogen Depletion And Body Water Status Assessed With Segmental Bioimpedance Spectroscopy**  
 Keisuke Shiose<sup>1</sup>, Yosuke Yamada<sup>2</sup>, Keiko Motonaga<sup>3</sup>, Hideyuki Takahashi<sup>3</sup>. <sup>1</sup>Fukuoka University, Fukuoka, Japan. <sup>2</sup>National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. <sup>3</sup>Japan Institute of Sports Sciences, Tokyo, Japan.  
 (No relevant relationships reported)

Glycogen is stored in combination with 3-5 g/g of water in muscle tissue, and carbohydrate (CHO) loading is accompanied by an increase in body water content, especially intracellular water. Therefore, body water status may be useful as an indicator of muscle glycogen level. However, body water status under conditions of glycogen depletion has not been investigated.

**PURPOSE:** To determine the effect of muscle glycogen depletion on body water distribution using segmental bioimpedance spectroscopy (S-BIS).

**METHODS:** Twelve healthy men performed cycling exercise aimed at muscle glycogen depletion, and 24 hours later consumed a high- (HIGH group; CHO, 7 g/kg/day) or low- (LOW group; CHO, <1 g/kg/day) CHO diet. Thigh muscle glycogen content was measured at baseline, immediately after, and 24 hours after exercise using <sup>13</sup>C-magnetic resonance spectroscopy. Intra- and extracellular water content (ICW and ECW) in the leg was assessed using S-BIS; measurement was performed at baseline and 24 hours after exercise to avoid the effect of exercise-induced acute changes in blood flow and metabolite concentration, but not glycogen, on body electrical properties.

**RESULTS:** Muscle glycogen content decreased after exercise in both groups (HIGH, 76.2 ± 16.4 to 28.1 ± 16.8 mmol/kg w.w.; LOW, 71.6 ± 12.1 to 25.5 ± 10.1 mmol/kg w.w.; both  $p < 0.05$  vs. baseline). At 24 hours after exercise, muscle glycogen content recovered in the HIGH group, but not in the LOW group (HIGH, 72.7 ± 21.2 mmol/kg w.w.; LOW, 33.2 ± 12.6 mmol/kg w.w.;  $p < 0.05$  between groups). ICW and ECW in the leg were unchanged from baseline in both groups (ICW; HIGH, 7.70 ± 1.43 to 7.59 ± 1.37; LOW, 7.53 ± 1.24 to 7.58 ± 1.35; ECW; HIGH, 4.73 ± 0.50 to 4.69 ± 0.54; LOW, 4.66 ± 0.67 to 4.49 ± 0.53).

**CONCLUSION:** Muscle glycogen was obviously decreased in thigh muscles, but ICW and ECW in the leg were unchanged. We conclude that muscle glycogen depletion per se does not alter body water status assessed with S-BIS.

**1391** Board #153 May 30 10:30 AM - 12:00 PM  
**Comparison Of High-Intensity Exercise And Continuous Moderate-Intensity Exercise On Postprandial Metabolism: Pilot Analysis**  
 David Buckley, James Rowe. *Stephen F. Austin State University, Nacogdoches, TX.*  
 Email: djbuckley293@gmail.com  
 (No relevant relationships reported)

**PURPOSE:** Examine the effects of low-volume high-intensity interval exercise (HIIE) and moderate-intensity continuous exercise (MICE) on postprandial glucose, insulin, and triglyceride (TG) concentration following a mixed meal (MM). **METHODS:** Recreationally active men ( $n = 7$ ; age = 22.2 ± 2.1 yrs; body mass = 93.7 ± 18.0 kg; BMI = 28.3 ± 4.6; body fat% = 29.2 ± 8.1; WC = 91.3 ± 16.5) completed a 1) rest bout, 2) MICE bout, and 3) HIIE bout in a randomized order. Rest consisted of sitting quietly for 20 minutes. MICE required 20 minutes of continuous cycling at 60% maximal work rate ( $WR_{max}$ ). HIIE consisted of performing 20 (15-second) cycling sprints (@ 130%  $WR_{max}$ ) followed with 45 seconds of passive cycling. Thirty minutes following the completion of each trial, participants consumed a MM in the form of a milkshake providing 5.3 ± 0.7 kcal/kg BM (body mass) with a macronutrient composition of 50% carbohydrate (CHO), 15% protein, and 35% fat. Blood samples were acquired prior to each trial and at 0, 0.5, 1, and 2 hours post-MM. Blood samples were analyzed for glucose, insulin, and TG concentration. Postprandial responses were quantified via the incremental area under the curve ( $AUC_i$ ) using the trapezoidal method. Significant differences ( $p < .05$ ) between trials were determined using a one-way, repeated measures ANOVA and Bonferroni post-hoc test. **RESULTS:** The average work performed over 20 minutes was similar between MICE (120.8 ± 30.8 W) and HIIE (115.6 ± 15.7 W) ( $p = .63$ , ES = .17). Glucose  $AUC_i$  was reduced following HIIE (26.4 ± 38.2 mg·dl<sup>-1</sup>·2hr<sup>-1</sup>) when compared to MICE (44.8 ± 35.9 mg·dl<sup>-1</sup>·2hr<sup>-1</sup>) ( $p = .018$ , ES = .51). HIIE was not different from rest (42.6 ± 66.4 mg·dl<sup>-1</sup>·2hr<sup>-1</sup>) ( $p = .13$ , ES = .30). Insulin  $AUC_i$  was unchanged between trials, however HIIE did elicit the lowest  $AUC_i$  (32.8 ± 31.8 μIU·ml<sup>-1</sup>·2hr<sup>-1</sup>) compared to rest (51.6 ± 31.7 μIU·ml<sup>-1</sup>·2hr<sup>-1</sup>) ( $p = .17$ , ES = .59) and MICE (52.4 ± 30.2 μIU·ml<sup>-1</sup>·2hr<sup>-1</sup>) ( $p = .15$ , ES = .63). TG  $AUC_i$  was unchanged between trials. **CONCLUSION:** Low-volume HIIE may reduce the postprandial glucose and insulin concentration. While there was no statistical significance with insulin  $AUC_i$ , there was a moderate effect size with HIIE. The lack of change in TG  $AUC_i$  was anticipated as previous studies have reported that exercise completed immediately prior to a mixed meal does not influence postprandial TG concentration.

**1392** Board #154 May 30 10:30 AM - 12:00 PM  
**Circulating Lactate Is Elevated in Prediabetes Phenotypes Compared with Normal Glucose Tolerant Counterparts**  
 Brielle L. Dotson, Emily M. Heiston, Stephanie L. Miller, Natalie Z.M. Eichner, Nicole M. Gilbertson, Steven K. Malin, FACSM. *University of Virginia, Charlottesville, VA.* (Sponsor: Steven K. Malin, FACSM)  
 Email: bld2cm@virginia.edu  
 (No relevant relationships reported)

**Purpose:** Prediabetes can be characterized as impaired fasting glucose (IFG) with or without impaired glucose tolerance (IGT; 2-hr blood glucose). IFG is depicted by impaired liver insulin sensitivity, while IFG+IGT is related to reduced liver and muscle insulin sensitivity. Lactate is a byproduct of non-oxidative glycolysis that may mediate altered glucose regulation. However, whether people with IFG and/or IFG+IGT have elevated lactate concentrations compared to normal glucose tolerant (NGT) controls is unclear. We hypothesized that individuals with IFG and IFG+IGT would have higher lactate levels than NGT controls in relation to glucose metabolism.

**Methods:** Forty-one obese adults (Age: 54.8 ± 2.0 yrs; BMI: 36.0 ± 1.0 kg/m<sup>2</sup>; 34F/7M) were screened for NGT, IFG, or IFG+IGT (75g OGTT, ADA criteria) following an overnight fast. Plasma lactate, glucose, and insulin were measured during a 120min 75g OGTT. The oral minimal model was used as an estimate for insulin sensitivity. Aerobic fitness ( $VO_{2peak}$ ), fasting substrate oxidation (respiratory exchange ratio (RER), indirect calorimetry) and body composition (bioelectrical impedance) were also tested. **Results:** There were no differences in  $VO_{2peak}$ , body fat or fasting RER across groups. Individuals with IFG+IGT had lower insulin sensitivity compared with IFG and NGT ( $P < 0.01$ ). However, both IFG and IFG+IGT had increased lactate tAUC compared to NGT ( $P < 0.01$  and  $P = 0.01$ , respectively). Increased lactate tAUC correlated with fasting glucose ( $r = 0.33$ ,  $P = 0.03$ ) and reduced  $VO_{2peak}$  ( $r = -0.34$ ,  $P = 0.03$ ). Fasting lactate also related to fasting RER ( $r = 0.31$ ,  $P = 0.04$ ). **Conclusion:** Despite no differences between prediabetes phenotypes, adults with IFG and IFG+IGT have elevated lactates compared to NGT controls. Lactate tAUC directly associates with fasting glucose and fitness, but not insulin sensitivity. These data suggest that fitness may mediate lactate metabolism via the liver. Future work is warranted to determine the mechanism by which lactate influences type 2 diabetes risk.

**1393** Board #155 May 30 10:30 AM - 12:00 PM  
**Effects of Breaking-up Prolonged Sitting with Three Different Walking Break Conditions on Glucose Metabolism**  
 Zhen-Bo Cao, Sheng-Xia Ma, Yan-yu Lin, Xiao-mei Liu, Sheng Zhao, Li-qiong Ma, Zheng Zhu. *Shanghai University of Sport, Shanghai, China.*  
 Email: caozb\_edu@yahoo.co.jp  
 (No relevant relationships reported)

**PURPOSE:** To compare the metabolic effects of interrupting prolonged sitting with three different walking break conditions in healthy adults.  
**METHODS:** In a randomized crossover trial, 16 inactive healthy adults (male:  $n = 7$ ) aged 21-30 years (body mass index:  $22.2 \pm 2.3$  kg/m<sup>2</sup>) completed four 26-h (from 8:00 AM on day 1 to 10:00 AM on day 2) laboratory conditions that included a 9-h intervention phase as follows: 9-h continuous sitting (SIT), 3-min brisk walking (60%VO<sub>2max</sub>) every 35 min during 9-h sitting (WALK3), 5-min brisk walking every 50 min during 9-h sitting (WALK5), and 8-min brisk walking every 70 min during 9-h sitting (WALK8). Continuous interstitial glucose monitoring (CGM) was performed during the 26-h intervention period. Four 2-h postprandial periods were also analyzed. Four meals and meal times were standardized across the conditions for all the participants.  
**RESULTS:** Compared with that in SIT (mean  $\pm$  SD:  $5.66 \pm 0.44$  mmol/L), the 26-h mean glucose level during WALK3 ( $5.42 \pm 0.42$  mmol/L), WALK5 ( $5.44 \pm 0.46$  mmol/L), and WALK8 ( $5.44 \pm 0.50$  mmol/L) were significantly lower (all  $P < 0.01$ ), with similar results for glucose total areas under the curve (tAUC; attenuated by 3%-4%; all  $P < 0.01$ ), but no significant differences were found among the three intervention conditions. The 2-h breakfast postprandial glucose incremental area under the curve (iAUC) was significantly lower for WALK3 (33%) and WALK8 (25%) than for SIT (all  $P < 0.05$ ) on day 1, whereas 2-h dinner postprandial glucose iAUC was significantly higher for WALK8 (25%) than for SIT ( $P = 0.038$ ). No significant treatment effects on both lunch (day 1) and breakfast (day 2) postprandial glucose iAUC were found.  
**CONCLUSIONS:** Three kinds of regular walking break conditions attenuated 26-h glucose responses. WALK8 most likely influenced the 2-h postprandial glucose metabolism of the healthy young adults in this study.

**1394** Board #156 May 30 10:30 AM - 12:00 PM  
**Does Pattern of Drink Intake Affect Exogenous Carbohydrate Oxidation During Prolonged Submaximal Running?**  
 Stephen A. Mears, Benjamin Boxer, David Sheldon, Hannah Wardley, Caroline Tarnowski, Lewis J. James, Carl J. Hulston. *Loughborough University, Loughborough, United Kingdom.*  
 Email: s.a.mears@lboro.ac.uk  
 (No relevant relationships reported)

Marathons and half-marathons usually position drink stations every 5 km, providing opportunity for fast runners to consume fluid and carbohydrate approximately every 15-20 min. In recent attempts to break the marathon world record, drinks have been provided at more frequent intervals, often in smaller volumes. **PURPOSE:** To determine how the pattern of carbohydrate ingestion during running affects exogenous carbohydrate oxidation rates and measures of gastrointestinal (GI) comfort.  
**METHODS:** Twelve well-trained male runners ( $27 \pm 7$  y,  $67.9 \pm 6.7$  kg,  $\dot{V}O_{2peak}$ :  $68 \pm 7$  mL/kg/min) completed three exercise trials of 100 min steady state running at 70%  $\dot{V}O_{2peak}$ . During the first trial, 200 mL water was consumed every 20 min and results were used for background correction of <sup>13</sup>CO<sub>2</sub> breath enrichment. In the final two trials a 1 L volume of a 10% dextrose solution, enriched with [U-<sup>13</sup>C] glucose, was consumed at a rate of either 200 mL every 20 min (CHO-20) or 50 mL every 5 min (CHO-5). Expired breath and venous blood samples were collected at rest and every 20 min during exercise. Subjective scales of GI comfort were recorded at regular intervals.  
**RESULTS:** Exogenous carbohydrate oxidation rates were higher after 80 ( $0.58 \pm 0.16$  v  $0.48 \pm 0.16$  g/min;  $P = 0.020$ ) and 100 min ( $0.67 \pm 0.14$  v  $0.58 \pm 0.15$  g/min;  $P = 0.016$ ) of running in CHO-20 compared to CHO-5. During exercise, total carbohydrate oxidation rates were similar between trials and remained within a range of 2.0 to 2.5 g/min ( $P > 0.168$ ). Oxidation of endogenous carbohydrate was lower in CHO-20 ( $1.87 \pm 0.37$  v  $2.08 \pm 0.44$  g/min;  $P < 0.05$ ). Serum glucose concentration increased above 5 mmol/L after drink ingestion, remaining elevated throughout exercise with no difference between trials ( $P = 0.095$ ). There were no differences in reported symptoms of GI comfort ( $P > 0.05$ ), with no subject reporting severe symptoms (all  $\leq 6$ ) in either trial.  
**CONCLUSIONS:** Ingestion of a larger volume of carbohydrate solution at less frequent intervals increased exogenous carbohydrate oxidation rates, resulting in similar rates of total carbohydrate oxidation but with reduced contribution from endogenous carbohydrate stores.

**1395** Board #157 May 30 10:30 AM - 12:00 PM  
**Acute Effects of Rotating Shift Work Paradigm on Activity and Metabolism**  
 Vasavi Shabrish. *University of Texas at Austin, Austin, TX.*  
 (No relevant relationships reported)

Shift work, which involves working during normal sleeping periods, results in asynchrony between central and peripheral molecular circadian clocks and is associated with increased risk for metabolic disease. Catecholamines released during physical activity act as entrainers of the circadian clock, and disruption of physical activity patterns may contribute to the negative effects of shift work.  
**PURPOSE:** The purpose of this study was to investigate the acute effects of rotating shift work on physical activity patterns, glucose tolerance, and body composition.  
**METHODS:** Eleven-week-old male mice on a FVB/N background were individually housed and randomly assigned to either a control group or a rotating shift work group. Control group mice were exposed to a normal 12:12 light/dark cycle, while the shift work mice were exposed to alternating 12:12 light/dark and dark/light inversions to simulate a rotating shift work pattern of 3 days "on shift"/4 days "off shift" for one week, followed by 4 days "on shift"/3 days "off shift" during the following week. Shift work conditions were maintained for two-weeks, followed by a 4-week period on normal light cycles and then another 3 weeks of alternating light cycles. Both groups received *ad-libitum* access to wireless running wheels, normal chow, and water. Glucose tolerance tests and body composition were measured at baseline, after two weeks, and the study end.  
**RESULTS:** Acute exposure to rotating shift work resulted in the shift work group being significantly more active between zt0-zt12 (5 vs 28 km,  $p < 0.001$ ; 11.8 vs 61 km,  $p < 0.001$ ) and during lights on (15.9 vs 24.5 km,  $p < 0.01$ ; 11.8 vs 51 km,  $p < 0.01$ ) and significantly less active between zt12-zt24 (23.7 vs 49.9 km,  $p < 0.01$ ) compared to the control group. Activity in the shift work group was more distributed throughout the 24-hour period compared to the control group. Acute exposure demonstrated significant differences between groups for fasting glucose ( $p < 0.05$ ) indicating dysregulation in carbohydrate metabolism. No significant differences were observed in body weight and body composition between groups at any time point.  
**CONCLUSIONS:** Acute exposure to a rotating shift work paradigm disrupts normal activity patterns and dysregulates carbohydrate metabolism.

**1396** Board #158 May 30 10:30 AM - 12:00 PM  
**Acute Resistance Exercise Fails to Alter Post-Exercise Glycemic Control**  
 William A. Braun, FACSM, Zach Rollar, Dan Hauck. *Shippensburg University, Shippensburg, PA.*  
 Email: wabrau@ship.edu  
 (No relevant relationships reported)

Acute exercise has commonly been found to transiently enhance glycemic control during recovery from the exercise. This effect has more commonly been observed following aerobic exercise. **PURPOSE:** This study combined results from two recent smaller investigations to gauge the effects of resistance exercise on post-exercise blood glucose (BG) response to an oral glucose tolerance test (OGTT). **METHODS:** Data from seventeen resistance-trained volunteers were used. All subjects completed a resting control trial consisting of a 75-min OGTT following consumption of a 25% glucose solution dosed at 1 g/kg body mass. On a separate day, subjects completed either 30 repetitions of squat only exercise (at 10-RM); 30 repetitions each of squat, bench press and biceps curl (at 10-RM); or ~30 repetitions each of biceps curl and knee extension (at 10-RM). BG was assessed via fingertip sampling prior to exercise, post-exercise and during the OGTT (every 15 min). Blood lactate was collected at rest and upon completion of exercise. **RESULTS:** Resistance exercise resulted in significantly increased blood lactate vs. resting state ( $8.58 \pm 0.87$  vs.  $1.39 \pm 0.22$  mmol/L). OGTT response following acute resistance exercise was not significantly different ( $p > 0.05$ ) from the resting OGTT condition. BG area under the curve was 2% smaller ( $p > 0.05$ ) following resistance exercise compared to resting control ( $11330.6 \pm 320$  vs.  $11551.3 \pm 405$  arbitrary units). **CONCLUSIONS:** Based on the results of this investigation, acute resistance exercise was not found to elicit enhanced glycemic control. The volume of working muscle, the overall energy deficit induced by exercise and the magnitude of the body's glycogen depletion may be important factors to consider when examining post-exercise blood glucose response to an OGTT challenge.

**1397** Board #159 May 30 10:30 AM - 12:00 PM  
**The Effects of High-Versus Low-Intensity Resistance Exercise on Acute Hyperglycemia in Young Healthy Males**

Brandon Beimborn, Luis Segura, Joshua Cotter, PhD, Evan Schick PhD. *California State University, Long Beach, Long Beach, CA.*

(No relevant relationships reported)

ACSM 2019

**THE EFFECTS OF HIGH- VERSUS LOW- INTENSITY RESISTANCE EXERCISE ON ACUTE HYPERGLYCEMIA IN YOUNG HEALTHY MALES**  
**Luis E. Segura, Brandon Beimborn, Shayan Emamjomeh, Josh A. Cotter, PhD, Evan E. Schick, PhD**

Nearly one-third of Americans older than 18 years of age are pre-diabetic, yet much remains to be understood about this condition. Regular exercise can help control prolonged hyperglycemia, a flagship symptom of type 2 diabetes, however, the nature in which exercise can alleviate periods of acute hyperglycemia, a common symptom of pre-diabetes, is unclear. **Purpose:** The purpose of this study was to examine the effect of high-intensity (HI) versus low-intensity (LO) resistance exercise (RE) on acute hyperglycemia in resistance-trained males. **Methods:** Thirteen recreationally trained males (age, 23.43 ± 2.18 yrs.; height, 175.16 ± 10.44 cm; mass, 77.02 ± 8.91 kg) completed three randomized testing sessions separated by 96 hours: 1) no exercise control (CON), 2) HI (5x4, 90% 1-RM), and 3) LO (3x14, 65% 1-RM). Following overnight fast, all three-testing session commenced with oral ingestion of a high glucose drink (2 g glucose/kg body weight). HI and LO RE protocols began 30 mins post-glucose ingestion. Capillary blood samples obtained via finger stick occurred immediately pre- and 30, 60, 90 and 120-mins post-glucose ingestion. **Results:** A two-way ANOVA revealed a significant ( $p < 0.015$ ) time main effect for plasma glucose and insulin concentrations throughout the 120 min testing duration, however neither glucose or insulin differed between conditions at any of the individual time points. One-way ANOVA showed that total glucose response in the HI condition, as assessed by AUC, was significantly greater ( $p < 0.012$ ) than in both CON and LO. Strong negative correlations existed between total body mass and lean body mass ( $r = -0.78$ ) as well as lean body mass and LO glucose AUC ( $r = -0.78$ ). **Conclusions:** High intensity resistance exercise may exacerbate acute episodes of hyperglycemia, thus combining high intensity with lower intensity resistance exercise may optimally manage skeletal muscle health and glycemic control.

**1398** Board #160 May 30 10:30 AM - 12:00 PM  
**Impact of Reduced Carbohydrate Intake after Exercise on Breath Acetone Levels**

naoki ota, hiroto ito, kazushige goto. *ritumeikanuniversity, kyoto, Japan.* (Sponsor: Robert Kraemer, FACSM)

Email: n.ota0820@gmail.com

(No relevant relationships reported)

**PURPOSE:** The purpose of the present study was to determine the impact of reduced carbohydrate (CHO) intake after sprint exercise on breath acetone levels during post-exercise.

**METHODS:** Nine subjects (20.8 ± 0.2 yrs, 170.1 ± 1.6 cm, 65.1 ± 1.8 kg) conducted two trials, consisting lower CHO trial (LOW) or normal CHO trial (NOR). In each trial, the subjects came to the laboratory at 7:30 to evaluate breath acetone level, blood variables and resting metabolic rate. From 17:00, they started repeated sprint exercise (4 × 30 s maximal cycle sprint exercise). After exercise, isoenergetic meals (during 2-3 h after exercise) were provided with containing normal CHO (60% for CHO, 20% for protein, 20% for fat) for NOR or reduced CHO (20% for CHO, 20% for protein, 60% for fat) for LOW. Time course changes in breath acetone levels were monitored immediately before exercise, immediately after exercise, 1 h, 3h, 4h and on the following morning.

**RESULTS:** In the LOW, exercise markedly increased breath acetone levels during post-exercise (trial × time interaction:  $p < 0.05$ ). At 4 h after exercise, breath acetone level was significantly higher in LOW (0.9 ± 0.02 ppm) than in NOR (0.66 ± 0.07 ppm,  $p < 0.05$ ). However, a significant difference between the trials was not observed on the following morning. Respiratory exchange ratio (RER) on the following morning was significantly lower in the LOW (0.81 ± 0.02) than in the NOR (0.87 ± 0.02,  $p < 0.05$ ). Moreover, LOW showed significantly lower contribution of CHO oxidation (34 ± 4.8 %) than that in NOR (50 ± 6.2 %,  $p < 0.05$ ), whereas fat oxidation was significantly higher in LOW (66 ± 4.8 %) than in NOR (50 ± 6.2 %,  $p < 0.05$ ).

**CONCLUSIONS:** Reduced CHO intake after exercise increased breath acetone level during early phase of post-exercise (4 h after exercise), suggesting augmented fat metabolism in the liver under impaired CHO availability. However, the increased breath acetone level by reduced CHO intake was not evident on the following morning. The results may suggest that breath acetone levels can be available to evaluate CHO availability following intensive exercise.

**1399** Board #161 May 30 10:30 AM - 12:00 PM  
**Effects of Acute Swimming Exercise on Pancreatic Enzyme Activity and Intestinal Glucose Transporters in Rats**

Saki Kondo, Ayumi Fukazawa, Shin Terada. *The University of Tokyo, Tokyo, Japan.* (Sponsor: Mitsuru Higuchi, FACSM)

(No relevant relationships reported)

**PURPOSE:** It has been reported that long-term endurance exercise training increases pancreatic amylase activity in rats, suggesting that chronic exercise training enhances the carbohydrate digestive capacity. To clarify whether an acute bout of endurance exercise can also induce the pancreatic adaptation and affect glucose transport capacity in small intestine as well, we evaluate the effects of acute swimming exercise with different duration on pancreatic amylase activity and intestinal glucose transporter contents in rats. **METHODS:** Male Sprague-Dawley rats performed acute bout of swimming exercise for 1 h (Ex-1h group) or 6 h (Ex-6h group, two 3-h bouts separated by 1h of rest). Sedentary rats were used as a control (Con group). Immediately and 24 h after the exercise, pancreas and small intestine (jejunum) were dissected out and amylase activity and glucose transporters (GLUT2 and SGLT1) content were measured, respectively. **RESULTS:** While no significant difference in total pancreatic amylase activity was observed between the Con and Ex-1h groups, the Ex-6h group had significantly lower total amylase activity compared with the Con group in both immediately (1233 ± 229 vs. 2088 ± 205 U,  $p < 0.05$ ) and 24 h after the exercise (1295 ± 112 vs. 1954 ± 227 U,  $p < 0.05$ ). There were no significant differences in GLUT2 and SGLT1 protein contents among the three groups. **CONCLUSIONS:** These results suggest that acute bout of prolonged exercise for longer time (~6 h) may decrease the carbohydrate digestive capacity in the rat pancreas through the diminished amylase activity, although it has little effect on intestinal glucose transporters content.

**1400** Board #162 May 30 10:30 AM - 12:00 PM  
**cfDNA As A Metabolic Marker**

David Ochmann, Charlotte Kreuz, Silvia Wenzel, Perikles Simon. *Institution of Sports Science, Mainz, Germany.*

Email: ochmann@uni-mainz.de

(No relevant relationships reported)

**PURPOSE:** We observed in previous studies that incremental running tests to exhaustion and continuous aerobic running leads to significant increases of cell-free DNA (cfDNA) in capillary blood, which showed a high positive correlation with total energy expenditure. Here we investigated the increases of cfDNA during different interval loads with a focus on metabolic rates, heart rate (HR), and TRIMP. We hypothesized that cfDNA shows a high association with carbohydrate energy expenditure.

**METHODS:** 14 male subjects were subjected to a stepwise incremental exercise test until exhaustion to determine the individual anaerobic threshold (IAT; as LT + 1.5 mmol/l) and subsequently participated in three different interval training sessions. cfDNA and lactate were taken after every step and metabolic data were monitored continuously after a 10min warmup phase on the treadmill (+1.5%) during 6 x 400m intervals at 18km/h with 2min pauses, 6 x 400m intervals at 18km/h with 5min pauses, and 6 x 1000m intervals at IAT with 2min pauses. The order of the first two tests that only differed in duration of pause was randomized. Heart rate and subsequent calculation of TRIMP was done based on ECG Monitoring.

**RESULTS:** cfDNA analysis showed a significantly higher increase in the 400m interval setting with short pause time (8.2-fold; 95% CI: 6.3-10.6;  $p < 0.0001$ ) compared to 400m interval setting with long pause time (3.4-fold; 95% CI: 2.6-4.4;  $p < 0.0001$ ). In contrast to cfDNA TRIMP showed a significantly higher increase in the 400m interval setting with a long pause time (long: 4.8-fold; 95% CI: 4.4-5.2;  $p < 0.0001$ ) compared to 400m interval setting with short pause time (4.3-fold; 95% CI: 4.0-4.7;  $p < 0.0001$ ). In a global analysis across all interval tests and points in time cfDNA increased 7.0-fold (95% CI: 5.4-9.1;  $p < 0.0001$ ) and the highest correlation of this increase with all other physiological parameters was with carbohydrate energy expenditure ( $r = 0.87$ ;  $p < 0.0001$ ).

**CONCLUSIONS:** cfDNA appeared to reflect training load of the 400m interval settings more properly than TRIMP. Here we report for the first time a high correlation between cfDNA and carbohydrate energy expenditure. Further studies will have to investigate the validity of cfDNA releases during exercise as a marker for carbohydrate energy expenditure.

1401 Board #163 May 30 10:30 AM - 12:00 PM

**Metabolic Responses of Pre-Exercise Carbohydrate Ingestion in Cycling and Running**

Michaela Alexandrou<sup>1</sup>, Chrysoula Kontrafour<sup>1</sup>, Damianos Papafiliippou<sup>1</sup>, Argyro Pountoukidou<sup>1</sup>, Efraimia Tsolaki<sup>1</sup>, Maria Evangelia Koloutsou<sup>1</sup>, Evangelia Tzeravini<sup>1</sup>, Elias Zacharogiannis<sup>1</sup>, Ioannis Lambropoulos<sup>2</sup>, Costas Chrysanthopoulos<sup>1</sup>, Alexander Kokkinos<sup>1</sup>, Maria Maridaki<sup>1</sup>, Michael Koutsilieris<sup>1</sup>, Anastassios Philippou<sup>1</sup>. <sup>1</sup>National and Kapodistrian University of Athens, Athens, Greece. <sup>2</sup>Biomedicine, Diagnostic and Research Laboratories, Marousi, Greece.  
Email: alexmichaela@yahoo.gr  
(No relevant relationships reported)

Several studies have examined the metabolic responses of pre-exercise carbohydrate (CHO) ingestion in cycling and running, however, none of the existing studies compared directly cycling and running on the same individuals. **PURPOSE:** To examine the metabolic responses of pre-exercise CHO ingestion in cycling and running on the same individuals. **METHODS:** Eleven males (25.5 ± 3.2 years old, 175.7 ± 2.0 cm, body fat percentage 12.4 ± 4.2%, mean ± SE), following an overnight fast, cycled or ran for 30 min at 77-83% maximal heart rate (HR<sub>max</sub>) after ingestion of either 1g/kg body weight maltodextrin (CHO-Cycle and CHO-Run respectively) or placebo (PL-Cycle and PL-Run) solutions. Fluids were ingested 30min before exercise in a double-blind and random way. Data were analyzed using three-way ANOVA, whereas pre-post exercise changes were compared by two-way ANOVA. **RESULTS:** Blood glucose and serum insulin responses were higher before exercise in CHO (mean CHO-Cycle+CHO-Run) (Glucose: 7.3 ± 0.4 mmol<sup>-1</sup>; Insulin: 59 ± 10 mU<sup>-1</sup>) compared to placebo trials (mean PL-Cycle+PL-Run) (Glucose: 4.7 ± 0.1 mmol<sup>-1</sup>; Insulin: 8 ± 1 mU<sup>-1</sup>) (p<0.01). No differences were observed during exercise among the 4 conditions, while blood glucose did not drop below 4.1 mmol<sup>-1</sup> in any trial. Blood lactate increased with exercise (post - pre difference) more in cycling (CHO-Cycle+PL-Cycle: 3.4 ± 0.4 mmol<sup>-1</sup>) compared to running (CHO-Run+PL-Run: 0.7 ± 0.2 mmol<sup>-1</sup>) (p<0.01). At the end of exercise plasma free fatty acids (FFA) were higher in placebo compared to CHO irrespective of exercise mode (PL-Cycle+PL-Run: 0.36 ± 0.03 vs. CHO-Cycle+CHO-Run: 0.14 ± 0.03 mmol<sup>-1</sup>), while at the same time plasma glycerol was higher in PL-Run (137 ± 8 mmol<sup>-1</sup>) compared to PL-Cycle (87 ± 8 mmol<sup>-1</sup>) (p<0.01). **CONCLUSIONS:** During 30min exercise at 77-83% HR<sub>max</sub>, lactate was higher in cycling compared to running irrespective of fluid ingestion, whereas glycerol was increased more in running when no CHO was provided. The ingestion of CHO reduced FFA concentrations independently of the mode of exercise, while glucose and insulin responses were not affected by the exercise mode

1402 Board #164 May 30 10:30 AM - 12:00 PM

**Electrolyte-based Carbohydrate Drink: Effect On Steady State Exercise Done Against Progressively Higher Workloads**

William D. Gray, Ian T. O'Brien, Amy E. Kozerski, Alexandria C. Vanhoover, Charles B. McEnroe, John F. Caruso. *University of Louisville, Louisville, KY.*  
Email: john.caruso@louisville.edu  
(No relevant relationships reported)

Aerobic exercise with progressively higher workload stages done in succession challenges a person's cardiorespiratory system as their VO<sub>2</sub>max is estimated. Higher heart rates (HR) at the end of stages lowers a person's estimated VO<sub>2</sub>max. Adding electrolytes to a carbohydrate-based drink may raise VO<sub>2</sub>max values if ingested before exercise. **Purpose:** Compare the merits of added electrolytes, in two otherwise similar beverages, when consumed before VO<sub>2</sub>max tests that entail progressively higher workload stages. **Methods:** In a randomized double-blind study subjects (13 men, 21 women) first gave written informed consent, followed by two stationary cycle ergometer workouts to estimate their VO<sub>2</sub>max. Workouts were preceded by intake of a 2% sucrose solution, one of which was an electrolyte-rich (500 mg of vitamin C, 1 mg of B-12, 100 mg of Mg<sup>2+</sup>, 400 mg of K<sup>+</sup>, 200 mg of Na<sup>+</sup>, 1 µg of Cr) beverage, while the other was devoid of added electrolytes and served as a placebo. HR were recorded before, four times during, and after workouts. Ratings of perceived exertion (RPE) were provided at the end of workouts. HR were compared with a three-way (gender, treatment, time) ANOVA, with repeated measures for treatment and time. Estimated VO<sub>2</sub>max and RPE were assessed with two-way (gender, treatment) ANCOVAs, with repeated measures for treatment. Body mass and body fat percentage were examined as covariates. Scheffe's served as our post-hoc and an α= 0.05 denoted significance. **Results:** There were significant inter-time differences for HR. RPE and VO<sub>2</sub>max each had inter-gender differences. Yet there were no inter-treatment differences. **Conclusions:** Little research exists on the ergogenic effects on electrolyte formulations added to carbohydrate beverages, yet our results concur with studies that also saw a lack of inter-treatment differences.

1403 Board #165 May 30 10:30 AM - 12:00 PM

**The Effects of a Carbohydrate Mouth Rinse on Central and Peripheral Fatigue Following High and Low Intensity Fatiguing Exercise**

Angelina Curiel, Kody Haskins, Michael G. Bemben, FACSM, Rebecca D. Larson, Christopher D. Black, FACSM. *University of Oklahoma, Norman, OK.*  
(No relevant relationships reported)

Carbohydrate (CHO) mouth rinsing has been shown to improve performance during long duration, aerobic exercise. However, the ability of a CHO mouth rinse to attenuate fatigue during shorter term exercise is not well characterized. **PURPOSE:** This study sought to determine the effects of a CHO mouth rinse on torque production and voluntary activation following high and low intensity isometric exercise. **METHODS:** Twelve, active male participants completed 6 sessions—2 familiarization and 4 testing visits. Knee extension MVC was determined (PRE), followed by performance a high (80% of MVC) or a low (20% of MVC)-intensity isometric exercise held to task failure. An 8% CHO solution or placebo was then rinsed for 20-secs. MVC was then reassessed immediately following (iPOST) the rinse and following 5-min of rest (SPOST). Voluntary activation (VA%) was determined during each MVC via twitch-interpolation and rate of torque development (RTD) and relaxation (RTR) were calculated from twitch torque (TT). **RESULTS:** There were no significant interactions (p≥0.31) between exercise intensity, time, and rinse condition on all variables. MVC was reduced compared to PRE following 20% and 80% exercise (p<0.01), but greater reductions were found at iPOST following exercise at 20% of MVC (-24.1% vs. -14.2%; p<0.001). VA% decreased following both exercise protocols (p≤0.02), but was reduced to a greater extent following exercise at 20% of MVC (-18.7% vs. -6.7%; p<0.004). A significant main effect for time (p = 0.01) was found on TT with reductions observed iPOST (p≤0.047), but not at SPOST (p>0.05). RTD was reduced following exercise at 80% (281±65 vs. 251±70 Nm·s<sup>-1</sup>; p<0.05), but not following exercise at 20% of MVC (p≥0.06). RTR was reduced following exercise at both 20% and 80% of MVC (p≤0.01) at iPOST. Greater reductions were observed following exercise at 80% of MVC (216±55 to 144±37 vs. 222±54 to 184±54; p<0.04). **CONCLUSIONS:** We were successful in eliciting differing levels of central and peripheral fatigue by exercising at a low and high intensity. Despite significantly larger declines in VA% following exercise at 20% of MVC, CHO mouth rinsing had no effects compared to placebo on any measured variable.

1404 Board #166 May 30 10:30 AM - 12:00 PM

**Influence of Chronic Carbohydrate Ingestion During High Intensity Exercise on Incidences of Gastrointestinal Distress**

Ben M. Krings<sup>1</sup>, Hunter S. Waldman<sup>2</sup>, Brandon D. Shepherd<sup>2</sup>, Matthew J. McAllister<sup>3</sup>, JohnEric W. Smith<sup>2</sup>. <sup>1</sup>University of Wisconsin- Platteville, Platteville, WI. <sup>2</sup>Mississippi State University, Mississippi State, MS. <sup>3</sup>Texas State University, San Marcos, TX.  
(No relevant relationships reported)

The effects of carbohydrate (CHO) ingestion during endurance exercise on gastrointestinal distress (GID) has been well researched, but there is limited research with high intensity exercise. **PURPOSE:** The purpose of this study was to examine the effects of chronic CHO ingestion on GID responses during a 4 week concurrent resistance training (RT) and high intensity interval training (HIIT) program. **METHODS:** 18 resistance trained males, aged 18-24 years old, were stratified into one of two groups: ingesting a 500 mL beverage containing a 6% CHO solution during exercise or ingesting a 500 mL artificially flavored placebo. Each group completed 4 weeks of RT and HIIT, three days per week of RT, and two days per week of HIIT, repeated all-out 30 second cycling sprints. GID was measured immediately before and after one RT session and one HIIT session per week for a total of 8 sessions. GID was measured using a 10-point Likert scale assessing feelings of nausea, regurgitation/reflux, stomach fullness, abdominal cramps, gas/flatulence, and urge to defecate. GID was analyzed using a four-way repeated measures ANOVA (exercise × group × time × week). **RESULTS:** There was a main effect for time for nausea (pre-exercise 0.29 ± 0.68, post-exercise 1.31 ± 2.24), regurgitation/reflux (pre-exercise 0.24 ± 0.75, post-exercise 1.53 ± 2.00), and abdominal cramps (pre-exercise 0.09 ± 0.54, post-exercise 0.83 ± 1.56) (p < 0.05), suggesting these symptoms of GID increased pre- to post-exercise independent of exercise type, group, or week. There were no interaction effects or main effects for gas/flatulence or urge to defecate (p < 0.05). **CONCLUSION:** Ingesting beverages containing CHO or artificial sweeteners both increase GID during high intensity exercise. Chronic CHO ingestion during endurance training has been suggested to train the gut to better absorb nutrients, but based on the results from this investigation, signs and symptoms of GID are not reduced following 4 weeks of chronic ingestion during high intensity exercise.

**1405** Board #167 May 30 10:30 AM - 12:00 PM  
**Carbohydrate Effects on Post-Exercise Performance in Prepubescent Girls**

C. Eric Heidorn, Brandon J. Dykstra, Cori A. Conner, Anthony D. Mahon. *Ball State University, Muncie, IN.*

(No relevant relationships reported)

Carbohydrate (CHO) consumption is a common practice during variable-intensity exercise (VIE) such as team sports. The effects of CHO on performance during VIE have been studied in adults; however, the effects are less defined in children and apparently not at all in prepubescent girls. **PURPOSE:** To investigate the effects of a 6% CHO drink on a one-minute performance test following 30-minutes of VIE in prepubescent girls. **METHODS:** Ten girls (10.4±0.7 yrs.) participated in this study. During the initial visit, maximal aerobic power was determined followed by a familiarization of the protocol used during the next two visits in which the child consumed either a CHO drink or an electrolyte-matched placebo (PL). The experimental protocol involved two 15-minute bouts of VIE (20, 55, 95% maximal aerobic power and 6-second maximal sprint); beverages were consumed prior to exercise and after each 15-minute segment. A one-minute performance trial was then completed at maximal effort. Measurements during VIE included heart rate (HR), rating of perceived exertion (RPE), sprint mean power (MP) and sprint peak power (PP). During the one-minute performance bout, HR, RPE, PP, total work (TW), and fatigue index (FI) were assessed. Data were analyzed using a 2-way ANOVA and paired t-tests. **RESULTS:**  $\dot{V}O_{2max}$  was  $39.7 \pm 5.5$  mL·kg<sup>-1</sup>·min<sup>-1</sup> and HR<sub>max</sub> was  $196 \pm 11$  bpm. During VIE, there were no interaction effects, no trial effects ( $p > 0.05$ ) for HR, %HR<sub>max</sub>, RPE, sprint MP, sprint PP and no time effects ( $p > 0.05$ ) for HR, %HR<sub>max</sub>, or MP. However, there were time effects ( $p < 0.05$ ) for RPE (VIE1 < VIE2) and PP (VIE1 > VIE2). No differences were found between trials (CHO vs. PL) for one-minute performance for HR ( $190 \pm 9$  vs.  $189 \pm 9$  bpm), %HR<sub>max</sub> ( $97.0 \pm 3.2$  vs.  $96.6 \pm 3.0$  %), RPE ( $7.8 \pm 2.3$  vs.  $8.1 \pm 1.9$ ), PP ( $238 \pm 70$  vs.  $235 \pm 60$  W), FI ( $54.7 \pm 10.0$  vs.  $55.9 \pm 12.8$  %), and TW ( $9.37 \pm 2.6$  vs.  $9.37 \pm 2.1$  kJ). **CONCLUSION:** A 6% CHO drink is ineffective at improving one-minute performance following 30-minutes of VIE in pre-pubertal girls. Based upon the current findings, CHO supplementation does not appear to be beneficial with respect to improving performance for prepubescent children completing VIE activity lasting 30-minutes.

**C-38** Free Communication/Poster - Nutrition and Energy Metabolism

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

**1406** Board #168 May 30 10:30 AM - 12:00 PM  
**Influence Of Sports And Energy Intake On BMD In Female Athletes Compared To Sedentary Controls**

Adriana De la Parra Sólomon, Hugues Plourde, Sebastien Beauregard, Ross E. Andersen, FACSM. *McGill University, Montreal, QC, Canada.*

Email: adriana.delaparrasolomon@mail.mcgill.ca

(No relevant relationships reported)

Physical activity, particularly percussive activities with adequate energy intake may influence bone mineral density (BMD) in young female adults. Unfortunately, it is common to see energy deficiencies in this population that can put them at risk of health issues including lower BMD. **PURPOSE:** To determine the influence of the type of sport and energy intake on BMD in female athletes compared to sedentary students. **METHOD:** Seventy-three female students (age  $20.8 \pm 1.9$  y, height  $167.4 \pm 8.8$  cm, weight  $62.3 \pm 9.2$ ) from McGill University were evaluated (44 from McGill Varsity Teams: basketball (BB n=13), volleyball (VB n=11), figure skating (FS n=13), and synchronized swimming (SS n=7); and 29 sedentary healthy women (controls). Dietary intake (kcal/day) was assessed using a 3-day Food Log and analysed with the Food Processor™ Software. Lumbar spine (LS) (L1-L4) and femoral neck (FN) BMD were assessed by DXA scanning. A one-way ANOVA explored between-group differences and an ANCOVA examined the influence of energy intake on BMD. **RESULTS:** A significant difference in BMD at the LS and FN sites was observed between the type of sports ( $F(4,68) = 8.6, p < .001, \eta^2 = .335; F(4,68) = 6.3, p < .001, \eta^2 = .272$ , respectively). Also, BB (LS =  $1.7 \pm 1.53, p < .001$ ; FN =  $1.7 \pm 1.13, p = .001$ ) and VB (LS =  $1.5 \pm 1.55, p = .001$ ; FN =  $1.7 \pm 1.66, p = .002$ ) players had a significantly higher BMD in both sites compared to their non-athletic counterparts (LS =  $-0.3 \pm 1.19$ ; FN =  $0.1 \pm 1.04$ ). The FS and SS athlete's bone densities were not different from the control group ( $p = .719; p = .246$ ). No significant association was observed between BMD at both sites and total energy intake/day across all groups ( $F(1,67) = .496, p = .484, \eta^2 = .007; F(1,67) = .035, p = .852, \eta^2 = .001$ ). There was a significant difference between the delta energy intake (recommended intake minus actual intake) in both BB and SS groups compared to the control group ( $p = .003$  and

$p = 0.02$ , respectively). **CONCLUSION:** The type of sport revealed an influence on BMD. However, no significant relationship was observed between energy intake and BMD. A significant discrepancy was found between the required versus actual energy intake in some athletes. These data suggest that female varsity athletes should work closely with sports dietitians to promote healthy eating and optimize bone health.

**1407** Board #169 May 30 10:30 AM - 12:00 PM  
**The Role of Acute Fasting on Substrate Utilization During Submaximal Exercise**

Melhaney Reichelt, Lauren Yanni, John Wygand, FACSM, John Petrizzo, Robert M. Otto, FACSM. *Adelphi University, Garden City, NY.* (Sponsor: John Wygand, FACSM)

Email: melaneyreichelt@mail.adelphi.edu

(No relevant relationships reported)

Purportedly, performing 20 minutes of aerobic exercise following an overnight fast has a greater effect on fat loss than in the postprandial state. Theoretically, a fast may attenuate glycogen stores, thus shifting to the utilization of increased free fatty acids, and resulting in greater fat burn throughout exercise. **Purpose:** To determine if exercising at a titrated intensity, as determined by equal fat and carbohydrate fuel utilization, will elicit more fat utilization in a fasted state when compared to a fed state. **Methods:** 13 (12 ♂) asymptomatic (ht.  $176.6 \pm 2.9$  cm; wt.  $79.1 \pm 17.2$  kg), healthy college students (age range 19-24) who regularly engage in aerobic exercise a minimum of twice per week volunteered for the study. During familiarization, individual treadmill workloads were titrated by using a ramp protocol (speed increase of 13.4 m/min) at 1% grade to achieve a RER of .85. All trials were preceded by a 12 hr fast w 24 hr abstinence from alcohol & caffeine, and 30 minutes of rest immediately prior to the trial. The fasted trial (Fa) required 25 minutes of rest and 5 min of measured resting metabolism (RMR) prior to the treadmill exercise, while the fed trial (Fe) required ingestion of 450 kcal (74% CHO, 14% pro, & 12% fat) in 10 minutes with 15 minutes of rest immediately prior to 5 min of RMR. Single blind randomization determined trial cross over order. Blood glucose (BG) was obtained by finger stick. Statistical analysis by paired samples T-test were applied to these data ( $p < .05$ ). **Results:** The RER at RMR of 0.88 Fe & 0.83 Fa, was significantly different, however, exercise  $\dot{V}O_2$  of  $2.46 \pm 0.8$  &  $2.36 \pm 0.8$  and RER of 0.89 & 0.87 for Fe & Fa, respectively, was NSD ( $p > .05$ ). BG pre and post exercise of  $81.3 \pm 9.2$  &  $61.8 \pm 9.1$  for Fe and  $80.9 \pm 5.5$  &  $85.5 \pm 10.1$  mg/dL for Fa was NSD for Fa. **Conclusion:** A 12 hr fast can alter resting fuel substrate, but exercise fuel sources are unaffected. Reductions in BG from exercise during the fed state may be attributed to fuel use, however the maintenance of BG in the fasted state may be related to glucagon release. Relative to fat expenditure, there is no advantage to exercising in an acute fasted state (12 hr) or in a fed state, however an extended fast may provide a different outcome.

**1408** Board #170 May 30 10:30 AM - 12:00 PM  
**Effects of Concussion on Whole-Body Energy Metabolism and Caloric Intake: A Preliminary Investigation**

Samuel R. Walton, Steven K. Malin, FACSM, Sibylle Kranz, Donna K. Broshek, Jay Hertel, FACSM, Jacob E. Resch.

*University of Virginia, Charlottesville, VA.*

Email: swaltonatc@gmail.com

(No relevant relationships reported)

**PURPOSE:** Prior studies suggest changes in resting metabolic rate (RMR) and brain substrate use in severe traumatic brain injuries (TBI). However, no data exist in humans with concussion. The purpose of this study was to examine the effect of concussion on RMR, estimated substrate use, and diet throughout recovery in male and female athletes.

**METHODS:** Concussed participants ( $N = 25$  [13 males, 12 females]) were recruited from a university and local high schools. RMR was determined by indirect calorimetry < 72 hours following a diagnosed concussion (T1), 7 days after T1 (T2), and 14 days after T1 (T3). Percent carbohydrate (CO) and lipid (LO) oxidation were calculated from  $\dot{V}O_2$  and  $\dot{V}CO_2$ . Dietary intake was self-reported for the day of and two days following each time point. Total caloric intake (kcal) and percentage from carbohydrates (CI), proteins (PI) and lipids (LI) were calculated. Separate repeated measures ANOVAs were used to assess sex by time changes in RMR and CI. Descriptive statistics were used to assess macronutrient intake and use. **RESULTS:** Participant demographics, metabolic, and nutrient data are in Table 1. RMR did not change over time ( $p = .49, \eta^2 = .03$ ) and sex did not significantly influence RMR over time ( $p = .08, \eta^2 = .11$ ). Total kcal decreased over time ( $p = .002, \eta^2 = .32$ ) such that intake at T1 was greater than T2 and T3, and there were no effects of sex over time ( $p = .20, \eta^2 = .10$ ). CO appeared to increase over time.

**CONCLUSION:** Our preliminary data suggest that concussions may influence whole-body and carbohydrate metabolism in a sex specific manner. While not significant, there was a moderate effect of sex on RMR where males increased from T1 to T3 and females did not, and there may have been an acute decrease in CO which elevated

throughout recovery. CI was elevated acutely and decreased throughout recovery, but macronutrient intake ratios did not drastically change. Further investigations of these measures with a larger sample size is warranted given our preliminary data.

Table 1. Demographic, Substrate Utilization, and Food Preference Descriptive Statistics\*

	T1			T2			T3		
	Total (n=25)	Males (n=13)	Females (n=12)	Total (n=24)	Males (n=12)	Females (n=12)	Total (n=23)	Males (n=11)	Females (n=12)
Age (years)	18.5(1.9)	18.9(1.7)	18.0(2.0)						
BMI (kg/m <sup>2</sup> )	24.2(4.35)	26.2(5.12)	22.0(1.65)						
RMR (kcal/d)	1057.5(309)	1224.4(336)	876.8(129)	1050.7(289)	1205.7(326)	895.7(115)	1061.7(296)	1276.6(272)	864.7(139)
Average Daily Substrate Use									
CO (%)	35.8(21.0)	33.2(18.0)	38.6(24.3)	37.5(21.0)	37.7(22.9)	37.3(20.1)	43.3(23.8)	42.4(22.5)	44.2(26.0)
LO (%)	64.2(20.1)	66.8(18.0)	61.4(24.3)	62.5(21.0)	62.3(22.9)	62.7(20.1)	56.7(23.8)	57.6(22.5)	44.2(26.0)
Average Daily Dietary Intake									
Total (kcal/d)	2006.4(697)	2291.1(867)	1745.5(373)	2009.3(697)	2328.3(732)	1719.3(542)	1743.3(572)	2029.6(680)	1561.1(428)
CI (%)	44.8(4.9)	43.7(4.1)	45.7(5.5)	47.8(7.6)	44.0(7.6)	50.8(6.4)	46.1(7.6)	44.0(7.3)	47.3(7.8)
PI (%)	17.7(4.1)	17.8(4.4)	17.6(4.1)	17.3(4.0)	17.4(3.6)	17.2(4.5)	17.4(3.1)	17.7(3.4)	17.2(3.1)
LI (%)	37.5(4.3)	38.5(3.5)	36.7(4.8)	35.0(6.3)	38.6(5.5)	32.0(5.4)	36.5(7.5)	38.4(8.3)	35.5(7.3)

\*Presented as Mean(SD)

#### 1409 Board #171 May 30 10:30 AM - 12:00 PM Effects of Time Restricted Feeding on Peak VO<sub>2</sub> and Substrate Utilization in Healthy Adults

Corbyn R. Bendtsen, Megan M. Coyle, Megan M. Lind, Nicole L. Schweitzer, Eric A. Norman, Lauren M. Kaminski, Cassandra A. Fileccia, Marquel A. Fleischacker, Andrew L. Kezar, Emma P. Masiulewicz, Justin R. Geijer. *Winona State University, Winona, MN.*

(No relevant relationships reported)

Time Restricted Feeding (TRF) is a type of Intermittent Fasting, which refers to the finite time to intake calories during the day. TRF has become a dietary approach that is used for weight loss and overall health. Individuals that partake in TRF may experience a decrease in peak volume of oxygen uptake (VO<sub>2peak</sub>) due to minimization of glycolytic stores. To date, few studies have compared the impact of TRF on VO<sub>2peak</sub>. **PURPOSE:** The current study aimed to further investigate the metabolic impact of TRF. **METHODS:** Twenty one participants, ages 18-60, completed an eleven week longitudinal study to examine differences in VO<sub>2peak</sub>, substrate utilization crossover, and resting substrate utilization. Participants self-reported diet, exercise, sleep, and medications over two separate four week periods. The first four weeks were without TRF and the following four were with TRF. A maximal exercise test and a resting metabolic test were performed three times, four weeks apart from each other. A repeated measures ANOVA was performed to determine within subject differences. A post-hoc analysis was performed to determine the time effect. **RESULTS:** VO<sub>2peak</sub> was significantly lower after implementing TRF ( $p < 0.001$ ). The mean pre-test VO<sub>2peak</sub> was  $2.95 \pm 0.59$  L/min and the non-TRF testing was  $3.14 \pm 0.68$  L/min. During TRF, the mean was  $2.76 \pm 0.54$  L/min. There was a significant difference between the pre-test and TRF ( $p = 0.012$ ). Also, there was a significant difference between non-TRF and TRF ( $p = 0.002$ ). Resting RQ showed a significant increase ( $p < 0.004$ ). The pre-test mean for resting RQ was  $0.716 \pm 0.071$ . Non-TRF resting RQ had a mean of  $0.736 \pm 0.082$  and the TRF resting RQ was  $0.802 \pm 0.097$ . There was a significant difference between the pre-test and TRF ( $p = 0.010$ ). Substrate utilization crossover showed a significant decrease ( $p < 0.03$ ) in fat usage after TRF implementation. There was a significant difference between the pre-test ( $123.9 \pm 30.1$  watts) and TRF ( $98.8 \pm 30.1$  watts;  $p = 0.05$ ). **CONCLUSION:** An earlier crossover of substrate utilization implies a decrease in fat usage and an increase in carbohydrate usage, therefore significantly lowering fat oxidation and VO<sub>2peak</sub>. Future studies are needed to examine the physiological mechanisms that may lead to shifts in substrate utilization during TRF.

#### 1410 Board #172 May 30 10:30 AM - 12:00 PM The Impact of Energy Balance on Sleep Time and Recovery

Andrew Jagim, Hannah Zabriskie, Brad Currier, Patrick Harty, Richard Stecker, Chad M. Kerkick, FACSM. *Lindenwood University, St. Charles, MO.* (Sponsor: Chad Kerkick, FACSM)  
Email: andrew.jagim@gmail.com

(No relevant relationships reported)

In female athletes, prolonged energy deficits have been demonstrated to negatively influence performance, recovery, and impair sleep. **PURPOSE:** The purpose of this study was to evaluate the relationship between energy status, sleep quality, recovery and training satisfaction in Division II female lacrosse players. **METHODS:** Twenty-two female lacrosse players ( $20.4 \pm 1.79$  years,  $69.1 \pm 8.7$  kg,  $168 \pm 6.3$  cm,  $28.1 \pm 2.99\%$  fat) wore a physical activity monitor to assess total daily energy expenditure (TDEE) and recorded dietary intake using MyFitnessPal over a four-day period during NCAA season play. Energy balance over the four-day period was then calculated based on the sum of total energy in - TDEE. Upon returning the physical activity

monitor, players also completed a questionnaire that assessed total sleep, sleep quality, ratings of recovery, soreness and satisfaction with training using visual analog scales. **RESULTS:** Players presented with an average energy deficit of  $-1,186.85$  kcal/d (SD =  $813.09$ ) and an average of  $6.77$  (SD =  $1.02$ ) hrs. of sleep per night. Those in a state of higher energy balance reported more hours of sleep ( $r = 0.641$ ,  $p = 0.001$ ), felt more rested ( $r = 0.535$ ,  $p = 0.01$ ) and were more satisfied with training ( $r = 0.484$ ,  $p = 0.023$ ). **CONCLUSION:** Our results imply that an improved energy state helps to facilitate an increase in total hours slept. An improved energy state also appears to result in athletes feeling more rested and satisfied with training during the competitive season. Female lacrosse players demonstrated that a more favorable state of energy balance appears to be associated with more total hours of sleep, feeling better rested and being more satisfied with training. Therefore maintaining a positive energy balance should be a primary focus for coaches and athletes to help promote optimal training, performance, and recovery.

#### 1411 Board #173 May 30 10:30 AM - 12:00 PM "Train-high Sleep-low" Dietary Periodization Does Not Alter Ventilatory Strategies During Cycling Exercise

Hunter L. Paris<sup>1</sup>, Timothy J. Fulton<sup>2</sup>, Daniel P. Wilhite<sup>3</sup>, Marissa N. Baranaukas<sup>2</sup>, Robert F. Chapman, FACSM<sup>2</sup>, Timothy D. Mickleborough<sup>2</sup>. <sup>1</sup>Pepperdine University, Malibu, CA. <sup>2</sup>Indiana University, Bloomington, IN. <sup>3</sup>Southwestern Medical Center, Dallas, TX.

(No relevant relationships reported)

"Train-high sleep-low" (THSL) dietary periodization elicits favorable adaptations within skeletal muscle, and improves endurance exercise performance. The effect of THSL on ventilatory patterns during exercise, however, has received little attention. If THSL alters ventilatory strategies during exercise, then exercise intensities and adaptations may unknowingly be influenced. **PURPOSE:** To investigate the effects of short-term exposure to THSL dietary periodization on ventilatory strategies during cycling exercise at submaximal and maximal intensities. **METHODS:** Eight trained men [age (mean  $\pm$  SEM) =  $28 \pm 1$  y;  $\dot{V}O_{2peak}$  =  $56.8 \pm 2.4$  ml·kg<sup>-1</sup>·min<sup>-1</sup>] completed a glycogen-depleting protocol on a cycle ergometer. Afterwards, participants were given a low carbohydrate (CHO) meal and beverages containing either no additional CHO (THSL) or beverages containing 1.2 g·kg<sup>-1</sup> CHO [traditional CHO replacement (TRAD)]. The following morning, participants completed 4 min of cycling below (Stage 1), at (Stage 2), and above (Stage 3) gas exchange threshold, followed by a 5 km time-trial. Metabolic data were collected continuously throughout exercise. Inspiratory capacity maneuvers were performed in the last minute of each stage as well as during the time-trial, for calculation of expiratory reserve volume (ERV) and inspiratory reserve volume (IRV). **RESULTS:** Respiratory exchange ratio (RER) was significantly lower ( $P < 0.01$ ) in THSL compared to TRAD at every exercise stage. During Stage 1,  $\dot{V}O_2$  was  $37.9 \pm 1.5$  mL·kg<sup>-1</sup>·min<sup>-1</sup> in the TRAD condition and  $39.6 \pm 1.8$  mL·kg<sup>-1</sup>·min<sup>-1</sup> in THSL ( $P = 0.05$ ). During Stage 2,  $\dot{V}O_2$  was  $44.6 \pm 1.7$  mL·kg<sup>-1</sup>·min<sup>-1</sup> in the TRAD condition and  $47.0 \pm 1.9$  mL·kg<sup>-1</sup>·min<sup>-1</sup> in THSL ( $P = 0.07$ ). No differences in  $\dot{V}_E$ ,  $V_T$ , or  $\dot{V}CO_2$  occurred between conditions at any exercise intensity ( $P > 0.05$ ). No change in ERV or IRV was detected between dietary conditions at any exercise intensity ( $P > 0.05$ ). 5 km time-trial performance was significantly faster in TRAD compared to THSL ( $8.7 \pm 0.3$  min and  $9.0 \pm 0.3$  min, respectively;  $P = 0.02$ ). **CONCLUSIONS:** THSL dietary periodization does not alter  $\dot{V}E$ ,  $\dot{V}CO_2$ ,  $V_T$ , ERV, or IRV when cycling at submaximal or maximal intensities. THSL impairs performance immediately following the dietary intervention, and may influence  $\dot{V}O_2$  at submaximal intensities.

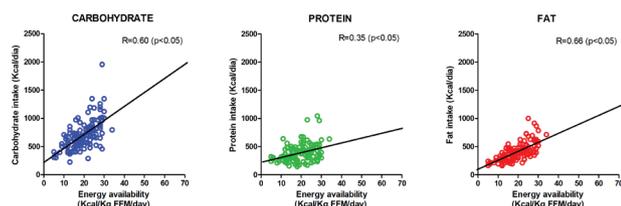
#### 1412 Board #174 May 30 10:30 AM - 12:00 PM Low Carbohydrate Intake Is Related To Energy Deficiency And Hypometabolism In Physically Active Population

Amanda Santos, Gisele Vaz, Cintia Oliveira, Daniel Lima. *Itaúna University, Itaúna, Brazil.*  
Email: dcarvalholima@gmail.com

(No relevant relationships reported)

**PURPOSE:** The aim of this study was to analyse metabolic factors associated to energy availability deficiency (EAD) in physically active people. **METHODS:** We evaluated 147 physically active people. The free fat mass (FFM), caloric intake (CI) and energy expenditure (EE) were analysed by Petroski (1995) protocol, 3-day self-reported food journal and metabolic equivalent calculation, respectively. Energy deficiency was assumed at  $\leq 30$  Kcal/Kg FFM/day by the EA equation: (CI - EE) x FFM (kg)<sup>-1</sup>. The hypometabolism was diagnosed when the ratio between resting metabolic rate (measured by indirect calorimetry) and Cunningham equation values was  $< 0.90$ . The associations were analysed by Pearson correlation, Chi-squared, Odds Ratio (IC 95%) and Fisher's tests, considering  $p < 0.05$ . **RESULTS:** We observed 80% of EAD. The hypometabolism was presented in 37% of ED people. Also, they had carbohydrate ( $2.8 \pm 1.1$  g/kg bw) and fat ( $0.76 \pm 0.3$  g/kg bw) consumption below the recommendations. As expected, the lower macronutrients caloric intake

were related to reduced energy availability in EAD sportspeople (carb.,  $r=0.60$ ; prot.,  $r=0.35$  e; fat,  $r=0.66$ ;  $p<0.05$ ). Interestingly, the magnitude of its reductions was greater in carbohydrate, analysed by slope curves (carb.,  $25 \pm 3$ ; prot.,  $9 \pm 2$ ; fat,  $16 \pm 2$ ;  $p<0.001$ ). In addition, only carbohydrate intake was independently associated to hypometabolism in EAD population (OR, 2.91; IC 95%, 1.08 - 7.82;  $p<0.05$ ). **CONCLUSION:** Low carbohydrate intake is the major diet contributors to energy deficiency and hypometabolism development in physically active people. It may impair the weight loss protocols.   
 \$\$\$MISSING OR BAD IMAGE SPECIFICATION {8E21C474-B12A-4E03-8A39-281DBF375AF8}\$\$



Diet factors associated to hypometabolism in physically active population			
	Odds ratio	95% IC	p values
Carbohydrate (g/kg bw)	2.912	1.085 to 7.815	0.031
Protein (g/kg bw)	0.6019	0.2767 to 1.309	0.244
Fat (g/Kg bw)	0.6706	0.1918 to 2.345	0.529

**1413 Board #175 May 30 10:30 AM - 12:00 PM**  
**Acute Carbohydrate Restriction During Recovery From Prolonged Exercise Enhances Intramuscular Triglyceride Resynthesis**

Sam Shepherd<sup>1</sup>, Emily FP Jevons<sup>1</sup>, Juliette A. Strauss<sup>1</sup>, Kasper D. Gejl<sup>2</sup>, Kurt Jensen<sup>2</sup>, Lars G. Hvid<sup>2</sup>, Ulrik Frandsen<sup>2</sup>, Kent Sahlin<sup>3</sup>, Niels Ørtenblad<sup>2</sup>. <sup>1</sup>Liverpool John Moores University, Liverpool, United Kingdom. <sup>2</sup>University of Southern Denmark, Odense, Denmark. <sup>3</sup>Stockholm University, Stockholm, Sweden. Email: s.shepherd@ljmu.ac.uk  
 (No relevant relationships reported)

Intramuscular triglyceride (IMTG) is an important substrate during moderate-intensity exercise, but providing a high carbohydrate (CHO) diet following exercise impairs IMTG resynthesis. Restricting CHO intake in the post-exercise period may augment the adaptive response to exercise, but whether this strategy enhances IMTG resynthesis is not known. Furthermore, because the lipid droplet (LD)-associated perilipin (PLIN) proteins promote IMTG storage, their distribution and interaction with LD may determine their role in post-exercise IMTG resynthesis. **Purpose:** To determine the effect of acutely restricting CHO during recovery from prolonged exercise on IMTG resynthesis and PLIN protein dynamics. **Methods:** 14 male triathletes ( $27 \pm 1$  y,  $66.5 \pm 1.3$  ml.kg<sup>-1</sup>.min<sup>-1</sup>) completed 4 h of cycling at  $\sim 56\%$   $VO_{2max}$ . In the initial 4 h period following exercise 7 participants consumed a high CHO diet whereas 7 participants consumed only water. For the remaining recovery period (20 h) all participants received the same CHO-rich diet. Muscle samples collected pre and post-exercise, and 4 and 24 h post-exercise were analysed using confocal immunofluorescence microscopy to determine muscle fibre type-specific IMTG content and PLIN localisation to LDs. **Results:** Exercise reduced IMTG content in type I fibres ( $-53\%$ ,  $P<0.05$ ), with LD both associated and not associated with PLIN2, PLIN3, and PLIN5 being used. During recovery, IMTG content tended to increase in type I fibres after 4 h in the water condition only ( $+63\%$ ,  $P=0.076$ ), and at 24 h IMTG content was similar to pre-exercise levels ( $P=0.987$ ). Despite no change in PLIN protein content, the number of LD with PLIN2 or PLIN3 associated tended to increase during recovery in type I fibres only ( $P=0.08$ ), and to a similar extent between conditions, whereas the number of LD with PLIN5 associated only increased in the CHO condition ( $P=0.002$ ). **Conclusion:** Acute restriction of CHO during recovery from prolonged exercise has a tendency to initially enhance IMTG resynthesis, although a CHO-rich diet does not impair overall IMTG resynthesis 24 h later. A redistribution of PLIN proteins appears to support post-exercise IMTG resynthesis, but the predominant PLIN isoform supporting post-exercise IMTG storage may be dependent on post-exercise CHO availability.

**1414 Board #176 May 30 10:30 AM - 12:00 PM**  
**Energy Availability In Physically Active Males And Females Across A 12- Week Tactical Training Programme**

Danielle M. Logue<sup>1</sup>, Sharon M. Madigan<sup>2</sup>, Sarah-Jane McDonnell<sup>2</sup>, Mirjam Heinen<sup>3</sup>, Eamonn Delahunty<sup>3</sup>, Clare A. Corish<sup>3</sup>. <sup>1</sup>University College Dublin & Sport Ireland Institute, Dublin, Ireland. <sup>2</sup>Sport Ireland Institute, Dublin, Ireland. <sup>3</sup>University College Dublin, Dublin, Ireland. Email: danielle.logue@ucdconnect.ie  
 (No relevant relationships reported)

**ACSM SCIENTIFIC ABSTRACT**  
**INTRODUCTION:** Tactical training personnel are exposed to frequent intense physical activity and sleep deprivation, the combination of which may compromise health. Insufficient energy availability (EA) can exacerbate these issues. **PURPOSE:** The aims of this study were to investigate in tactical training personnel, i) energy intake (EI), exercise energy expenditure (EEE) and EA, ii) reported injury and illness incidence and iii) dietary intake vs. estimated nutritional recommendations. **METHODS:** On four consecutive days during two weeks of tactical training, nine weeks apart, participants recorded all food eaten in a smartphone application (Nutritics Education v4.315, 2011). Injury and illness incidence were recorded weekly using the Oslo Sports Trauma Research Centre Questionnaire on health problems and the females completed the Low Energy Availability in Females Questionnaire (LEAF-Q) to assess risk of low energy availability (LEA). **RESULTS:** Mean daily EI was 2523 ( $\pm 469$ ) kcal for males and 2182 ( $\pm 380$ ) kcal for females. EEE increased significantly from W1 (Mean = 656 kcal,  $\pm 76$ ) to W2 (Mean = 842 kcal,  $\pm 93$ )  $P<0.001$ . Insufficient carbohydrate (3.3g/kg BW/day vs. recommended 6g/kg BW/day,  $P<0.001$ ) and excess fat consumption was observed (37% dietary energy (DE) vs. the recommended 20-35% DE). There were 274 reported health problems; 160 injuries and 114 illnesses. Of females, 59% were classified as at risk of LEA. **CONCLUSIONS:** These findings demonstrate the need to improve awareness of EA during training for health and performance. Implementation of adequate fueling strategies is necessary for tactical training personnel to optimise health and performance.

**1415 Board #177 May 30 10:30 AM - 12:00 PM**  
**The Effects of Endurance Training Under Low Energy Availability on Muscle Glycogen Contents**

Chihiro Kojima<sup>1</sup>, Aya Ishibashi<sup>2</sup>, Yoko Tanabe<sup>2</sup>, Kaito Iwayama<sup>3</sup>, Akiko Kamei<sup>2</sup>, Hideyuki Takahashi<sup>2</sup>, Kazushige Goto<sup>1</sup>. <sup>1</sup>Ritsumeikan University, Shiga, Japan. <sup>2</sup>Japan Institute of Sports Sciences, Tokyo, Japan. <sup>3</sup>Tenri University, Nara, Japan. (Sponsor: Robert Kraemer, FACS M) Email: chii.2727@gmail.com  
 (No relevant relationships reported)

**PURPOSE:** Some previous studies demonstrated that acute bout of exercise suppressed appetite and reduced energy intake among athletes. However, the accumulative effects of reduced energy intake during consecutive days of training period remains unclear. The purpose of the present study was to investigate the influences of 3 days of endurance training under low energy availability on muscle glycogen content, endocrine responses and endurance capacity. **METHODS:** Seven male long distance runners ( $19.9 \pm 0.4$  years,  $175.6 \pm 1.8$  cm,  $61.4 \pm 2.0$  kg,  $67.5 \pm 1.6$  ml/kg/min) completed 3 consecutive days of endurance training under low energy availability trial (LEA,  $18.9 \pm 0.7$  kcal/kg FFM/day) and normal energy availability trial (NEA,  $52.9 \pm 1.9$  kcal/kg FFM/day). The order of two trials was randomized with two weeks interval between trials. The experiment consisted of 3 consecutive days of endurance training (days 1-3) and exercise performance test on the following morning (day 4). The endurance training consisted of 75 min of treadmill running at 70% of maximal oxygen uptake ( $VO_{2max}$ ) in both trials. Muscle glycogen contents, respiratory gas variables, subjective parameters, blood and urinal variables were evaluated in the morning during 3 days of training periods (day 1-day 3) and on the following morning after the training (day 4). As an indication of endurance capacity, time to exhaustion during submaximal running test was determined on day 4. **RESULTS:** LEA trial showed that body weight, free fat mass and skeletal muscle volume were significantly reduced during training period ( $P<0.05$ ). Also, muscle glycogen contents were significantly decreased in LEA ( $P<0.001$ ) with significant lower values than those in NEA trial ( $P<0.001$ ). Blood glucose, serum free testosterone and insulin like growth factor-1 concentrations were significantly lowered with training under LEA ( $P<0.05$ ). On the other hand, serum leptin concentration did not change significantly in LEA trial during training period ( $P>0.05$ ). Time to exhaustion during submaximal running test evaluated on day 4 was not significantly different between LEA trial ( $1170 \pm 127$  s) and NEA trial ( $1361 \pm 196$  s,  $P>0.05$ ). **CONCLUSION:** Three consecutive days of endurance training under Low EA reduced muscle glycogen content. However, endurance capacity was not attenuated.

1416 Board #178 May 30 10:30 AM - 12:00 PM  
**Acute Effects of Exercise With and Without Energy Replacement on Energy Expenditure and Substrate Utilization**

Jie Kang, FACSM, Saif B. Hassan, Nicole L. Ellis, Ira T. Vought, Nicholas A. Ratamess, Jill A. Bush, FACSM, Avery D. Faigenbaum, FACSM. *The College of New Jersey, Ewing, NJ.*  
 Email: kang\_08055@yahoo.com  
 (No relevant relationships reported)

It has been well documented that exercise of sufficient energy expenditure can elicit an increase in fat oxidation that persists following exercise. However, whether and how this exercise-induced metabolic benefit would be affected by replacing the energy expended during exercise remains unclear. **Purpose:** To compare energy expenditure and substrate utilization between exercise with and without energy replacement at rest and during exercise. **Methods:** Fourteen healthy and recreationally trained subjects including 7 men and 7 women volunteered to participate in this study. Each subject underwent three 2-day experimental protocols in a random order. Each protocol consisted of no exercise (NE), exercise only (EO), or exercise with energy replacement (ER) on day 1 that was followed by metabolic assessment that took place in a fasted condition on day 2. The exercise in EO and ER was a treadmill running at 60%  $\dot{V}O_{2max}$  that induced an energy expenditure of 500 kilocalories. The replacement meal used in ER contained 500 kilocalories made up by 45% carbohydrate, 30% fat, and 25% protein. During the metabolic assessment, oxygen uptake ( $\dot{V}O_2$ ), heart rate (HR), respiratory exchange ratio (RER), and rates of carbohydrate (COX) and fat oxidation (FOX) were determined in three successive 10-min periods that included rest, exercise at 50%  $\dot{V}O_{2max}$  and exercise at 70%  $\dot{V}O_{2max}$ . **Results:** No differences in  $\dot{V}O_2$  and HR were found at rest between NE, EO, and ER. However, RER was lower in EO than NE ( $0.840 \pm 0.014$  vs.  $0.889 \pm 0.012$ ,  $p < 0.05$ ), COX ( $\text{g} \cdot \text{min}^{-1}$ ) was lower in ER than NE ( $0.144 \pm 0.016$  vs.  $0.197 \pm 0.019$ ,  $p < 0.05$ ), and FOX ( $\text{g} \cdot \text{min}^{-1}$ ) was higher in either EO or ER than NE ( $0.054 \pm 0.010$  or  $0.057 \pm 0.009$  vs.  $0.034 \pm 0.007$ ,  $p < 0.05$ ). When these variables were compared under the exercise conditions, no treatment effects were noted for all variables at either intensity. **Conclusion:** Our results demonstrate that an acute bout of aerobic exercise can elicit an increase in fat oxidation even when the exercise-induced energy deficit is replaced by energy intake. These findings suggest that factors other than caloric deficit mediate the exercise-induced lipolytic effect.

1417 Board #179 May 30 10:30 AM - 12:00 PM  
**Comparing Liver And Skeletal Muscle Sensitivity In Response To Acute And Chronic Calorie Restriction**

Erik Kirk, FACSM<sup>1</sup>, Dominic Reeds<sup>2</sup>, Sam Klein<sup>2</sup>. <sup>1</sup>*Southern Illinois University Edwardsville, Edwardsville, IL.* <sup>2</sup>*Washington University School of Medicine, Saint Louis, MO.*  
 Email: ekirk@siue.edu  
 (No relevant relationships reported)

**PURPOSE:** We determined the effects of acute and chronic calorie restriction on hepatic and skeletal muscle insulin sensitivity. **METHODS:** Twenty-three obese subjects (body-mass index,  $36.3 \pm 0.7 \text{ kg/m}^2$ ) followed an energy-deficit diet (1,200kcal/day). Magnetic resonance spectroscopy, muscle biopsies, and a euglycemic-hyperinsulinemic clamp were used to determine insulin action, cellular insulin signaling and intrahepatic triglyceride content before, after 48-h, and after ~12 wks (7% weight loss) of diet therapy. **RESULTS:** Intrahepatic triglyceride content significantly decreased at both 48-h ( $-16.6 \pm 2.3\%$ ,  $p < 0.001$ ) and 7% weight loss ( $-40.7 \pm 6.2\%$ ;  $p < 0.001$ ) compared to baseline. Basal glucose production rate significantly decreased at 48-h ( $-21.8 \pm 3.2\%$ ,  $p < 0.001$ ) and after 7% weight loss ( $-20.8 \pm 3.4\%$ ,  $p < 0.001$ ). Insulin-mediated glucose uptake did not significantly change at 48-h ( $-5.2 \pm 12.8\%$ ,  $p > 0.05$ ) but did significantly increase at 7% weight loss ( $26.1 \pm 4.3\%$ ,  $p < 0.05$ ). Insulin-stimulated phosphorylation of Jun N-terminal kinase did not change at 48-h ( $-0.2 \pm 16.2\%$ ,  $p > 0.05$ ) but did significantly decrease at 7% weight loss ( $-29.9 \pm 12.6$ ,  $p < 0.05$ ) and phosphorylation of Akt increased by  $15.2 \pm 14.6\%$  ( $p > 0.05$ ) and  $36.2 \pm 8.8\%$  ( $p < 0.05$ ), after 48-h and 7% weight loss, respectively. **CONCLUSION:** A low calorie diet acutely reduced intrahepatic triglyceride content and improved hepatic insulin sensitivity whereas moderate weight loss is necessary to improve insulin sensitivity in the skeletal muscle.

1418 Board #180 May 30 10:30 AM - 12:00 PM  
**Neither Autophagy Inhibition Nor High Intensity Interval Training Alter Exercise Adaptations During High Fat Feeding**

Megan E. Rosa-Caldwell, Lisa T. Jansen, Seongkyun Lim, Kirsten R. Dunlap, Wesley A. Haynie, Katarina A. Bejarano, Tyrone A. Washington, Nicholas P. Greene. *University of Arkansas, Fayetteville, AR.* (Sponsor: Dr. Matthew Gano, FACSM)  
 Email: mrosa@uark.edu  
 (No relevant relationships reported)

Obesity and associated comorbidities remain a significant health crisis. Exercise mitigates many of these pathologies, however, controversy remains on optimal exercise types for favorable adaptations. More so, mechanisms underlying these adaptations are not fully understood. Evidence suggests autophagy (cellular degradation and recycling of proteins) may be an important mediator for adaptations, however, the necessity of autophagy, specifically autophagosome formation, on exercise adaptations during obesity has yet to be investigated. **PURPOSE:** To investigate the individual and combined effects of different exercise interventions and autophagy inhibition on glucose handling and exercise capacity after high fat feeding. **METHODS:** C57BL/6J male mice initiated 45% high fat diet at 8 wks of age. After 6 wks of high fat diet, animals were divided into moderate intensity (MOD) or high intensity interval training interventions (HIIT), animals were further subdivided into autophagy inhibition (AI) or control (CON) conditions. Animals exercised their respective protocols 3X/wk; work and average intensity were matched between exercise groups. Autophagy was inhibited by 3X/wk injections of NSC185058 at 100mg/kg of bodyweight, to block autophagosome formation, CON animals received vehicle injections. Animals continued interventions for 4 wks. Glucose tolerance tests (GTTs) and graded exercise tests (GXTs) were completed pre-high fat diet, pre-interventions, and post-interventions. **RESULTS:** High fat diet resulted in impaired glucose handling (~20% increase in glucose area under the curve (AUC)), while exercise interventions normalized glucose handling to pre-exercise levels, without any differences between groups. Additionally, high fat diet induced a ~20% lower aerobic capacity, which were normalized to baseline values after exercise interventions. All animals had ~2.5g of weight loss from pre- to post- exercise interventions with no differences noted in CON animals. **CONCLUSIONS:** When exercise intensities and total work are matched, HIIT and MOD confer similar adaptations on exercise capacity and glucose tolerance in high fat fed mice. Also, late stage autophagy inhibition does not influence exercise adaptations, but does appear to influence body weight, which warrants further investigation.

1419 Board #181 May 30 10:30 AM - 12:00 PM  
**Effects of Time Restricted Feeding on Resting Energy Expenditure and Respiratory Quotient**

Lauren M. Kaminski<sup>1</sup>, Cassandra A. Fileccia<sup>2</sup>, Corbyn R. Bendtsen<sup>2</sup>, Megan M. Coyle<sup>2</sup>, Marquel A. Fleischacher<sup>2</sup>, Megan M. Lind<sup>2</sup>, Emma P. Masiulewicz<sup>2</sup>, Nicole L. Schweitzer<sup>2</sup>, Eric A. Norman<sup>2</sup>, Andrew L. Kezar<sup>2</sup>, Justin R. Geijer<sup>2</sup>. <sup>1</sup>*Winona State, Buffalo, MN.* <sup>2</sup>*Winona State, Winona, MN.*  
 (No relevant relationships reported)

Time restricted feeding (TRF) is a form of dietary intake which limits the feeding time in a day. Researchers have observed weight loss and improved body composition as the original motivators for investigation of TRF. With a variation in energy intake during TRF, resting energy expenditure (REE) has been shown to increase with high caloric consumption. An increase in REE is also associated with an increase in fat free mass and physical activity. Respiratory quotient (RQ) demonstrates the ratio between  $\text{CO}_2$  production and  $\text{O}_2$  uptake, determining substrate utilization at rest. RQ has been shown to change through altered macronutrient intake. Studies indicate, a diet high in carbohydrate intake increases RQ whereas diets high in fat intake have been shown to lower RQ. RQ has also been found to decrease when subjects partake in endurance training. **Purpose:** The intent of this study was to determine the impact TRF may have on REE and RQ. **Methods:** Thirty-four apparently healthy adults ages 19-51 participated in 4 weeks non-TRF and 4 weeks of TRF. The feeding window for the TRF was a nine-hour period. Participants were provided journals over the course of the study to self-record caloric intake, exercise type, and duration. REE and RQ were measured using a metabolic cart initially, after 4 weeks of non-TRF, and 4 weeks after TRF. Data was analyzed using IBM SPSS statistics. **Results:** RQ increased significantly between pretest ( $0.721 \pm 0.015$ ) and TRF testing ( $0.808 \pm 0.02$ ) ( $p = 0.01$ ). No significance was found between non-TRF and TRF. REE had no significant difference between any of the three testing periods ( $p = 0.233$ ). There was no significant change in caloric intake throughout the testing ( $p = 0.94$ ). A significant decrease was found in total exercise days between non-TRF and TRF periods ( $p = 0.023$ ). **Conclusion:** This study did not find a significant change in REE during TRF. The increase in RQ may be attributed to increases in carbohydrate intake. Caloric intake was hypothesized to increase the first couple of days due to the time-restricted nature, but overall was not

hypothesized to have a significant impact on energy intake or REE. Future studies should investigate the impact of TRF on macronutrient intake and carbohydrate utilization at rest.

**1420** Board #182 May 30 10:30 AM - 12:00 PM  
**Resistance Exercise-mediated Improvements In Post-prandial Metabolic Responses Are Related To Exercise Volume And Muscle Mass**

Patrick M. Tomko, Ryan J. Colquhoun, Nile F. Banks, Christina M. Sciarrillo, Nicholas A. Koemel, Sam R. Emerson, Nathaniel D.M Jenkins. *Oklahoma State University, Stillwater, OK.*  
 (No relevant relationships reported)

**PURPOSE:** To examine the effects of full-body resistance exercise on the post-prandial metabolic response to a high-fat meal (HFM) in healthy men. **METHODS:** Ten males (mean  $\pm$  SD, age =  $24 \pm 3$  y, BMI =  $26.8 \pm 2.9$  kg/m<sup>2</sup>) participated in this randomized, repeated measures, crossover study. Participants visited the laboratory for familiarization, and baseline strength and body composition testing. They then returned to the laboratory and completed either a session of resistance exercise (RE), consisting of three sets of 8 exercises using a 12 repetition maximum load, or no exercise (NE) and consumed a protein shake (300 - 400 kcal; protein = 0.3/kg) as their last meal. After a 12-h overnight fast, participants consumed a HFM (12 kcal/kg, 63% fat, 34% carbohydrate). Blood draws were performed prior to, and 1-, 3-, and 5-h post-meal to determine triglyceride (TG), glucose (GLU), and total metabolic load index (MLI; sum of TG and GLU) responses. Three separate, 2 (Condition)  $\times$  2 (Time) repeated measures ANOVAs were used to examine the TG, GLU, and MLI responses. Zero-order correlations and stepwise multiple regression analyses were used to examine the relationships and relative contributions of RE volume (VOL) and skeletal muscle mass (SMM) to the change in MLI from NE to RE ( $\Delta$ MLI). **RESULTS:** There were significant condition  $\times$  time interactions for TG ( $F_{3,27} = 3.5$ ;  $p = 0.03$ ) and MLI ( $F_{3,27} = 3.0$ ;  $p < 0.05$ ). Both TG and MLI were lower at 3- (TG,  $152.6 \pm 74.8$  vs.  $182.4 \pm 103.9$  mg/dL; MLI,  $224.2 \pm 72.9$  vs.  $257.4 \pm 106.8$  au) and 5-h (TG,  $132.2 \pm 85.3$  vs.  $175.6 \pm 118.0$  mg/dL; MLI =  $210.5 \pm 86.3$  vs.  $260.2 \pm 119.0$  au) post HFM in the RE versus NE condition, respectively. There were condition ( $F_{1,9} = 8.9$ ;  $p = 0.02$ ) and time main effects ( $F_{3,27} = 8.4$ ;  $p < 0.01$ ) for GLU. GLU was lower in the RE ( $76.4 \pm 7.1$  mg/dL) than NE ( $82.4 \pm 6.8$  mg/dL) condition and decreased from baseline ( $88 \pm 3.6$  mg/dL) to 1- ( $74.6 \pm 6.4$  mg/dL), 3- ( $73.3 \pm 2.4$  mg/dL), and 5-h ( $81.5 \pm 4.5$  mg/dL). Both VOL ( $r = 0.66$ ) and SMM ( $r = 0.80$ ) were independently related to, and significantly contributed to the prediction ( $R^2 = 0.76$ ; beta coefficients = VOL [-1.03] and SMM [1.79]) of  $\Delta$ MLI. **CONCLUSIONS:** A session of full-body resistance exercise improves the postprandial metabolic response to a HFM in healthy men. Further, VOL and SMM explained 76% of the variance in the metabolic response improvement caused by resistance exercise.

**1421** Board #183 May 30 10:30 AM - 12:00 PM  
**Energy Expenditure and Load Carriage Exceeded Military Recommendations in Special Operations Forces Deployed to Afghanistan**

William R. Conkright<sup>1</sup>, Nicholas D. Barringer<sup>2</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>U.S. Army Research Institute of Environmental Medicine, Natick, MA.  
 Email: wrc16@pitt.edu  
 (No relevant relationships reported)

U.S. Army Special Operations Forces (SOF) undergo difficult missions in extreme environments, oftentimes while carrying heavy loads, the combination of which results in a high energy output. Energy expenditure in excess of intake may result in weight loss and impaired performance. In a scenario where energy demands consistently exceed intake, Soldiers are at increased risk of injury and mission compromise. **PURPOSE:** To determine the energy expenditure of SOF Soldiers based on present-day missions in the Central Command (CENTCOM) region. **METHODS:** Demographics of the participants were as follows: age (yrs)  $30.3 \pm 3.5$ , height (in)  $70.65 \pm 2.8$ , weight (lbs)  $195.2 \pm 24$ , enlisted (86%), officer (7%), warrant officer (7%), years in the Army  $8.3 \pm 3.9$ , and total time deployed during career (yrs)  $1.26 \pm 1.2$ . Surveys were collected from 46 SOF Soldiers operating in eight locations in the CENTCOM theater of operations. Information from the surveys revealed the mission energy requirements and difficulty of exertion pre-, during-, and post-mission. A physical activity factor was determined based on multiple aspects surrounding mission intensity and used to calculate estimated energy expenditure based on a SOF-specific equation. **RESULTS:** During a six-month deployment, participants underwent a multitude of missions ( $17.25 \pm 8.66$ ). Ninety percent of respondents reported carrying a load 40% heavier than the recommended fighting load ( $32.9 \pm 8.62$  vs.  $21.8$  kg, respectively) based on military doctrine. Average estimated energy expenditure ( $4848 \pm 525$  kcal-day<sup>-1</sup>) far exceeded the military dietary reference intake of 3400 kcal-day<sup>-1</sup>. All but three respondents reported a rate of energy expenditure exceeding the benchmark of 300 kcal-day<sup>-1</sup> necessary to maintain adequate energy reserves upon enemy contact. **CONCLUSION:** Excessive load carriage is a major contributor to

high energy expenditure. The reported loads carried by SOF Soldiers exceeded the recommendations in Army doctrine. Additionally, their high energy expenditure, if not matched by an equally high energy intake, has been shown to result in performance decrements and may compromise mission success. Special attention must be given to pack weights during pre-mission planning and nutrition strategies aimed at meeting mission demands and recovery from strenuous activity.

**1422** Board #184 May 30 10:30 AM - 12:00 PM  
**Effects Of Menstrual Cycle On Energy Utilization And Endurance Performance In Eumenorrheic Women**

Tomoka Matsuda<sup>1</sup>, Mizuki Yamada<sup>2</sup>, Hazuki Ogata<sup>1</sup>, Kayoko Kamemoto<sup>1</sup>, Mikako Sakamaki-Sunaga<sup>2</sup>. <sup>1</sup>Graduate School, Nippon Sport Science University, Tokyo, Japan. <sup>2</sup>Nippon Sport Science University, Tokyo, Japan.  
 (No relevant relationships reported)

The blood concentrations of estrogen and progesterone change during various phases of the menstrual cycle. The levels of estrogen and progesterone are lower during the menstrual period (MP) and higher during the luteal phase (LP) in eumenorrheic women. Previous studies have indicated that the menstrual cycle influences energy utilization during endurance exercises. Alterations in energy utilization that may occur during the different phases of the menstrual cycle in eumenorrheic women may also influence endurance performance.

**PURPOSE:** The purpose of this study was to compare energy utilization and endurance performance between the MP and LP of the menstrual cycle during exercise.

**METHODS:** The subjects were fifteen women (age,  $22.1 \pm 1.0$  years) with regular menstrual cycle. Subjects exercised on a cycle ergometer at 60%  $\dot{V}O_{2peak}$  for 45 min, and then exercise intensity was increased to 80%  $\dot{V}O_{2peak}$  until exhaustion during the two phases of the menstrual cycle (MP and LP). Blood samples were collected at rest, 45 min during exercise, immediately after exercise, and 30 min after completion of exercise. Blood levels of estradiol, progesterone, glucose, and free fatty acid (FFA) were assessed. The duration of each menstrual cycle phase was estimated by assessing the levels of the estradiol and progesterone.

**RESULTS:** The menstrual cycle of the subjects was  $30.9 \pm 1.9$  days. MP was  $4.1 \pm 1.4$  days, and LP was  $24.8 \pm 2.2$  days. Blood concentrations of estradiol (MP, rest,  $35 \pm 14.6$  pg/mL; LP, rest,  $164 \pm 58.3$  pg/mL,  $p < 0.001$ ) and progesterone (MP, rest,  $0.3 \pm 0.2$  ng/mL; LP, rest,  $13.1 \pm 5.0$  ng/mL,  $p < 0.001$ ) were significantly higher in LP than in MP. No significant differences were observed in the levels of glucose ( $p = 0.36$ ), FFA ( $p = 0.80$ ), and respiratory exchange ratio ( $p = 0.34$ ) at all time points. Carbohydrate oxidation (MP,  $38.5 \pm 7.7$  g; LP,  $39.2 \pm 6.4$  g,  $p = 0.66$ ), fat oxidation (MP,  $11.6 \pm 2.9$  g; LP,  $11.2 \pm 3.4$  g,  $p = 0.64$ ), and exercise time to exhaustion were not different between MP and LP (MP,  $7.4 \pm 7.9$  min; LP,  $6.8 \pm 6.0$  min,  $p = 0.55$ ).

**CONCLUSION:** Our results reveal no effect of the menstrual cycle phase on substrate oxidation and prolonged endurance exercise performance during cycle ergometer exercise in eumenorrheic women.

**1423** Board #185 May 30 10:30 AM - 12:00 PM  
**A Short-term Calorie Restricted Diet with High-fat on Inflammatory Biomarkers and Plasma Lipids**

Yunsuk Koh. Baylor University, Waco, TX.  
 Email: yunsuk\_koh@baylor.edu  
 (No relevant relationships reported)

A high-fat (HF) diet may play a positive role in weight management and body composition, yet its role in inflammation and blood lipids is not clearly understood.

**PURPOSE:** To examine the effects of a short-term calorie restricted diet with HF or high-carbohydrate (HC) and an acute bout of exercise on plasma lipids and inflammatory biomarkers. **METHODS:** In a randomized, cross-over design, 9 physically inactive college-aged individuals were assigned to a calorie restricted diet (20% reduction of total calorie intake from their typical diet) with either HF or HC for 2 weeks. The HF diet consisted of 70% fat (mostly mono- and poly-unsaturated fatty acids) and 30% carbohydrate and protein, whereas the HC diet consisted of 70% carbohydrate and 30% fat and protein. There was a one-week wash-out period between the two diet interventions. At the end of each diet intervention, a single bout of aerobic exercise was performed at 70% heart rate reserve for 40 minutes. Overnight fasting blood samples were collected at pre- and 24-hours post-exercise at the end of each diet intervention (pre-intervention, HF, and HC) to analyze changes in the key biomarkers of inflammation and plasma lipids, including glucose and triglycerides.

**RESULTS:** Either HF or HC diet did not change any inflammatory biomarkers or plasma lipids. However, a single bout of exercise significantly decreased B-cell activating factor (BAFF,  $1619.37 \pm 446.57$  to  $1520.94 \pm 476.05$  pg/mL,  $p = 0.019$ ), matrix metalloproteinase-3 (MMP-3,  $1700.82 \pm 1090.16$  to  $1227.33 \pm 976.38$  pg/mL,  $p = 0.021$ ), thymic stromal lymphopoietin (TSLP,  $2.38 \pm 1.4$  to  $1.88 \pm 1.0$  pg/mL,  $p = 0.048$ ), and TNF-related weak inducer of apoptosis (TWEAK,  $26.26 \pm 10.36$  to  $22.53 \pm 3.0$  pg/mL,  $p = 0.048$ ). **CONCLUSION:** A short-term calorie restricted diet with either HF or HC may not significantly influence soluble inflammatory markers or plasma lipids. However, a single bout of aerobic exercise, independent of dietary modification, can

improve inflammatory responses in healthy, sedentary young adults. Future studies need to further examine the effects of a long-term diet intervention on the responses of inflammatory markers in a variety of subject populations, including obese and patients with metabolic diseases in order to better understand the role of high-fat diet in inflammation.

**1424** Board #186 May 30 10:30 AM - 12:00 PM  
**Impact of Time Restricted Feeding on Muscular Strength Within a Healthy Adult Population.**

Eric A. Norman, Nicole L. Schweitzer, Corbyn R. Bendtsen, Megan M. Coyle, Cassie A. Fileccia, Marquel A. Fleischacker, Lauren M. Kaminski, Andrew L. Kezar, Megan M. Lind, Emma P. Masiulewicz, Justin R. Geijer. *Winona State University, Winona, MN.*  
 (No relevant relationships reported)

Time restricted feeding (TRF) is a feeding habit that restricts the amount of time during the day in which individuals consume calories. TRF has been shown to produce several health benefits, one of which may be an increase in force production. Muscular strength and nutritional intake have been strongly researched prior to this study. Though little research exists investigating the impacts of TRF on muscular strength in human subjects. **PURPOSE:** The purpose of this study was to identify the potential impacts of TRF on muscular strength. **METHODS:** Participants participated in two, four-week periods during which caloric intake, sleep duration, sleep quality, exercise, and medications were all documented. The first period, participants partook in non-TRF eating behavior. The second period participants were exposed to a nine-hour window of TRF. To measure muscular strength, participants were tested using an isokinetic dynamometer. Resting metabolism was also measured. Statistical analyses quantifying within subject effects were performed with a repeated measures ANOVA. Post-hoc analyses were performed to elicit differences between testing periods. **RESULTS:** Both mean torque flexion at 60 degrees/second (MTF 60) ( $83.92 \text{ Nm} \pm 29.53 \text{ Nm}$  vs.  $95.63 \text{ Nm} \pm 28.95 \text{ Nm}$ ) and mean torque flexion at 180 degrees/second (MTF 180) ( $66.75 \text{ Nm} \pm 25.9 \text{ Nm}$  vs.  $69.01 \text{ Nm} \pm 21.29 \text{ Nm}$  vs.  $75.55 \text{ Nm} \pm 23.9 \text{ Nm}$ ;  $F = 7.920 \text{ Nm}$ ) had a significant increase from pre-test to TRF, as well as non-TRF to TRF. Post-hoc testing revealed significant differences between pre-test and TRF MTF 60 increased ( $p\text{-value}=0.001$ ). Similar results were found for MTF 180 as well ( $p\text{-value}=0.037$ ). When observing respiratory quotient (RQ) at rest ( $0.716 \pm 0.077$  vs.  $0.73 \pm 0.077$  vs.  $0.08 \pm 0.79$ ;  $F = 8.352$ ) there was a significant increase from pre-test to TRF ( $p\text{-value}=0.008$ ), as well as non-TRF to TRF ( $p\text{-value}=0.034$ ). Lastly, after analyzing total strength training days from non-TRF to TRF (8.11 days  $\pm$  1.18 vs. 5.22 days  $\pm$  1.48), a significant decrease was found ( $p\text{-value}=0.003$ ). **CONCLUSION:** Post TRF, participants showed an increase in muscular strength and resting RQ despite a decrease in strength training. Increased glucose utilization may be linked to short bouts of increased muscular strength activity. Future studies are needed to identify physiological mechanisms behind these findings.

**1425** Board #187 May 30 10:30 AM - 12:00 PM  
**Effects Of Whole30 Dietary Programa On Resting Energy Expenditure, Oxygen Consumption And Heart Rate In Crossfit Athletes**

Valden Capistrano Junior<sup>1</sup>, Renata Carnauba<sup>2</sup>, Natália Marques<sup>2</sup>, Ana Beatriz Baptistella<sup>2</sup>, Renata Sena<sup>3</sup>, Angela Furtado Martin<sup>1</sup>, Adriana Sampaio<sup>1</sup>, Diego Lacerda<sup>3</sup>. <sup>1</sup>*VClínica de Nutrição, Fortaleza, Brazil.* <sup>2</sup>*Centro de Nutrição Funcional VP, São Paulo, Brazil.* <sup>3</sup>*CrossFit Haka, Fortaleza, Brazil.*  
 Email: valdenjunior@gmail.com  
 (No relevant relationships reported)

Valden L. M. Capistrano Junior, Renata A. Carnauba, Natália Marques, Ana Beatriz Baptistella, Renata Desiree Beserra de Sena, Angela Siqueira Furtado Martin, Adriana Pereira Sampaio, Diego de Castro e Silva Lacerda.  
 VClínica de Nutrição Research Institute

**Purpose:** To evaluate whether the Whole 30 dietary program alters resting energy expenditure, oxygen consumption, and heart rate in CrossFit trained individuals. **Methods:** Sixty four subjects (age range: 21-54 years) attended to nutrition education class to learn food items and recommended volumes comprising the Whole 30 program for 30 days (allowed foods: meats, seafood/ fish, eggs, fruit, vegetables and mono and polyunsaturated fats; forbidden foods: sugar, sweeteners, alcohol, flour, oat, quinoa, corn, rice, starch, beans, soy, milk and dairy products) and underwent a training protocol (4 days/week) during the program period. Resting energy expenditure and oxygen consumption were evaluated before the beginning and one day after the end of protocol by indirect calorimetry (CardioCoach, Korr™), and the resting heart rate by oximeter finger. Samples were tested for normal distribution and groups were compared by Student's t-test. The type I error was set at  $p < 0.05$ . **Results:** Of the 64 initial participants, 38 participants who had no follow-up information were excluded and final analysis was performed in 26 (40.63%) participants. There was a significant reduction in resting energy expenditure ( $1402 \pm 255.7$  vs  $1087 \pm 303.3$ , pre

and post, respectively,  $p=0.00001$ ), resting oxygen consumption ( $203.6 \pm 36.91$  vs  $154.3 \pm 35.58$ , pre and post, respectively,  $p=0.0001$ ) and resting heart rate ( $59.58 \pm 15.32$  vs  $51.46 \pm 13.73$ , pre and post, respectively,  $p=0.0001$ ). **Conclusion:** The Whole 30 dietary program promoted resting energy expenditure, oxygen consumption and heart rate reduction in trained Crossfit individuals, which may be related to the lower carbohydrate consumption proposed by the program.

**1426** Board #188 May 30 10:30 AM - 12:00 PM  
**A Short Term Paleolithic Dietary Intervention Does Not Alter Adipokines Implicated In Obesity**

Rachel M. Graff<sup>1</sup>, Kristopher Jennings<sup>2</sup>, Natalie A. Davies<sup>3</sup>, Andres E. Carrillo<sup>3</sup>, Emily C. LaVoy<sup>1</sup>, Edward J. Ryan<sup>3</sup>, Melissa M. Markofski<sup>1</sup>. <sup>1</sup>*University of Houston, Houston, TX.* <sup>2</sup>*University of Texas Medical Branch, Galveston, TX.* <sup>3</sup>*Chatham University, Pittsburgh, PA.*  
 (No relevant relationships reported)

Adipokines, including adiponectin, omentin, nesfatin, and vaspin, are dysregulated with obesity and may respond favorably to diet-induced fat loss. The Paleolithic (Paleo) diet, characterized by an emphasis on hunter-gatherer type foods accompanied by an exclusion of grains, dairy products, and highly processed food items, is often promoted for weight loss and a reduction in cardiometabolic disease risk factors. The **PURPOSE** of this study was to evaluate the effects of an 8-week Paleo dietary intervention on serum adiponectin, omentin, nesfatin, and vaspin levels in a cohort of physically inactive but otherwise healthy adults. **METHODS:** Seven physically inactive adults participated in 8 weeks of a Paleo diet intervention. Anthropometric measures, body composition data, and fasting blood samples were collected from each participant pre- and post-intervention. Serum adiponectin, omentin, nesfatin, and vaspin were measured with commercially available ELISA kits. **RESULTS:** The Paleo dietary intervention elicited reductions ( $p < 0.05$ ) in mean relative body fat (-4.4%), waist circumference (-5.9 cm), and sum of seven-site skinfolds (-36.8 mm). No changes were observed in waist to hip ratio (WHR) or any of the measured adipokines ( $p > 0.05$ ). **CONCLUSIONS:** It is possible that short-term modest fat loss will not induce changes in adiponectin, omentin, nesfatin, or vaspin in apparently healthy but physically inactive adults. Longer-term studies that examine Paleo diet-induced changes across sex, body composition, and in populations with metabolic dysregulation are warranted in order to determine whether the Paleo diet is effective in improving biomarkers related to obesity, metabolism and overall health.

**C-39** Free Communication/Poster - Pain, RPE, and Fatigue

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

**1427** Board #189 May 30 9:30 AM - 11:00 AM  
**Narrow Cuffs Decrease The Perceptual Of Discomfort With Blood Flow Restricted Exercise**

Robert W. Spitz, Raksha N. Chatakondi, Zachary W. Bell, Vickie Wong, Scott J. Dankel, Takashi Abe, Jeremy P. Loenneke. *The University of Mississippi, University, MS.*  
 (No relevant relationships reported)

Wide cuffs cause arterial occlusion at lower pressures but may produce greater discomfort during blood flow restricted exercise compared to more narrow cuffs when applied to the same absolute pressure. Whether this is true at the same relative pressure or if this differs by sex is currently unknown. **PURPOSE:** To examine how cuff size and sex affect perceptual discomfort following blood flow restricted exercise. **METHODS:** Forty-nine participants (25 males and 24 females) completed two conditions in a random order with 10 minutes of rest prior to each condition (one on each arm). Participants performed 4 sets of unilateral elbow flexion to failure. Pressure was applied with either a narrow (5 cm) or a wide cuff (12 cm) with each cuff set to the same relative arterial occlusion pressure (40%). Discomfort was rated following the 4<sup>th</sup> set (0: no discomfort, 100: maximal discomfort). Following exercise the participants were asked to choose which condition they would prefer to use regularly. A repeated measures analysis with a between subject factor of sex was used to assess differences in discomfort. Default priors were used for fixed effects ( $r=0.5$ ) and random effects ( $r=1$ ). A contingency table with a default prior concentration of 1 was used to determine if cuff preference differed by sex. Bayes Factors ( $BF_{10}$ ) were used to quantify evidence for the null and alternative hypothesis. Data are presented as mean (SD) unless otherwise stated. **RESULTS:** There was evidence for an effect of cuff size ( $BF_{10}: 6.752$ ) but no evidence for an interaction or an effect of sex ( $BF_{10}: .699$ ). The narrow [42 (17) AU] cuff had less discomfort than the wide [47 (18) AU] cuff [median  $\delta$  (95% credible interval) -53 (-928, -145)]. When participants rated which cuff they would prefer to exercise with, participants preferred the narrow cuff

and this did not differ by sex ( $BF_{10}$  joint multinomial: .262). The lower discomfort and greater preference for the narrow cuff was found despite completing more repetitions with the narrow cuff [Narrow: 70 (25) vs. Wide: 59 (16) repetitions;  $BF_{10}$  of 67.2]. **CONCLUSIONS:** A narrow cuff appear to cause less discomfort than a wider cuff when inflated to the same relative pressure with no difference between sexes. The use of a narrow cuff was preferred and may help increase the palatability of blood flow restricted exercise.

**1428** Board #190 May 30 9:30 AM - 11:00 AM  
**Session RPE Following a Six-minute Bout of Cardiopulmonary Resuscitation Training**  
 Alex B. Shafer, Wyatt I. Witty, Dana A. Lubieniecki, Kasie D. Cooper. *Montana State University Billings, Billings, MT.* (Sponsor: Elizabeth Nagle, FACSM)  
 Email: alex.shafer@msubillings.edu  
 (No relevant relationships reported)

Ratings of perceived exertion (RPE) are used to monitor intensity during exercise. A session RPE (S-RPE) provides an estimate of exercise intensity of a completed exercise session. S-RPE has demonstrated adequate validity and reliability for quantifying exercise intensity in traditional aerobic and anaerobic modalities. However, the efficacy of S-RPE during the physically demanding task of cardiopulmonary resuscitation (CPR) has yet to be explored. **PURPOSE:** The purpose of this investigation is to explore the relationship between RPE and S-RPE assessed during and after a 6-minute bout of CPR training. **METHODS:** Thirty healthy young adults (age 24.3±6.0 y; BMI 26.1±3.5 kg/m<sup>2</sup>) completed a 6-minute bout of CPR on a CPR manikin. RPE values were recorded during the last 15 seconds of each minute of exercise, and S-RPE was recorded 2 min post exercise using the Adult OMNI-RPE scale. Heart rate (HR) was recorded during each minute of activity. A repeated measures ANOVA was used to compare RPE values from minute 1-6 and S-RPE recorded during the CPR bout. A paired samples t-test compared the average RPE for the 6-minute bout to S-RPE. Statistical significance was accepted at  $p < 0.05$ . **RESULTS:** RPE values recorded during the CPR bout are reported in table 1. Participants obtained a peak HR of 132.3±25.7 bpm during the 6-minute bout of CPR. A paired samples t-test shows S-RPE was significantly higher than the average RPE for the 6-minute bout (4.7±1.9 vs. 4.1±1.7,  $p < 0.0001$ ). However, S-RPE did not differ from the RPE obtained from minutes 3-6 of the CPR bout. **CONCLUSION:** Current findings suggest that S-RPE for a bout of CPR may not represent the average RPE, but reflects the RPE reported during the later stages of exercise. In this case, S-RPE represented exertion levels reported during the final two-thirds of the exercise session. Similar findings have been reported during aerobic and resistance training studies, where S-RPE represents exertion of the later stages of activity.

Table 1. S-RPE and RPE values for each minute of CPR

Min 1	Min 2	Min 3	Min 4	Min 5	Min 6	Session
2.8±1.4*	3.4±1.7*	4.1±1.7	4.6±1.9	4.8±2.0	5.0±2.1	4.7±1.9

\*significantly less than S-RPE,  $p < 0.05$

**1429** Board #191 May 30 9:30 AM - 11:00 AM  
**Enjoyment In Low Intensity Continuous Training Versus High Intensity Interval Training In An Iso-caloric Design**  
 Sigurd Pedersen, Tord Markussen Hammer, Tommy Hamsund, Mathilde Nordhus Kristiansen, Edvard Hamnvik Sagelv. *UiT the Norwegian Arctic University, Tromsø, Norway.*  
 Email: sigurd.pedersen@uit.no  
 (No relevant relationships reported)

**Purpose:** To examine the enjoyment during and after one exercise session of continuous aerobic exercise (CE) versus one session of high intensity aerobic interval training (HIIT) in an iso-caloric design. **Methods:** Seven young healthy participants (3 males, 4 females, age: 23.4±2 years, maximal oxygen uptake: 52±8.7 ml·kg<sup>-1</sup>·min<sup>-1</sup>) were recruited to undergo two different exercise sessions of similar total caloric expenditure in randomized order: 1) one CE session at 70% of heart rate maximum (HRmax) and 2) one HIIT session of 4x4 minutes intervals at > 90% of HRmax with 3 minutes rest between interval sets. Maximal oxygen uptake (VO<sub>2</sub>max) and HRmax were tested prior to the experiment. During and after both exercise session, the participants reported perceived exercise enjoyment using an 8-item short form of the Physical Activity Enjoyment Scale (PACES) (Raedeke, 2007, *J Appl Sport Psychol*). This is a reduced scale of the original 18-item scale from Kendzierski & DeCarlo (1991, *J. Sport Exerc Psychol*). Additionally, the participants also reported rating of perceived exertion (RPE) (Borg, 1981, *Med Sci Sport Exerc*), during and after both exercise sessions. **Results:** There were no difference in PACES score between HIIT and CE during (HIIT:

94.4±12.9, CE: 91.1±16.3,  $p = 0.61$ ) and after the two exercise sessions (HIIT: 96.6±13.2, CE: 94.4±15.4,  $P = 0.75$ ). The participants reported higher RPE both during and after the HIIT session compared with the CE session (During HIIT: 15.4±1.3, CE: 9.8±1.2,  $p < 0.01$ , after HIIT: 17.0±1.3, CE: 10.0±1.3,  $p < 0.001$ ). When pooling the reported PACES scores, there were no difference in perceived enjoyment between the HIIT and CE session (95.5±12.4 vs 92.4±15.4, respectively,  $p = 0.68$ ). The participants reported higher RPE for the HIIT session compared with the CE session in the pooled analysis (16.2±1.0 vs 9.9±1.3,  $p < 0.001$ ). **Conclusion:** Although a higher perceived exertion was reported following high intensity exercise, participants reported similar enjoyment following exercise independent of exercise intensity in this iso-caloric design. Thus, if enjoyment is the depending factor for engaging in exercise, one should expect similar exercise adherence probability following HIIT and CE when prescribing aerobic exercise as preventive medicine.

**1430** Board #192 May 30 9:30 AM - 11:00 AM  
**Comparison Of Two Cold Water Immersions Protocols On Psychological Variables Of Recovery**  
 Braulio Sánchez-Ureña<sup>1</sup>, Kristy Barrantes-Brais<sup>1</sup>, Pedro Ureña-Bonilla<sup>1</sup>, Felipe Araya-Ramírez<sup>1</sup>, Juan José Romero-Zúñiga<sup>1</sup>, Daniel Rojas-Valverde<sup>1</sup>, Julio Calleja-González<sup>2</sup>, Jeffrey M. Mjaanes, FACSM<sup>3</sup>. <sup>1</sup>National University of Costa Rica, Heredia, Costa Rica. <sup>2</sup>University of the Basque Country, Araba, Spain. <sup>3</sup>Northwestern University, Evanston, IL. (Sponsor: Jeffrey M. Mjaanes3, FACSM)  
 Email: brau09@hotmail.com  
 (No relevant relationships reported)

In sport, recovery is a multifactorial process and one modality commonly recommended for athletes is cold water immersion (CWI). Few studies, have analyzed the psychological effects of CWI protocols, specifically with regards to pain and perceived recovery. **Purpose:** Compare the effects of two CWI protocols on psychological variables of recovery. **Methods:** Forty healthy male participants (age 21.8 ± 2.76 years, weight 73.15 ± 8.15 kg, height 176.6 ± 5.3 cm, and 13.5 ± 3.4% body fat). Participants performed a fatigue protocol (8 sets of 30-second countermovement jumps with 90-second of rest between sets). Were randomized to one of three recovery conditions: control group (CG) (12-min sitting in a 23 °C room), continuous cold water immersion (CnCWI) (12-min in water at 12 ± 0.4 °C), and intermittent cold water immersion (InCWI) (12-min in water at 12 ± 0.4 °C as follows: 2-min in cold water, 1-min in a controlled environment at 23 °C, until the 12-min of immersions were completed). Delayed onset muscle soreness (DOMS) was assessed through a Visual Analog Scale (VAS-Pain) and perceived recovery were used. Both were evaluated at pre, post-CWI, 24 and 48 hours post. A mixed ANOVA was used. Significance was accepted at  $p < 0.05$ . **Results:** Statistically significant differences were found in DOMS ( $F_{(8,148)} = 5.15, p < .001, \omega^2 = .174$ ) in post immersion CnCWI vs. CG (2.7 ± 2.28 vs. 6.42 ± 1.9,  $p < 0.001$ ) and InCWI vs. CG (2.7 ± 2.1 vs. 6.42 ± 1.9,  $p < 0.001$ ), in the post 24h CnCWI vs. CG (3.07 ± 2.3 vs. 5.1 ± 1.7,  $p < 0.011$ ) and InCWI vs. CG (3.2 ± 1.8 vs. 5.1 ± 1.7,  $p < 0.01$ ). In the post 48h testing, results showed CnCWI vs. CG (3.3 ± 2.3 vs. 6.1 ± 2.2,  $p < 0.002$ ) and InCWI vs. CG (3 ± 1.9 vs. 6.1 ± 2.2,  $p < 0.001$ ). In terms of perceived recovery ( $F_{(6,111)} = 2.49, p = .027, \omega_p^2 = .070$ ), results included post immersion CnCWI vs. CG (15.92 ± 1.7 vs. 14 ± 1.2,  $p < 0.001$ ) and InCWI vs. CG (16.3 ± 1.6 vs. 14 ± 1.2,  $p < 0.001$ ), in the post 24h CnCWI vs. CG (16.3 ± 2.4 vs. 12.8 ± 1.12,  $p < 0.001$ ) and InCWI vs. CG (14.9 ± 2 vs. 12.8 ± 1.12,  $p < 0.001$ ). In the case of post 48h, results were CnCWI vs. CG (15.9 ± 2.6 vs. 12 ± 3.3,  $p < 0.001$ ) and InCWI vs. CG (15.3 ± 2.6 vs. 12 ± 3.3,  $p < 0.001$ ). **Conclusion:** CWI protocols are effective in reducing DOMS and improving perceived recovery all post fatigue measurements. Either the CnCWI or InCWI protocol could be used as both had similar effects on psychological variables of recovery.

**1431** Board #193 May 30 9:30 AM - 11:00 AM  
**Time Courses of Changes In Perceptual, Respiratory, and Neuromuscular Responses in the Severe Intensity Domain**  
 Haley C. Bergstrom<sup>1</sup>, Terry J. Housh, FACSM<sup>2</sup>, Taylor K. Dinyer<sup>1</sup>, M. Travis Byrd<sup>1</sup>, Pasquale J. Succ<sup>1</sup>, Nathaniel D.M. Jenkins<sup>3</sup>, Kristen C. Cochrane-Snyman<sup>4</sup>, Richard J. Schmidt<sup>2</sup>, Glen O. Johnson, FACSM<sup>2</sup>. <sup>1</sup>University of Kentucky, Lexington, KY. <sup>2</sup>University of Nebraska-Lincoln, Lincoln, NE. <sup>3</sup>Oklahoma State University, Stillwater, OK. <sup>4</sup>California State University, Fresno, CA.  
 Email: hbergstrom@uky.edu  
 (No relevant relationships reported)

The severe intensity domain zone 1 (SIZ<sub>1</sub>) includes intensities between critical velocity (CV) and 50%Δ (Δ = difference between CV and VO<sub>2</sub>peak), where exhaustion may occur below VO<sub>2</sub>peak. The severe intensity domain zone 2 (SIZ<sub>2</sub>) includes intensities

> 50%Δ but < 175% CV, where  $\dot{V}O_{2peak}$  is reached at exhaustion. **PURPOSE:** This study examined the time course of changes in ratings of perceived exertion (RPE), breathing frequency ( $f_b$ ), electromyographic amplitude (EMG AMP) and EMG mean power frequency (MPF) during exhaustive treadmill runs within the  $SIZ_1$  and  $SIZ_2$ . **METHODS:** Ten runners (Age:  $23 \pm 3$  yrs) performed an incremental treadmill test to determine the velocity at  $\dot{V}O_{2peak}$  ( $vVO_{2p}$ ). The CV was determined from 4 constant velocity runs. The RPE,  $f_b$ , EMG AMP, EMG MPF (from the vastus lateralis) and times to exhaustion ( $T_{lim}$ ) were examined during  $SIZ_1$  and  $SIZ_2$  runs. Polynomial regression was used to examine the normalized (% change from the initial values) RPE,  $f_b$ , EMG AMP, and EMG MPF versus % $T_{lim}$  (10-100%) relationships for the  $SIZ_1$  and  $SIZ_2$  runs. Repeated measures ANOVAs and Student Newman-Keuls tests were used to determine the time course of changes from the initial 10% of  $T_{lim}$ . **RESULTS:** During the  $SIZ_1$  ( $86 \pm 5\%$   $vVO_{2p}$ ,  $\sim 33\%$ Δ,  $T_{lim} = 17.7 \pm 2.6$  min) run, there was a quadratic increase for RPE ( $R^2 = 0.99$ ,  $p < 0.001$ ), significant from 30 to 100% of  $T_{lim}$ , a cubic increase for  $f_b$  ( $R^2 = 0.99$ ,  $p < 0.001$ ), significant from 30 to 100% of  $T_{lim}$ , a linear increase for EMG AMP ( $r^2 = 0.85$ ,  $p < 0.001$ ), significant at 100% of  $T_{lim}$ , and a linear decrease for EMG MPF ( $r^2 = 0.66$ ,  $p = 0.004$ ), but no differences among time points. During the  $SIZ_2$  ( $98 \pm 4\%$   $vVO_{2p}$ ,  $93\%$ Δ,  $T_{lim} = 6.6 \pm 0.8$  min) run, there was a linear increase for RPE ( $r^2 = 0.99$ ,  $p < 0.001$ ), significant from 30 to 100% of  $T_{lim}$ , a quadratic increase for  $f_b$  ( $R^2 = 0.99$ ,  $p = 0.03$ ), significant from 20 to 100% of  $T_{lim}$ , a quadratic increase for EMG AMP ( $R^2 = 0.68$ ,  $p = 0.02$ ), but no differences among time points, and a cubic decrease for EMG MPF ( $R^2 = 0.84$ ,  $p = 0.01$ ), significant at 100% of  $T_{lim}$ . **CONCLUSIONS:** These findings indicated RPE was more closely related to increases in  $f_b$ , than to neuromuscular fatigue in both the  $SIZ_1$  and  $SIZ_2$ . It is possible feedback from group III and IV afferents in the respiratory muscles contributed to increased perceptions of effort to a greater degree than those in the leg muscles during severe exercise intensities.

**1432** Board #194 May 30 9:30 AM - 11:00 AM  
**Mood Changes In Runners During An Ultra-marathon**  
 Caleb B. Bockoras, Tracie Wilkins Zimmer, Steven B. Hammer, James W. Agnew. *Indian River State College, Fort Pierce, FL.*  
 Email: Caleb.bockoras@gmail.com  
 (No relevant relationships reported)

**PURPOSE:** There is currently very little data available in literature on the effects of ultra-marathon training and competition regarding mood. Ultra-marathons are races with distances greater than the standard marathon distance of 26.2 miles. The purpose of this experiment was to examine differences in mood during an ultramarathon competition. We speculated that perceived exertion (RPE) and pain would be the predominant determinates of mood during the race. **METHODS:** Pain, RPE, and mood were assessed using Visual Analog Scales (VAS) prior to the race, at predetermined ten-mile marker points, and immediately at the completion of the race. The support teams that would accompany each runner throughout the race were given instructions prior to the start on how to collect the data. They were instructed not to "coach" responses from the runners and not to assume their runner's responses or answer for them. The mood scale started at 10 representing best mood and decreased to 0 as mood declined. Pain and RPE scales started at 0 for no pain and no exertion respectively, increasing to a maximum of 10 for maximum pain or maximum exertion. Data were analyzed using regression analyses with  $p < 0.05$  as our accepted level of significance. **RESULTS:** The regression analysis revealed a ( $R^2 = 0.89$ ). Mood steadily decreased from 9.6 one hour before the race to 9.4 ten miles into the race. At 90 miles, mood was 5.2, then 6.2 at the completion of the race. RPE and pain steadily increased throughout the race. Pain was 0 before the start, 0.6 at ten miles and 7 at 100 miles. RPE was 1.4 one hour before the race and 2.6 at ten miles increasing to 6.8 at the end of the race. Subjective pain assessment was significantly correlated to mood throughout the race ( $p < .05$ ), and RPE had no significant associations ( $P > .05$ ). **CONCLUSION:** These data suggest that the increase in subjective pain assessment with runners completing a 100-mile ultra-marathon is directly related to a decrease in mood throughout the race. RPE was also correlated and is surely an important factor impacting mood throughout the race, but it did not reach statistical significance. This suggests that pain has greater association with mood compared to RPE during an ultra-marathon. Further analysis is needed to fully identify the primary factors impacting mood in ultra-endurance activities.

**1433** Board #195 May 30 9:30 AM - 11:00 AM  
**Physical Aspects of Fatigue Throughout a Season**  
 Jordan F. Norris<sup>1</sup>, Nicholas F. Boér<sup>1</sup>, Richard Henderson<sup>2</sup>.  
<sup>1</sup>University of Tennessee at Chattanooga, Chattanooga, TN.  
<sup>2</sup>McCallie School, Chattanooga, TN.  
 (No relevant relationships reported)

High school athletes experience changes in performance throughout sport seasons. It's important to discover if an athlete is fatigued in order to make modifications to their practice and training regimen.

**PURPOSE:** The purpose of this investigation is to use the jump squat measurement to determine athlete fatigue throughout a season. **METHODS:** 58 male varsity students that attend a private college preparatory school volunteered to participate in the

study (N=21 football; N=11 lacrosse; N=6 track; N=12 basketball; N=9 wrestling). The average grade level for the participants was 10.91 (0.89). Students completed a modified Borg scale of rate of perceived exertion (RPE) to determine physical RPE. Students self-reported practice time and sleep. A jump squat using "Just Jump" with a flight time calculator was used to measure the level of fatigue. Data was recorded by the strength and conditioning coaches. Each athlete recorded a jump squat each week throughout the season; however, due to missing data, data was analyzed through a repeated measures analysis at times corresponding to the beginning of the season, the one-third mark, the two-third mark, and at the end of the season.

#### RESULTS:

Average Physical RPE	5.19; 1.75	5.19; 1.44	5.00; 1.87	4.93; 1.69
Average Sleep	7.61; 0.90	7.55; 0.81	7.80; 1.15	7.69; 0.82
Average Practice Time	130.45; 16.08	129.30; 18.55	125.96; 19.00	122.02; 24.07
Average jump Squat	18.99; 3.07	19.22; 3.10	19.29; 2.91	19.85; 3.04

**CONCLUSION:** It was assumed that students who recorded lower jump squat scores experienced fatigue at that point in the season. While there were individual differences, there were no significant differences among the teams. There was a gradual increase in performance, rather than a fatigue effect, which indicates that training modalities addressed individual fatigue levels. A limitation of this study is the data collection methods; academia and strength coaches will need to work together to develop data collection methods that meet the needs of both the coaching staffs and researchers.

**1434** Board #196 May 30 9:30 AM - 11:00 AM  
**The Interactive Effect of DOMS and Topical Analgesic on Corticospinal Excitability of the Biceps Brachii**  
 Evan J. Lockyer<sup>1</sup>, Lucas Stefanelli<sup>1</sup>, Brandon W. Collins<sup>1</sup>, Nicholas J. Snow<sup>1</sup>, Julie Crocker<sup>1</sup>, Christopher Kent<sup>1</sup>, Michael Holmes<sup>2</sup>, Kevin E. Power<sup>1</sup>, Duane C. Button<sup>1</sup>. <sup>1</sup>Memorial University of Newfoundland, St. John's, NL, Canada. <sup>2</sup>Brock University, St. Catharines, ON, Canada.  
 Email: elockyer@mun.ca  
 (No relevant relationships reported)

Delayed onset muscle soreness (DOMS) is a normal response to strenuous, unfamiliar exercise characterized by muscle swelling, tenderness and pain. Typically arising 24-72 hours following exercise, DOMS results in neuromuscular impairment such as decreased muscular strength and activation. Recently, the application of topical analgesics has been proposed as a possible means to mitigate the symptoms and negative outcomes of DOMS, though the mechanisms of action are not well-understood. It is currently unknown how the presence of DOMS with and without the application of topical analgesia influences central nervous system excitability. **PURPOSE:** The purpose of this study was to investigate the interactive effects of DOMS and the application of a menthol-based topical analgesic on corticospinal excitability (CSE) to the biceps brachii. **METHODS:** A total of 32 participants completed two separate experiments; *Experiment A* (No DOMS;  $n = 16$ ) and *Experiment B* (DOMS;  $n = 16$ ). For each experiment, participants were randomly assigned to two groups: 1) topical analgesic gel (Topical Analgesic,  $n = 8$ ), or 2) placebo gel (Placebo,  $n = 8$ ). Prior to the application of gel (pre-gel), as well as 5, 15, 30, and 45 min post-gel, motor evoked potential (MEP) area, latency, and silent period, as well as cervicomedullary MEP (CMEP) and maximal compound motor unit action potential ( $M_{max}$ ) areas and latencies were measured. In addition, pressure-pain threshold (PPT) was measured pre-DOMS and at the same time points in *Experiment B*. **RESULTS:** In *Experiment A*, neither group showed a significant change for any outcome measure. In *Experiment B*, both groups exhibited a significant decrease in PPT from pre-DOMS to pre-gel ( $p < .05$ ). Following the application of topical analgesic, but not placebo, there was a significant increase in PPT at 15, 30, and 45 min post-gel ( $p < .05$ ), respectively compared to pre-gel and an increase in silent period at post-30 and 45 min ( $p < .05$ ) compared to pre-gel. Participants with DOMS had reduced MEP ( $p < .02$ ) and CMEP areas ( $p < .05$ ), and increased MEP silent periods ( $p < .05$ ) compared to those who did not have DOMS. **CONCLUSIONS:** These findings suggest that DOMS reduced CSE to the biceps brachii, and that the application of a menthol-based topical analgesic reduced pain, which was accompanied by an increase in corticospinal inhibition.

**1435** Board #197 May 30 9:30 AM - 11:00 AM  
**The Influence of Temperature on Prefrontal Cortex Activation and Performance During a Fatiguing Task**  
 Kevin C. Phillips<sup>1</sup>, Derek Verbrugghe<sup>1</sup>, Alex Gabe<sup>1</sup>, Brittany Jauquet<sup>1</sup>, Claire Eischer<sup>1</sup>, Steven Elmer<sup>1</sup>, Tejin Yoon<sup>2</sup>. <sup>1</sup>Michigan Technological University, Houghton, MI. <sup>2</sup>Kangwon National University, Chuncheon, Korea, Republic of.  
 Email: kcpPhill@mtu.edu  
 (No relevant relationships reported)

Evidence suggests the prefrontal cortex (PFC) may play a role in interpreting afferent feedback during fatiguing tasks. Temperature changes are known to influence fatigability. It is unknown how changing the temperature of a limb influences PFC activation during a fatiguing task. **PURPOSE:** To examine changes in PFC oxygenation, psychological ratings, and muscular function in response to a fatiguing task, following thermal alterations of the exercising arm. **METHODS:** Nineteen healthy adults completed three experimental sessions. At baseline, participants performed maximum voluntary isometric contractions (MVIC) of the elbow flexors. Next, participants submerged their right arm in a water bath for 15 min. Cold (C), neutral (N), and hot (H) water temperatures were maintained at 8°, 33° and 44°C, respectively. Following water immersion, participants performed an isometric elbow flexion contraction, at 20% of MVIC, for 5 minutes. Ratings of perceived exertion (RPE) and muscular discomfort were assessed. Functional near-infrared spectroscopy was used to measure oxygenation of the right PFC during the fatiguing task. Repeated measures ANOVAs were used to analyze changes in dependent variables. **RESULTS:** There was an increase in PFC oxygenation throughout the fatiguing task, however, the increase in oxygenation was greater for the H (14.1±4.9 μM) and N (12.7±5.6 μM) conditions, compared to the C condition (11.1±4.4 μM, time x temperature, p<0.01). There was an increase in RPE throughout the fatiguing task, however, the increase in RPE was greater for the H (8.7±0.9) and N (8.0±0.9) conditions, compared to the C condition (7.2±1.1, time x temperature, p<0.01). Muscular discomfort at the end of the fatiguing task was lower in the C condition compared to the H condition (2.7±0.1 vs. 3.7±0.1, p<0.001). There was a reduction in MVIC torque at the end of the fatiguing task, however, the reduction in MVIC torque was greater for the H (25.7±8.4 %) and N (22.2±9.6 %) conditions, compared to the C condition (17.5±8.9 %, temperature x fatigue, p<0.05). **CONCLUSION:** Precooling before a fatiguing task attenuated the rise in PFC oxygenation, RPE, muscular discomfort, and muscular fatigue. These results have implications for reducing mental workload and improving performance in workers, athletes, and patients.

**1436** Board #198 May 30 9:30 AM - 11:00 AM  
**Factors Affecting the Outcome of an Ultramarathon Before the Race Starts**  
 Steven B. Hammer. Indian River State College, Fort Pierce, FL.  
 Email: shammer@irisc.edu  
 (No relevant relationships reported)

**Purpose:** Very little data is available concerning the influence of pre-race mood and pain on ultra-marathon completion. This research was designed to answer questions such as how pain, mood and exertion affect ultramarathon race performance (defined as any race greater than 26.2 miles). **Methods:** Data was collected at the 2018 Keys 100 and 2017 Saint Sebastian 100 (n=23). Each research participant was presented with visual analog scales, one each for Pain (0=low pain to 10=maximum pain), Mood (10=great mood to 0=bad mood) and exertion (RPE) (0=no exertion to 10=maximum exertion). Scores were collected pre-race. Those participants who did not finish (DNF) were recorded as such. Independent sample t-test (SPSS version 21) was used with independent variable coded post-race, Finished or DNF, dependent variables were Mood, Pain and Exertion collected Pre-Race (p<0.05). **Results:** Pain pre-race for finishers (0.23±0.44) and DNF's (0.86±0.38), paired differences were t(19)=3.18, p=0.005. Mood pre-race for finishers (9.5±0.85) and DNF's (7.3±2.56) paired difference were t(19)=-2.98, p=0.008. Exertion pre-race for finishers (1.07±0.99) and DNF's (0.86±0.38), paired differences were t(19)=-0.54, p=0.59. **Conclusion:** Pre-race numerical scores that rank higher in mood and lower in pain have a positive impact on race outcome. Current research shows a greater link between psychological state and performance than previously postulated. Our research supports the hypothesis that the athlete's physical performance affects their mental state. Furthermore their mental state, in turn, effects their performance. We believe this to be the first collected data of this type to show these results on ultra-marathon performance.

**1437** Board #199 May 30 9:30 AM - 11:00 AM  
**Effects of Transspinal Direct Current Stimulation on Cycling Perception of Effort and Time to Exhaustion**  
 Christopher A. De la Vega<sup>1</sup>, Anthony B. Ciccone<sup>1</sup>, Trent J. Herda<sup>2</sup>, Andrew C. Fry<sup>2</sup>, Dawn M. Emerson<sup>2</sup>, Joseph P. Weir, FACSM<sup>2</sup>. <sup>1</sup>Utah Valley University, Orem, UT. <sup>2</sup>University of Kansas, Lawrence, KS. (Sponsor: Dr. Joseph Weir, FACSM)  
 (No relevant relationships reported)

**PURPOSE:** In the past decade, researchers have investigated the efficacy of transspinal direct current stimulation (tsDCS) on central nervous system and afferent neuron function in humans. In the past year, data has suggested it may be possible for such tsDCS-induced changes in neuromuscular function to enhance performance. This study utilized non-invasive thoracic spine tsDCS to determine if cycling performance and perception of effort (RPE) could be modulated by tsDCS. **METHODS:** In three different stimulation conditions, anodal, cathodal, and sham, participants cycled at 80% of their maximal aerobic capacity until exhaustion and reported their RPE every minute. From this period, researchers compared the RPE responses over the first three minutes and time to exhaustion. **RESULTS:** There was no significant difference in time to exhaustion between anodal (408 ± 121 s), cathodal (413 ± 168 s), and sham (440 ± 189 s) conditions (p=0.58). There was no significant difference in RPE from minutes 1-3 (collapsed across time) between anodal (12.9 ± 2.4 AUs), cathodal (13.3 ± 2.2 AUs), and sham (12.9 ± 2.1 AUs) conditions (p=0.51). **CONCLUSIONS:** These data suggest tsDCS condition did not influence cycling performance or perception of effort during high-intensity cycling. Therefore, thoracic spine and lower abdominal montage delivering a current density of 0.071 mA/cm<sup>2</sup> for 20 minutes likely does not affect high-intensity cycling work capacity. Therefore, more research is needed to investigate the efficacy of tsDCS and which stimulation methods may and may not enhance human performance.

**1438** Board #200 May 30 9:30 AM - 11:00 AM  
**Relationship Among Site Specific Fat, Lean Mass, And Pressure Pain Sensitivity**  
 Ashley Dioguardi, Jessica Peterson, Cameron Lohman, Michael G. Bembem, FACSM, Rebecca Larson, Christopher D. Black, FACSM. University of Oklahoma, Norman, OK. (Sponsor: Christopher Black, FACSM)  
 Email: ashley.j.dioguardi-1@ou.edu  
 (No relevant relationships reported)

Chronic pain and obesity are significant public health issues. Although the association between a higher BMI and chronic pain has been established, little data exist on the relationship among more direct measures of body composition and pain sensitivity. **PURPOSE:** The purpose of the study was to examine the relationship between pressure pain thresholds (PPT), total body fat and lean tissue, and fat and muscle mass at the PPT assessment site. **METHODS:** PPT of 73 participants (38 female) were assessed in the vastus lateralis (VL) and brachioradialis (BR) using a pressure algometer on the left (L) and right (R) sides of the body. Whole body and limb specific fat and lean tissue were assessed via DEXA scan, and muscle and fat thickness were assessed in the VL and BR using ultrasound and skinfold measures. **RESULTS:** PPT in both arms correlated with whole body lean mass (LBR: r=0.284; p=0.015; RBR: r=0.249; p=0.034), and site specific lean mass (LBR: r=0.263; p=0.025; RBR: r=0.238; p=0.043). LBR was also correlated to muscle thickness (r=0.235; p=0.045). No relationships were found between PPT and measures of fat mass in the LBR (p>0.05). PPT in the RBR were inversely correlated with BF% (r=-0.231; p=0.049). PPT in both legs were correlated with whole body lean mass (LVL: r=0.422; p<0.0001; RVL: r=0.444; p<0.0001), site specific lean mass (LVL: r=0.425; p<0.0001; RVL: r=0.397; p=0.001) and muscle thickness (LVL: r=0.262; p=0.025; RVL: r=0.312; p=0.007). No relationships found with any measure of fat mass in the LVL (p>0.05). PPT RVL inversely correlated with BF% (r=-0.239; p=0.042) and RL fat% (r=-0.331; p=0.004) but no relationship was found with region specific fat mass measures (p>0.05). **CONCLUSION:** PPT and assessments of fat tissue were not related. However, lean mass tended to have a positive relationship with PPT. These findings suggest a loss of lean tissue mass, which typically occurs with aging and inactivity, may play a role in increased sensitivity to pain.

1439 Board #201 May 30 9:30 AM - 11:00 AM  
**Self-Efficacy for Changing Sedentary Behavior or Physical Activity: Comparisons in Healthy and Chronic Pain Populations**

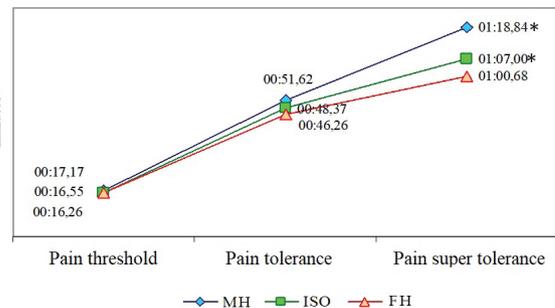
Jeni E. Lansing, Jacob D. Meyer, Maria Perez, Gabriel Cruz-Maldonado, Laura D. Ellingson, FACSM. *Iowa State University, Ames, IA.* (Sponsor: Laura Ellingson, FACSM)  
 (No relevant relationships reported)

Physical activity (PA) has well known health benefits, especially for clinical populations like individuals with chronic pain (CP). However, interventions aimed at increasing PA often report low adherence, possibly due to low self-efficacy (SE). Reducing sedentary time (SED) also has health benefits and may be perceived as more achievable than increasing PA. **PURPOSE:** To compare levels of SE for reducing SED to those for increasing PA in healthy adults (HA) and individuals with CP and to explore SE for overcoming barriers for each behavior. **METHODS:** Participants completed a survey assessing SE for changing PA and SED and common barriers. Questions were rated on a Likert scale from 1 (Not at all Confident) to 10 (100% Confident). T-tests and effect sizes (Cohen's *d*) compared differences between behaviors. **RESULTS:** Participants were 1,240 HA (age = 26 ± 12; 61% female) and 273 individuals with CP (age = 34 ± 16; 70% female). Both HA and individuals with CP reported greater SE for reducing daily SED by 1 hour compared to increasing daily MVPA by 30 minutes, with moderate effects observed in both groups ( $p < 0.001$ , CP:  $d = 0.60$ ; HA:  $d = 0.58$ ). Additionally, SE was greater ( $p < 0.001$ ) for overcoming barriers related to changing SED than PA, except social norms. In CP, the effect sizes between SE for overcoming barriers related to SED to barriers related to PA were small to moderate for fatigue ( $d = 0.46$ ), time ( $d = 0.42$ ), environment ( $d = 0.44$ ), motivation ( $d = 0.37$ ), pain ( $d = 0.27$ ), and mood ( $d = 0.24$ ). In HA, moderate effects for environment ( $d = 0.66$ ) and fatigue ( $d = 0.50$ ) and small effects for time ( $d = 0.44$ ), motivation ( $d = 0.44$ ), pain ( $d = 0.37$ ) and mood ( $d = 0.24$ ) were observed. However, SE for resisting social norms to sit was lower than SE for social norms surrounding exercise ( $p < 0.001$ , CP:  $d = -0.32$ , HA:  $d = -0.59$ ). **CONCLUSION:** While the health effects of each behavior are not equivalent, both patients and HA may be more likely to change behavior when encouraged to sit less rather than exercise more, which may still result in substantial benefits. Individuals with CP had the lowest average SE for interrupting SED when feeling unwell or in pain, feeling sad or unhappy, or in social situations where others are sitting. Interventions targeting SED may benefit from discussing mental and physical benefits of reducing SED and strategies for overcoming social norms.

1440 Board #202 May 30 9:30 AM - 11:00 AM  
**Evaluation Of Perception And Tolerance To Acute Pain Thru Typological Groups Of Gender Schemas**

Claudia Dias Leite<sup>1</sup>, Isabela Almeida Ramos<sup>2</sup>, Gislane Ferreira de Melo<sup>3</sup>. <sup>1</sup>*UniProjeção, Brasília, Brazil.* <sup>2</sup>*Catholic University of Brasilia, UniProjeção, Brasília, Brazil.* <sup>3</sup>*Catholic University of Brasilia, Brasília, Brazil.*  
 (No relevant relationships reported)

Pain is defined as a physiological and psychological experience, composed of an interaction between emotional, cognitive and sensorial components. The cultural aspects associated with the individual experiences of pain, tend to influence the way that individual reaction to a painful stimulus. **PURPOSE:** to evaluate if typological groups of gender schemas, generate by the Interactive Model, differs on acute pain perception and tolerance. **METHODS:** 137 athletes and 175 non-athletes, male and female (22.95 ± 4.29 yrs) were allocated into Masculine Heteroschematic (MH - Inventory of the Self-Concept's Gender Schemas - IMEGA), Isoschematic (ISO) and Feminine Heteroschematic (FH - Feminine Inventory of Self-Concept's Gender Schemas - IFEGA), groups. A scale called Factor of Acute Pain (FSAP) was developed to evaluate the sensations of acute pain. Pain threshold, pain tolerance, and pain super tolerance were evaluated during some test where the pain was induced by immersing hand on ice (0.1°C to 0.3°C). To FSAP validation and reliability were used Factorial Analysis and Cronbach's Alpha, and for acute pain perception and tolerance analysis was used inferential analysis Three-Way MANOVA and *post hoc* Least Significant Differences (LSD). **RESULTS:** Significant differences in acute pain perception and tolerance between typological groups were found ( $p=0.03$ ). At graphic 1 is possible to observe that MH and ISO showed higher pain super tolerance than FH (00:18,16min and 00:06;32min respectively;  $p=0.01$ ). For acute pain sensations, athlete woman FH reported more unpleasant sensation of pain ( $\Delta=00:55,05min$ ) than MH. **CONCLUSIONS:** gender schemas at typological groups support different high levels of acute pain, as well as different sensations of unpleasant caused by the cold thermal sensations. Groups with developed masculine schema tend to have a higher tolerance to maximum pain than the other groups.



Graphic 1. Pain threshold, pain tolerance and pain super tolerance between gender schemas typological groups . \*  $p < 0.05$  different compared with FH.

1441 Board #203 May 30 9:30 AM - 11:00 AM  
**Grit, Fitness, And Goal Setting**

Ethan E. Hull, Jason Vultaggio. *Slippery Rock University, Pittsburgh, PA.*  
 Email: ethanhull@gmail.com  
 (No relevant relationships reported)

Grit is a measure of passion and perseverance and has been associated with academic and career success. Whether grit is associated with success in other areas such as health, fitness, or goal setting is unknown. **PURPOSE:** This research attempted to examine whether grit and additional variables such as self-control and growth mindset would predict success in physical fitness goal setting and tolerance to discomfort during endurance fitness testing. **METHODS:** Eligible participants ( $n = 51$ , 60% male, 21.45 ± 1.7 years old) were drawn from wellness classes at Slippery Rock University. Participants completed questionnaires on grit, self-control, and growth mindset at baseline and six weeks later at follow-up. Pre and post measures also included a FitnessGRAM push-up test to failure, the level of discomfort in the upper body during the push-up test, and various other upper body fitness tests. Participants set a strength goal and trained for six weeks performing a variety of upper body exercises twice per week, consisting of strength training and plyometric exercises. **RESULTS:** Significant improvements were seen in push-up endurance scores (24.9 ± 10.2 vs 28.6 ± 9.0,  $p < 0.01$ ) and discomfort tolerance during the push-up test (7.3 ± 1.7 vs. 8.0 ± 1.4,  $p < 0.01$ ). No significant changes were noticed in grit (3.6 ± 0.4 vs. 3.7 ± 0.6,  $p = 0.86$ ), self-control, or growth mindset scores. A weak correlation ( $r = 0.30$ ,  $p = 0.03$ ) was noticed between baseline grit levels and baseline push-up scores. No other associations were found between grit and improvements in fitness. **CONCLUSIONS:** Results appeared to show that improvements in endurance, strength, and tolerance to discomfort were not associated with levels of grit, growth mindset, or self-control. Although these variables have been highlighted as predictive of success, future research should continue to examine their relation to goal setting in health and fitness.

1442 Board #204 May 30 9:30 AM - 11:00 AM  
**Firefighter Turnout Suit Weight Influences Simulated Exercise Performance**

Stephanie Gipson, Meredith McQuerry, Margaret Morrissey, Jacob Kisiolek, Michael Ormsbee, FACSM. *Florida State University, Tallahassee, FL.*  
 Email: sgd13b@my.fsu.edu  
 (No relevant relationships reported)

**PURPOSE:** To investigate how structural firefighter protective ensemble weight influences rate of perceived exertion (RPE) during firefighter simulated exercise (FFSE). **METHODS:** 10 active firefighters (age: 33 ± 6 years, Ht: 178.2 ± 3.1 cm, Wt: 78.6 ± 16.7 kg) were asked to wear, in random order, two ensembles: 1) a single layer (SL) outer shell (2.45 kg) and 2) a traditional turnout suit (4.57 kg). On each laboratory visit, the firefighters performed the FFSE that consisted of two rounds of a 15.24m hose advance, a 15.24m weighted (40.83 kg) carry, sledge hammer exercise, a 15.24m tire flip, a 15.24m dummy drag, rope pull, and unweighted stair climb, with a 1-minute rest period between rounds. The FFSE included a 5-minute acclimation period in the ensemble, a warm up (10 pushups, 10 squats, 20 jumping jacks). Subjects were asked to complete the FFSE as fast as possible. The traditional turnout suit consisted of an outer shell, moisture barrier, and thermal barrier typically found in most turnout suits. The Borg rating of perceived exertion scale was asked immediately at the end of each round of FFSE and ensemble weights were measured pre-FFSE.

**RESULTS:** The SL resulted in lower average RPE for round 1 (SL: 12.8±1.7 vs. Traditional: 13.8±1.7;  $p=0.05$ ) and round 2 (SL: 14.2±1.6 vs. Traditional: 16.2±2.3,  $p=0.01$ ) than the traditional turnout. In addition, round 2 of the FFSE was completed significantly faster than the traditional turnout suit (SL: 262.8±55.7 vs. Traditional: 293.4±64.9 sec;  $p=0.02$ ). **CONCLUSIONS:** The weight of the turnout suit increases RPE, which appears to influence performance for FFSE. Supported by Fire-Dex, LLC.

**1443** Board #205 May 30 9:30 AM - 11:00 AM

**Pre-Exercise Perceptions of Energy and Fatigue are Significantly Related to Performance during Sprint Interval Cycling**

Carly L. A. Wender, Sun Joo Ahn, Patrick J. O'Connor, FACSM.  
University of Georgia, Athens, GA.  
Email: carly.wender10@uga.edu  
(No relevant relationships reported)

Administration of ergogenic aids before exercise can increase feelings of energy and improve performance while completion of a demanding cognitive task before exercise can increase physical fatigue and decrease performance. Studies on this topic have been small (7-10 participants) and have failed to adequately measure perceptions of mental energy and fatigue. Thus, relationships between pre-exercise feelings of energy, fatigue and physical performance are not well understood.

**PURPOSE:** Describe relationships between anaerobic power during brief all-out cycling sprints and pre-exercise feelings of physical energy, physical fatigue, mental energy and mental fatigue.

**METHODS:** Ninety-four healthy men and women (18 to 29 years) completed 3 x 30-sec sprints at a high resistance. Participants were randomly assigned to cycle in an interactive or non-interactive virtual environment presented through a virtual reality setup (data presented elsewhere). Perceived feelings of energy and fatigue were measured pre-exercise using the Mental and Physical State Energy and Fatigue Scales. Compared to their capacity to perform typical mental or physical activities, participants rated their "right now" feelings of energy, vigor, pep, fatigue, exhaustion, and being worn out, on 10-cm visual analog scales. Scores were summed to yield criterion scores for physical energy, physical fatigue, mental energy and mental fatigue. Correlations between perceptions of energy, fatigue, mean power (MP) and objective performance fatigue (MP during the 1st sprint minus MP during the 3rd sprint) were used to evaluate relationships.

**RESULTS:** All variables were normally distributed. MP during the 1st 30-sec sprint was significantly related to pre-exercise perceptions of physical fatigue ( $r = -0.300$ ,  $p = .003$ ), mental fatigue ( $r = -0.270$ ,  $p = .008$ ) and mental energy ( $r = 0.246$ ,  $p = .017$ ). Performance fatigue was significantly related to pre-exercise perceptions of physical fatigue ( $r = -0.237$ ,  $p = .021$ ) and mental energy ( $r = 0.224$ ,  $p = .030$ ). Partial correlations controlling for the experimental condition and removal of outliers did not influence these relationships.

**CONCLUSIONS:** There are significant, small relationships between pre-exercise feelings of physical and mental fatigue, anaerobic power and performance fatigue.

**1444** Board #206 May 30 9:30 AM - 11:00 AM

**Assessment of Performance Fatiguability During Resistance Exercise Anchored to Ratings of Perceived Exertion**

Joshua L. Keller, Terry J. Housh, FACSM, Ethan C. Hill, Cory M. Smith, Richard J. Schmidt, Glen O. Johnson, FACSM.  
University of Nebraska - Lincoln, Lincoln, NE. (Sponsor: Terry Housh, FACSM)  
(No relevant relationships reported)

**PURPOSE:** According to the critical threshold hypothesis, fatiguing single-leg exercise at intensities above the critical force should result in performance fatiguability that is unvarying. The purpose of the present study was to examine the fatigue-related decreases in maximal voluntary isometric contractions (MVIC) as an indirect measure of performance fatiguability at intensities anchored by ratings of perceived exertion (RPE).

**METHODS:** Ten recreationally-active men ( $22.9 \pm 2.0$  yr) performed 3 randomly ordered, sustained submaximal isometric leg extension muscle actions anchored to RPE values of 2, 5, and 8 (OMNI-RES 10-point scale) until the RPE value could no longer be maintained or a maximal time-limit of 5-min was reached. The percent decline in MVIC was defined as the difference between pretest and posttest values. A 1x3 repeated measures ANOVA was used to examine mean differences in MVIC percent decline values at RPE=2, 5, and 8.

**RESULTS:** The mean ( $\pm$ SD) actual time-limits for the sustained muscle actions anchored to RPE=2, RPE=5, and RPE=8 were  $300.0 \pm 0.0$  s,  $202.0 \pm 95.5$  s, and  $87.7 \pm 27.6$  s, respectively. The pretest to posttest decreases in MVIC values for RPE=2, 5, and 8 were  $61.9 \pm 14.3$  to  $42.8 \pm 11.4$ ,  $62.4 \pm 14.3$  to  $47.9 \pm 12.8$  and  $63.0 \pm 12.6$  to  $54.0 \pm 14.7$  kg, respectively. There was a significant ( $p=0.023$ ) difference in MVIC percent decline, and the pairwise comparisons indicated that the percent decline

in MVIC was significantly ( $p<0.001$ ) greater for RPE=2 ( $30.4 \pm 11.6\%$ ) than RPE=8 ( $15.1 \pm 13.6\%$ ), but there were no differences ( $p>0.05$ ) for RPE=5 ( $22.0 \pm 14.0\%$ ) versus RPE=2 or 8.

**CONCLUSIONS:** In general, the similar MVIC percent decline values at RPE=5 and 8, as well as the greater percent decline at RPE=2, supported the critical threshold hypothesis. Furthermore, performance fatiguability as assessed from MVIC measurements followed the expected pattern of responses as those previously described for involuntary potentiated twitch amplitude. These findings also suggested that RPE=2 was below critical intensity, but RPE=5 and RPE=8 were not.

**1445** Board #207 May 30 9:30 AM - 11:00 AM

**Association between Dietary Quality and Fatigability among the Elderly in the Geisinger Rural Aging Study**

Brett Davis<sup>1</sup>, James E. Stampley<sup>1</sup>, G. Craig Wood<sup>2</sup>, Diane C. Mitchell<sup>3</sup>, Gordon L. Jensen<sup>4</sup>, Yi-Hsuan Liu<sup>3</sup>, Xiang Gao<sup>3</sup>, Bethann Whilden<sup>2</sup>, Marianne Yohn<sup>2</sup>, Krystal Cunningham<sup>2</sup>, Megan Lamotte<sup>2</sup>, Christopher D. Still<sup>5</sup>, Brian A. Irving, FACSM<sup>1</sup>. <sup>1</sup>Louisiana State University, Baton Rouge, LA. <sup>2</sup>Geisinger Medical Center, Danville, PA. <sup>3</sup>Penn State University, University Park, PA. <sup>4</sup>University of Vermont, Burlington, VT. <sup>5</sup>Penn State University, Danville, PA. (Sponsor: Brian A Irving, PhD, FACSM)  
Email: bdav159@lsu.edu  
(No relevant relationships reported)

Poor dietary quality contributes to impaired physical function and frailty in the elderly. Elevations in perceived fatigue, fatigability, likely exacerbate impairments in physical function and frailty. However, the association between dietary quality and fatigability is unknown. **PURPOSE:** We examined the cross-sectional association between overall diet quality and fatigability among the elderly in the Geisinger Rural Aging Study (GRAS). **METHODS:** In the present study, we included 122 (66F, 56M) elderly ( $\geq 80$  years) participants from the GRAS who completed the Pittsburgh Fatigability Scale (PFS) and Diet Screening Tool (DST). We used multiple linear regression to measure the association between the PFS - Physical Fatigability Score (0-50, no fatigue to extreme fatigue) and the DST Score (0-100, <60 at risk, >75 low risk) adjusted for age group, sex, BMI, and number of medications used over the past two years. **RESULTS:** The mean (SD) Physical Fatigability Score, DST Score, BMI, and number of medications were 23 (10), 60 (12), 28 (5) kg/m<sup>2</sup> and 18 (8), respectively. The females reported higher Physical Fatigability Scores compared to males ( $26 \pm 1$  vs.  $21 \pm 1$ ,  $p<0.01$ ), while those in the 90+ years old group reported higher Physical Fatigability Scores ( $28 \pm 2$ ,  $n=20$ ) compared to those in the 80-84 ( $20 \pm 1$ ,  $n=51$ ) and 85-89 ( $23 \pm 1$ ,  $n=51$ ) groups (both  $p<0.05$ ). Low diet quality, as assessed by the DST, was associated with high Physical Fatigability Score in the crude model ( $r = -0.25$ ,  $p=0.007$ ). Further adjustment for age, sex, BMI and number of medications did not change the significant inverse correlation between diet quality and physical fatigability ( $r = -0.31$ ,  $p = 0.0006$ ). **CONCLUSION:** Our results suggest that elderly individuals with lower dietary quality may also have higher physical fatigability independent of age, sex, BMI, and number of medications. In addition, both females and the oldest-of-old reported the highest levels of physical fatigability. Further studies should examine the impact that individual macronutrients as well as micronutrients have on physical fatigability in the elderly. This study is funded by the USDA, Agricultural Research Service agreement 8050-51530-012-01A

**1446** Board #208 May 30 9:30 AM - 11:00 AM

**The Effects of Music Tempo on an Exerciser's Experiences During Isometric Strength Task**

Jason R. Kostrna<sup>1</sup>, Robyn Feiss<sup>2</sup>, Gershon Tenenbaum<sup>3</sup>. <sup>1</sup>Florida International University, North Miami, FL. <sup>2</sup>Auburn University, Auburn, FL. <sup>3</sup>Florida State University, Tallahassee, FL.  
Email: jkostrna@fiu.edu  
(No relevant relationships reported)

**PURPOSE:** This study examined the effects of different music tempos on effort-related thoughts, rating of perceived exertion (RPE), affect, heart rate, and performance during isometric strength exercises. Recent research on musical stimuli during exercise supports that music has multiple physiological and psychological responses during exercise including: attention, RPE, affect, and performance (e.g., Atler et al., 2015; Connon, 2011; Crust, 2004; Dyrland & Winger, 2008; Karageorghis, Terry, Lane, Bishop, & Priest, 2011).

**METHODS:** Participants were assigned randomly to one of three conditions: silent control, fast tempo music first followed by slow tempo music, and slow tempo music first followed by fast tempo music, and performed a two different isometric strength exercises in a counter-balanced order. **RESULTS:** RM ANOVAs revealed non-significant differences among conditions during any of the trials, indicating that the presence of music of either slow or fast tempo failed to influence HR,  $F(2, 55) = 2.48$ ,

$p = .09$ ,  $\eta^2 = .07$ , RPE,  $F(2, 60) = 0.75$ ,  $p = .48$ ,  $\eta^2 = .02$ , attention,  $F(2, 60) = 0.15$ ,  $p = .86$ ,  $\eta^2 < .01$ , time to voluntary exhaustion,  $F(2, 60) = .81$ ,  $p = .45$ ,  $\eta^2 = .02$ , and affect,  $F(2,60) = 1.98$ ,  $p = .15$ ,  $\eta^2 = 0.07$ .

**CONCLUSIONS:** Music of either tempo did not have an effect on exerciser's experience of an isometric strength test. However, these results are in line with Tenenbaum's (2001) social-cognitive model which postulates that as exercise intensity increases attentional flexibility decreases and attention narrows to associative, somatic cues.

1447 Board #209 May 30 9:30 AM - 11:00 AM

**Association between Fatigability and Physical Function among the Elderly in the Geisinger Rural Aging Study**

James E. Stampley<sup>1</sup>, Brett Davis<sup>1</sup>, G. Craig Wood<sup>2</sup>, Diane C. Mitchell<sup>3</sup>, Gordon L. Jensen<sup>4</sup>, Yi-Hsuan Liu<sup>3</sup>, Xiang Gao<sup>3</sup>, Bethann Whilden<sup>2</sup>, Marianne Yohn<sup>2</sup>, Krystal Cunningham<sup>2</sup>, Megan Lemotte<sup>2</sup>, Christopher D. Still<sup>2</sup>, Brian A. Irving, FACSM<sup>1</sup>. <sup>1</sup>Louisiana State University, Baton Rouge, LA. <sup>2</sup>Geisinger Medical Center, Danville, PA. <sup>3</sup>Penn State University, University Park, PA. <sup>4</sup>University of Vermont, Burlington, VT. (Sponsor: Brian A Irving, PhD, FACSM)  
Email: jstamp5@lsu.edu  
(No relevant relationships reported)

Elevations in perceived fatigue, fatigability, likely contribute to impairments in physical function in the elderly. However, the independent and combined effects of physical and mental fatigability on physical function in the elderly is unknown. **PURPOSE:** We examined the cross-sectional associations between physical fatigability, mental fatigability, and physical function among the elderly in the Geisinger Rural Aging Study (GRAS). **METHODS:** Here, we included 122 (66F, 56M) elderly ( $\geq 80$  years) participants from the GRAS who completed the Pittsburgh Fatigability Scale (PFS) and PROMIS Physical Function, Short-Form 20a [question pfa11 was excluded due to missing values]. We used multiple linear regression to measure the association between the PROMIS Physical Function Score (19-95) and PFS - Physical Fatigability Score (0-50, no to extreme physical fatigue) and PFS - Mental Fatigability Score (0-50, no to extreme mental fatigue) adjusted for age, sex, BMI, and number of medications used over the past two years. **RESULTS:** The mean (SD) Physical Function Score, Physical Fatigability Score, Mental Fatigability Score, BMI, and number of medications were 80 (11), 23 (10), 12 (11), 28 (5) kg/m<sup>2</sup> and 18 (8), respectively. Low Physical Function Scores were associated with higher Physical and Mental Fatigability Scores in crude models ( $r = -0.65$ ,  $p < 0.0001$  and  $r = -0.38$ ,  $p < 0.0001$ , respectively). When Physical and Mental Fatigability Scores were included in the same model, the association between the Physical Function and Physical Fatigability Scores remained significant ( $r = -0.57$ ,  $p < 0.0001$ ), while the association between the Physical Function and the Mental Fatigability Scores was no longer significant ( $r = 0.07$ ,  $p = 0.43$ ). Adjustment for age, sex, BMI and number of medications did not change the significant inverse association between the Physical Function and Physical Fatigability Scores ( $r = -0.65$ ,  $p < 0.0001$ ). **CONCLUSION:** Our results suggest that elderly individuals with lower physical function may also have higher physical fatigability independent of age, sex, BMI, and number of medications. Future studies should examine the impact of improving physical fatigability on physical function in the elderly. This study is funded by the USDA, Agricultural Research Service agreement 8050-51530-012-01A

1448 Board #210 May 30 9:30 AM - 11:00 AM

**Longitudinal Association Between Fatigability and Executive Function: Results from the Baltimore Longitudinal Study of Aging**

Elizabeth Salerno<sup>1</sup>, Amal Wanigatunga<sup>2</sup>, Jacek Urbanek<sup>2</sup>, Eleanor Simonsick<sup>3</sup>, Susan Resnick<sup>3</sup>, Jennifer Schrack<sup>2</sup>. <sup>1</sup>National Cancer Institute, Bethesda, MD. <sup>2</sup>Johns Hopkins Bloomberg School of Public Health, Baltimore, MD. <sup>3</sup>National Institute on Aging, Baltimore, MD. (Sponsor: Charles Matthews, FACSM)  
(No relevant relationships reported)

Cognitive decline, specifically within the domains of executive function, has been consistently associated with diminished life satisfaction and the ability to carry out activities of daily living in older adults. As the population continues to age, identifying methods of attenuating cognitive decline is important for promoting long-term survival and quality of life. Previous research has suggested that fatigability, one's perceived exertion after a standardized walking task, is associated with declines in physical function; however, it remains unclear as to whether these effects may also extend to cognitive function. **PURPOSE:** To examine whether fatigability is associated with executive function among individuals participating in the Baltimore Longitudinal Study of Aging (BLSA). **METHODS:** The BLSA is an ongoing study of normative human aging. Participants included 1,068 older adults ( $M_{age} = 67.3 \pm 12.7$  years)

seen between 2007 and 2015. At baseline and after  $M = 4.5 \pm 1.8$  years of follow-up, individuals completed a physical examination, health history assessment, standardized walking task to assess fatigability, and cognitive battery assessing several domains of executive function. **RESULTS:** Multiple linear regression analyses revealed significant effects of baseline fatigability on several domains of executive function at follow-up: Digit Symbol Substitution Test ( $\beta = -0.47$ ,  $p = 0.011$ ), Trails Part B ( $\beta = 1.85$ ,  $p = 0.031$ ), and Trail Making Delta (Part B-Part A;  $\beta = 1.56$ ,  $p = 0.038$ ). Specifically, higher baseline fatigability was significantly associated with poorer cognitive performance at follow-up after controlling for age, sex, race, body mass index (kg/m<sup>2</sup>), years of education, years of follow-up, and number of comorbid conditions. **CONCLUSIONS:** Our findings suggest that the perception of fatigue in response to a standardized walking task may act as an indicator of future cognitive decline, at least in the short-term (e.g., 5 years). More research is warranted to examine the underlying biological mechanisms contributing to this relationship as well as how future interventions may target fatigability in mid-life to potentially attenuate age-related cognitive decline. Supported by NIH Grants R21AG053198, P30AG021334, and U01AG057545

1449 Board #211 May 30 9:30 AM - 11:00 AM

**The Perceptual Responses to Continuous vs Intermittent Blood Flow Restriction Resistance Exercise**

Eduardo D. S. Freitas<sup>1</sup>, Ryan M. Miller<sup>1</sup>, Aaron D. Heishman<sup>1</sup>, Japneet Kaur<sup>1</sup>, Brady S. Brown<sup>1</sup>, Julio C. G. Silva<sup>2</sup>, Rodrigo R. Aniceto<sup>3</sup>, Joao B. Ferreira-Junior<sup>4</sup>, Michael G. Bembem, FACSM<sup>1</sup>. <sup>1</sup>University of Oklahoma, Norman, OK. <sup>2</sup>Federal University of Paraiba, João Pessoa, Brazil. <sup>3</sup>Federal Institute of Rio Grande do Norte, Currais Novos, Brazil. <sup>4</sup>Federal Institute of Southwest Minas Gerais, Rio Pomba, Brazil. (Sponsor: Michael G. Bembem, FACSM)  
(No relevant relationships reported)

**PURPOSE:** To investigate the perceptual responses (ratings of perceived exertion [RPE] and discomfort [RD]) to continuous and intermittent resistance exercise (RE) with blood flow restriction (BFR; 50% of total occlusion pressure), as well as to compare these responses to high- and low-load RE without BFR. **METHODS:** Fifteen untrained participants were randomly assigned to 4 RE conditions: 1) low-load with continuous BFR (cBFR: cuffs remain inflated between sets); 2) low-load with intermittent BFR (iBFR: cuffs are deflated between sets); 3) low-load without BFR (LI); and 4) high-load without BFR (HI). For all low-load conditions, participants performed 4 sets (30-15-15-15 reps) of bilateral leg press and knee extension at 20% of 1RM, whereas the HI condition involved 4 sets (10-10-10-10 reps) at 70% of 1RM for the same exercises. RPE was assessed after each set using the OMNI-RES scale with scores ranging from 0 to 10. RD was assessed before exercises and after each set using a visual analog pain scale with scores ranging from 0 to 10. Data were analyzed using the Friedman's and the Wilcoxon tests with Bonferroni correction and  $p$  set at 0.05. **RESULTS:** There were no significant ( $p > 0.05$ ) differences in RPE after each set of leg press for the cBFR and iBFR conditions. HI was significantly ( $p < 0.05$ ) greater than all low-load conditions after each set except for cBFR at sets 1 and 2. There were no significant differences ( $p > 0.05$ ) in RD after each set of the cBFR, iBFR, and HI conditions, except after set 4, when HI was significantly ( $p < 0.05$ ) greater than iBFR. For knee extension, similar responses were observed for RPE after each set, with no significant differences ( $p > 0.05$ ) observed for cBFR, iBFR, and LI conditions; however, HI was significantly ( $p < 0.05$ ) greater than the other 3 conditions. For the HI condition, RD was significantly ( $p < 0.05$ ) greater than the iBFR condition at baseline. Similar RD values were observed for the cBFR, iBFR, and HI conditions after each set, which was significantly ( $p < 0.05$ ) greater than the LI condition. **CONCLUSION:** Continuous and intermittent RE with BFR seem to elicit similar perceptual responses. For RPE, these responses were similar to those from low-load RE and lower than those from high-load. For RD, both BFR conditions were similar to high-load levels and greater than the low-load condition.

1450 Board #212 May 30 9:30 AM - 11:00 AM

**Emotional Influence Of Music In Relation To The Effect Of Music On Exercise Performance**

Kayla M. Baker, Jeanette Garcia, Tal Belity. University of Central Florida, Orlando, FL.  
(No relevant relationships reported)

**PURPOSE:** The purpose of this study is to examine the relationship between individuals' emotional influence of music (EIM) and the effect of listening to music during treadmill running. **METHODS:** Twenty-two recreationally-active adults ( $21.7 \pm 1.78$  yrs) completed six visits, including an initial visit to complete a questionnaire to assess EIM. During this visit, participants also created a personal playlist from a song database which utilized cadences of 180 beats per minute. Participants completed treadmill familiarization trials, running at a self-selected pace for 20 minutes, during the second and third visits. Participants then completed a VO2max test on the treadmill during the fourth visit, where running speeds and ratings

of perceived exertion (RPE) were measured. During the final two visits, participants completed time-to-exhaustion (TTE) trials while running at a speed corresponding to 80% of their VO<sub>2</sub>max on a treadmill. For these trials, two separate conditions were utilized: 1) no music (NM); and 2) self-selected music (SSM). Bivariate correlations were used to determine the relationship between EIM and physiological variables, while paired samples t-tests were used to examine differences between TTE trials. **RESULTS:** A significant difference was found between TTE with NM (M=12.18±5.77) and TTE with SSM (M=14.36±5.22) (t=4.124, p<0.001). EIM was positively correlated to RPE during the TTE without music (r=0.457, p<0.05), while VO<sub>2</sub>max was negatively correlated to the difference between TTE trials (r=-0.481, p<0.05). **CONCLUSION:** Individuals with a higher EIM perceived greater exertion during running without music compared to running while listening to music, indicating that these individuals may experience a heightened level of motivation or inspiration while using music as an external stimulus during exercise and a diminished level of motivation when music is not utilized. Additionally, individuals with a greater VO<sub>2</sub>max experienced less of a difference between TTE trials, suggesting that individuals with greater aerobic fitness may not rely on external stimuli for motivation, regardless of EIM. Utilizing music as an external stimulus to increase motivation may be a beneficial tool for certain individuals, whether it be in a personal training environment or a physical rehabilitation setting.

**1451** Board #213 May 30 9:30 AM - 11:00 AM  
**Declines In Mental Energy Led To Decreases In Functional Balance: A Pilot Study Using Machine Learning To Detect Changes In Functional Balance**  
 Ali Boolani, Jenna Ryan, Trang Vo, Brandon Wong, Natasha Kholgade Banerjee, George Fulk. *Clarkson University, Potsdam, NY.* (Sponsor: Dr. Bert Jacobson, FACSM)  
 Email: aboolani@clarkson.edu  
 (No relevant relationships reported)

**Purpose:** The purpose of this study was to determine the impact of mental task performance on fall risks and to use machine learning to predict changes in fall risk assessments.  
**Methods:** Using a crossover-design, older adults (N=11) were recruited from the community and assigned to random allocation of days where they performed fall risk assessments (30 second chair stand test (CST), Timed-up-and-Go (TUG), and Berg Balance Scale (BBS) prior to and after the completion of mental tasks or days where they were told to perform non-mentally and physically taxing tasks (i.e. talk, listen to music) in between the completion of fall risk assessments. A Wilcoxon Sign Rank Test was used to assess differences in fall risks and a Friedman's rank test was used to assess changes in mood (energy, fatigue, physical and mental energy and fatigue). Using the X-box Kinect we measured variances in 25 joints. A random forest classifier was used to predict changes in functional balance. **Results:** Analysis yielded statistically significant declines in feelings of energy (p=.003), specifically mental energy (p=.015), and a decline in the BBS (p<.001) for participants on days when they completed mental tasks compared to days they did not. There were no significant differences (p>.05) between other moods and fall risk assessments. We observed a significant increase (p=.006) in joint variance during the "standing with eyes closed" part of the BBS after the subjects had performed mental tasks. In the post-hoc analysis our random-forest algorithms allowed us to predict with 79.0% accuracy whether the "standing with eyes closed" part of the BBS was performed after a decline a mental energy or not. The false positive rate was 40.0% and the false negative rate was 21.0%. **Conclusions:** The results of our study suggest that declines in mental energy negatively impacts postural control. Our work was able to predict with a fair degree of accuracy when someone had a decline in mental energy based on changes in functional balance however, it was unable to predict when there was no mental work performed. This suggests that when there is no decline in feelings of energy there is no change in functional balance, and mental work leads to declines in postural control.

**1452** Board #214 May 30 9:30 AM - 11:00 AM  
**Exercise Intensity: Do Individuals Perceive It as We Physiologically Define It?**  
 Kristofer Wisniewski. *Saint Francis University, Loretto, PA.*  
 Email: kwisniewski@francis.edu  
 (No relevant relationships reported)

The ACSM defines exercise intensities using physiological measures (%VO<sub>2</sub>max, %VO<sub>2</sub>R, %HRmax, %HRR). Currently, there are no studies examining if individuals perceive the exercise intensity as it is defined by the physiological ranges for each measure. **PURPOSE:** To determine if individuals perceive aerobic exercise intensities as defined by ACSM physiological criteria. **METHODS:** Sixty-three subjects (31 females, 32 males) aged 28.3 ± 11.3 years, BMI 25.0 ± 3.5 kg·m<sup>-2</sup>, and VO<sub>2</sub>max 43.0 ± 9.0 mL·kg<sup>-1</sup>·min<sup>-1</sup> participated in this study. Subjects completed a Bruce treadmill protocol to maximal exertion while rating the intensity at the end of each stage using a Perceived Intensity (PI) scale. The scale reads: Very Light, Light, Moderate, Vigorous, Near Maximal, and Maximal. Subjects were given standard instructions on how to

use the scale prior to the test. Actual Intensity (AI) was determined using %VO<sub>2</sub>max, %VO<sub>2</sub>R, %HRmax, and %HRR attained at the end of each stage. PI rated at the end of each stage was compared against the AI for each variable. **RESULTS:** Correlation analyses showed strong relationships between PI responses and %VO<sub>2</sub>max (r = 0.886, p < 0.05), %VO<sub>2</sub>R (r = 0.891, p < 0.05), %HRmax (r = 0.858, p < 0.05), and %HRR (r = 0.862, p < 0.05). Cohen's Kappa (K) for the total sample showed fair to moderate agreements between PI and AI for %VO<sub>2</sub>max (K = 0.405, p < 0.05), %VO<sub>2</sub>R (K = 0.394, p < 0.05), %HRmax (K = 0.386, p < 0.05), and %HRR (K = 0.392, p < 0.05). The Contingency table for %VO<sub>2</sub>max showed only 37.0% of PI ratings at a Moderate intensity were accurate with 61.1% of PI rated as less than Moderate. Vigorous intensity ratings were similar with 33.9% accuracy, and 61.3% of ratings as less than Vigorous. **CONCLUSION:** Current physical activity recommendations state that adults should participate in moderate and vigorous intensity activities for health-related benefits. Despite having strong relationships with physiological criteria, the majority of subjects under-rated moderate and vigorous intensities. The results suggest that further subjective definitions of intensity may be needed to match perceptions with physiological measures. Therefore, individuals may need additional familiarization with intensity definitions if they are going to use perceptual measures to regulate intensity.

**1453** Board #215 May 30 9:30 AM - 11:00 AM  
**Effect of Prescribing Exercise through Verbal Commands on Psychophysiological Responses in Walkers or Runners**  
 Sergio G. da Silva<sup>1</sup>, Armando L. Bonfim Neto<sup>1</sup>, Lucio Follador<sup>1</sup>, Sandro S. Ferreira<sup>1</sup>, Murilo Bastos<sup>1</sup>, Ragami C. Chaves<sup>1</sup>, Antoby G. Lopes<sup>1</sup>, Maressa P. Krause<sup>2</sup>, Carlo Baldari, FACSM<sup>3</sup>. <sup>1</sup>Universidade Federal do Parana, Curitiba, Brazil. <sup>2</sup>Universidade Tecnologica Federal do Parana, Curitiba, Brazil. <sup>3</sup>Link Campus University, Rome, Italy.  
 Email: sergiogregorio1@gmail.com  
 (No relevant relationships reported)

**Purpose:** To compare the effect of prescribing exercise intensity through verbal commands on physiological, perceptual and affective responses in habitual walkers or runners. **Methods:** Fifteen walkers or runners (11 men, 4 women; age: 39.9 ± 9.9 years; height: 172.0 ± 6.1 cm; body mass: 72.6 ± 9.5 kg; BMI: 24.5 ± 2.5 kg·m<sup>-2</sup>; VO<sub>2</sub>max: 46.3 ± 7.4 mL·kg<sup>-1</sup>·min<sup>-1</sup>; HR<sub>max</sub>: 177.2 ± 11.5 bpm) were submitted to four trials of walking or running at self-selected intensities corresponding to the following verbal commands: Preferred, Low, Moderate and High. All trials were performed in a randomized order. Heart rate (%HR<sub>max</sub>), ratings of perceived exertion (RPE 0-10, OMNI-Walk/run scale) and feelings of pleasure/displeasure (-5 to +5, Feeling Scale) were recorded at the end of each trial. **Results:** Walking or running based on the Preferred-intensity verbal command elicited similar speed, %HR<sub>max</sub> and RPE values, and pleasant feelings compared to the Moderate trial. The High trial was the most effortful and the least pleasant one. All trials elicited %HR<sub>max</sub> values that are within the range proposed by the ACSM to promote health-related outcomes.

	Preferred	Low	Moderate	High
<b>Speed (m·s<sup>-1</sup>)</b>	3.3 ± 0.6	2.7 ± 0.6 <sup>a</sup>	3.1 ± 0.6 <sup>b</sup>	3.7 ± 0.6 <sup>abc</sup>
<b>%HR<sub>max</sub></b>	91.3 ± 6.3	81.4 ± 9.7 <sup>a</sup>	89.9 ± 8.4 <sup>b</sup>	96.2 ± 3.9 <sup>abc</sup>
<b>RPE</b>	4.5 ± 0.6	2.3 ± 0.4 <sup>a</sup>	4.5 ± 0.4 <sup>b</sup>	7.8 ± 0.4 <sup>abc</sup>
<b>Feeling Scale</b>	3.6 ± 1.0	2.4 ± 2.1	3.7 ± 1.3	0.5 ± 2.5 <sup>ac</sup>

<sup>a</sup>different from Preferred; <sup>b</sup>different from Low; <sup>c</sup>different from Moderate. p < .01.

**Conclusion:** Prescribing walking or running through verbal commands seems highly attractive due to its effectiveness and simplicity. Walking or running at the Preferred-intensity verbal command may promote health-related outcomes and elicit a positive affective experience, which might influence exercise adherence.

**1454** Board #216 May 30 9:30 AM - 11:00 AM  
**Relationship Among Site Specific Fat, Lean Mass, And Endogenous Pain Inhibitory Function**  
 Jessica A. Peterson, Cameron Lohman, Michael Bembem, FACSM, Rebecca Larson, Christopher D. Black, FACSM. *University Of Oklahoma, Norman, OK.* (Sponsor: Christopher Black, FACSM)  
 Email: jessica.a.peterson-1@ou.edu  
 (No relevant relationships reported)

Overweight individuals experience greater functional and psychological complications of chronic pain. Dysfunction of endogenous pain-modulatory mechanisms such as conditioned pain modulation (CPM) and exercise-induced hypoalgesia (EIH) have

been found across a host of chronic pain conditions. **PURPOSE:** The purpose of the study was to assess endogenous pain inhibitory function and its relationship with whole body and site specific lean and fat mass. **METHODS:** PPT of 73 participants (38F; 35M) were assessed in the vastus lateralis (VL) and brachioradialis (BR) using a pressure algometer on both sides of the body before and after submersion of their feet in an ice bath (2°C) for 1min and an isometric knee extension, time to failure task based off of 25% of their maximal voluntary contraction. The difference between post and pre measures was defined CPM response (ice bath) and EIH response (exercise condition). Whole body and site specific fat and lean tissue were assessed via DXA scan, and muscle and fat thickness were assessed in the right (R) and left (L) VL and BR using ultrasound and skinfolds. **RESULTS:** Both CPM and EIH responses significantly increased PPTs for all of the four measured sites ( $p \leq 0.001$ ). BF% ( $r=0.256$ ;  $p=0.029$ ) and fat mass ( $r=0.277$ ;  $p=0.018$ ) correlated with LBR CPM but not with site specific measures ( $p>0.05$ ). RBR, RVL, and LVL CPM did not correlate with any measures of body composition ( $p>0.05$ ). An inverse relationship was found between dominant VL EIH and whole body lean mass ( $r=-0.259$ ;  $p=0.028$ ), as well as limb specific lean mass ( $r=-0.262$ ;  $p=0.026$ ). No relationships were found between any of the body composition measures and non-dominant VL ( $p>0.05$ ). **CONCLUSION:** It appears that in young, healthy adults, whole body and site specific fat mass does not influence endogenous pain-inhibitory function. However, having more lean tissue may have a negative effect on the EIH response. This may be due to larger muscle mass leading to a faster rate of fatigue, reducing exercise time which may have influenced the EIH response rather than muscle mass per se.

**1455 Board #217 May 30 9:30 AM - 11:00 AM**  
**Effects Of Carbonated Sports Drink Intake After High-intensity Exercise On Fatigue Recovery In Athletic Sprinters**

Natsuki Hasegawa<sup>1</sup>, Shumpei Fujie<sup>2</sup>, Naoki Horii<sup>1</sup>, Takafumi Hamaoka, FACSM<sup>3</sup>, Motoyuki Iemitsu<sup>1</sup>. <sup>1</sup>*Ritsumeikan University, Kusatsu, Japan.* <sup>2</sup>*University of Tsukuba, Ibaraki, Japan.* <sup>3</sup>*Tokyo Medical University, Shinjuku-ku, Japan.* (Sponsor: Takafumi Hamaoka, FACSM)  
 Email: hase0528@fc.ritsumei.ac.jp  
 (No relevant relationships reported)

Carbon acid bathing elevates vasodilation and blood flow due to transcutaneous absorption of carbon acid, resulting in acceleration of fatigue recovery. On the other hand, carbonated drink intake has no effect on aerobic exercise performance in endurance athletes. However, the effect of carbonated drink intake on anaerobic exercise performance remains unclear. **PURPOSE:** This study aimed to clarify whether carbonated sports drink intake after high-intensity exercise promotes fatigue recovery, leading to attenuation of performance decrement in athletes. **METHODS:** Seven male and four female athletic sprinters were enrolled in this study (20.4±0.4 years). All subjects performed wingate exercise session, as an index of anaerobic exercise capacity, (3 sets of 20-sec all-out pedaling on a cycle ergometer against a resistance equivalent to 7.5 % of body weight, with a 30-sec rest), and the same exercise session is performed once again after a 25-mins break. They orally took carbonated sports drink (CSD) containing 22g of carbon acid or non-carbonated sports drink (NCSD) (500mL) during the 25-mins break in a crossover randomized trial with 3-4days between each trial. Blood lactate concentration was measured at rest and 1, 3, 5 and 10 mins after the first exercise session. **RESULTS:** In all athletic sprinters, mean power output of the first set at the second exercise session was significantly higher in the CSD intake than the NCSD intake ( $P<0.05$ ). Additionally, in males, mean power output of the first set at the second exercise session in the CSD intake tended to be higher compared with the NCSD intake ( $P=0.07$ ), whereas, no significant difference was observed in females. Moreover, in males, lactic acid integrated value after 10 mins of first exercise session in males was significantly lower in the CSD intake than NCSD intake ( $P<0.05$ ), but there was no significant difference in females. **CONCLUSIONS:** These results suggest that the carbonated sports drink intake after high-intensity exercise may promote fatigue recovery, and this effect may differ by gender. Supported by JSPS KAKENHI (#18H06423, N. Hasegawa)

**C-40 Free Communication/Poster - Cold/Hyperbaric/Diving Physiology**

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

**1456 Board #218 May 30 9:30 AM - 11:00 AM**  
**Circulating Mcp-1 During And Following Prolonged Cycling In Cold Temperature**

Ellen L. Glickman, FACSM, Cody Dulaney, Emily Tagesen, Eliot Arroyo, Brittany N. Followay, Jeremiah A. Vaughan, Adam R. Jajtner. *Kent State University, Kent, OH.*  
 Email: eglickma@kent.edu  
 (No relevant relationships reported)

**PURPOSE:** The purpose of this investigation was to examine the impact of aerobic exercise in a cold condition on the recruitment of classical monocytes (CD14++CD16-). **METHODS:** Six recreationally active men (24.7±3.9 yrs; 182.3±6.9 cm; 85.7±12.8 kg; 3.7±0.3L·min<sup>-1</sup>) completed three experimental conditions; a VO<sub>2</sub>max test, and a cycling protocol in 9°C/55% Relative Humidity (RH)(LTLH), and 24°C/38%RH (MTMH). The exercise session consisted of 60-min cycling at 60% VO<sub>2</sub>max, 15-min rest, and a time to exhaustion at 90% VO<sub>2</sub>max (TTE). Blood samples were obtained before (PRE), after 60-min of cycling (60), after TTE (90) and after 1-hour of recovery (REC). Blood was analyzed for plasma concentration of Monocyte Chemoattractant Protein 1 (MCP-1) via ELISA, and the expression of MCP-1 receptor (CCR2) on classical monocytes and assessed by flow cytometry. Expression was determined based on fold changes over fluorescence minus one (FMO). Data were analyzed using within-subjects repeated measures ANOVA. **RESULTS:** No interaction ( $F = 2.3$ ;  $p = 0.128$ ;  $\eta^2_p = 0.251$ ), main effect for time ( $F = 1.9$ ;  $p = 0.202$ ;  $\eta^2_p = 0.209$ ) nor main effect of condition was observed ( $F = 0.13$ ;  $p = 0.727$ ;  $\eta^2_p = 0.018$ ) for circulating MCP-1. No interaction ( $F = 1.7$ ;  $p = 0.251$ ;  $\eta^2_p = 0.249$ ) was observed for CCR2 expression on classical monocytes, however, a main effect for time ( $F = 31.2$ ;  $p = 0.002$ ;  $\eta^2_p = 0.862$ ) was observed. CCR2 expression was maintained from PRE (137.6 ± 37.4) to 60 (124.4 ± 91.2,  $p = 0.068$ ), before decreasing at 90 (124.4 ± 36.8,  $p = 0.001$ ) and REC (86.4 ± 25.2,  $p < 0.001$ ). **CONCLUSION:** This data indicates that prolonged cycling in cold temperature may reduce the recruitment of classical monocytes, evident by reduced CCR2 expression. This may indicate a suppression of classical monocyte recruitment during exercise in moderate and cold temperatures. Further research is warranted to assess these responses at greater intensities or duration.

**1457 Board #219 May 30 9:30 AM - 11:00 AM**  
**Effects Of Cooled Compression Exercise Technology On Health, Sleep, And Quality Of Life In Veterans.**

Pat Marques<sup>1</sup>, Grove Higgins<sup>1</sup>, Chloe Wernecke<sup>2</sup>, Sara Webb<sup>1</sup>, Lindsay Haughton<sup>1</sup>, Liz Grimm<sup>1</sup>, Mary Wilson<sup>1</sup>, Aaron Black<sup>1</sup>, Cristian Torres<sup>2</sup>. <sup>1</sup>*Colorado Springs Center for Human Performance and Rehabilitation, Colorado Springs, CO.* <sup>2</sup>*Vaspar Systems, Moffett Field, CA.*  
 (No relevant relationships reported)

Veterans are disproportionately affected by physical and emotional functional disorders compared to their civilian counterparts, a discrepancy that is deepened by delay to care within the Veterans Health Administration. Research has supported use of compression exercise in physically limited populations and demonstrated physiological responses at lower intensities (10-20% one repetition maximum vs 70% for hypertrophy in resistance exercise). Combination of low-pressure compression exercise and cooling has shown elevated growth hormone and testosterone and depressed nighttime cortisol, indicating this may be beneficial for addressing emotional and sleep dysfunctions. **PURPOSE:** To determine the safety and efficacy of an accessible cooled compression exercise system on markers of physical and emotional function in veterans. **METHODS:** 14 veterans completed 24 sessions in 12 weeks. Baseline and endpoint questionnaires validated for clinical significance were administered to determine sleep quality (Pittsburg Sleep Quality Index), quality of life (RAND Short Form 36), and respiratory dysfunction related to stress and anxiety (Nijmegen Questionnaire). **RESULTS:** Two-tailed T-tests were performed on the data. Sleep quality improved in 71% of subjects (9.15±6.87 vs 5.57±3.74,  $p = 0.0232$ ), 57% improved quality of life (73.45±17.17 vs 84.46±9.27,  $p = 0.0316$ ), and 71% decreased adverse respiratory symptoms (11.29±8.38 vs 7.86±6.26,  $p = 0.0594$ ) compared to baseline. Increases were seen in all 8 sub-scores of quality of life, with statistically significant improvements in social functioning (75±28.17 vs 94.64 ± 11.62,  $p = 0.0058$ ), energy and fatigue (48.93±25.21 vs 65.63±19.26,  $p = 0.0426$ ), emotional wellbeing (66±24.29 vs 85.14±14.16,  $p = 0.0054$ , and general health (72.14±15.78 vs 79.64±12.78,  $p = 0.0497$ ). For sleep quality, those subjects with baseline scores defined as clinically disturbed sleep (n=8, 58%) all (100%) experienced sleep improvements (9.14±6.87 vs 5.57±3.74,  $p = 0.00301$ ), with 25% resolving below clinical delineation.

**CONCLUSION:** These findings suggest that the combination of cooling and compression exercise may be an effective intervention method to address symptoms in veterans and other individuals living with insomnia, post-traumatic stress, chronic fatigue, and depression.

**1458 Board #220 May 30 9:30 AM - 11:00 AM**  
**Whole-body Cryotherapy: Case Series Of Sleep, Pain And Anxiety In Healthy Individuals**

Jennifer L. Scheid<sup>1</sup>, James W. Kenney<sup>2</sup>, Daniel H. Lang<sup>2</sup>, Nicole Chimera<sup>3</sup>. <sup>1</sup>Daemen College, Amherst, NY. <sup>2</sup>Cryo Wellness of America, Depew, NY. <sup>3</sup>Brock University, St. Catharines, ON, Canada.  
 Email: jscheid@daemen.edu  
 (No relevant relationships reported)

**BACKGROUND:** Whole-body cryotherapy (WBCT) takes place in an enclosed chamber at -184 degrees Fahrenheit. WBCT is currently used to alleviate inflammation and pain in arthritis and osteoarthritis and for pain relief in fibromyalgia. However, to date, only anecdotal evidence exists on the benefits of cryotherapy to provide deep, restful sleep. **PURPOSE:** The purpose of this case series was to test the hypothesis that WBCT would have a positive impact on sleep, pain levels and anxiety of healthy individuals. **METHODS:** Surveys regarding sleep, pain levels and anxiety were administered before and after 10 WBCT sessions (max 3 minutes) to five participants (Age > 50). Sleep was assessed using the Pittsburg Sleep Quality Assessment Index (PSQI), pain was assessed using the Borg Rate of Perceived Pain Scale, and anxiety was assessed using the Hamilton Anxiety Scale. **RESULTS:** One male (Age 74, BMI = 30.7 kg/m<sup>2</sup>, Caucasian) and one female (Age 73, BMI = 24.9kg/m<sup>2</sup>, Caucasian) presented with pain from arthritis and while the WBCT had no impact on sleep or anxiety, their pain was reduced from moderate/strong pain (Borg = 4) to extremely weak pain (Borg = 0.5) and from moderate/strong pain (Borg = 4) to weak/moderate pain (Borg = 2.5), respectively. One female (Age 52, BMI = 24.0 kg/m<sup>2</sup>, Caucasian) presented with stress/anxiety and sleep problems. Her pain improved from moderate (Borg = 3) to very weak (Borg =1), her sleep quality improved by 12 points on the PSQI and her anxiety score improved by 18 points on the Hamilton anxiety scale. Finally, two females (Age 65 and 72) both had no specific reason for trying the WBCT. Both demonstrated no changes in pain, sleep, or anxiety. **CONCLUSION:** These five cases demonstrate that WBCT can improve pain if the subjects present with moderate (or greater pain) and that WBCT may be able to improve sleep and anxiety in subjects that present with problems with sleep or anxiety. Future research is needed in larger samples of people with a history pain, anxiety and/or sleep issues to continue to test the hypothesis that WBCT may have a positive impact on sleep, pain levels and anxiety.

**1459 Board #221 May 30 9:30 AM - 11:00 AM**  
**Human Physiologic Thermogenic Response to Resting Cold-Water Immersion: A Thorough Calorimetric Inquiry**

James E. Campbell, Elizabeth R. Bergeron, Christopher D. Gallagher, John P. Florian. Navy Experimental Dive Unit, Panama City, FL.  
 (No relevant relationships reported)

**PURPOSE:** Navy Diver thermal protection, a primary concern in attempting or completing cold-water tasks, remains inadequate. Optimal heat distribution with minimal energy input is sought. Therefore, heating requirements that support thermal balance (TB) in various cold-water scenarios were quantified. **METHODS:** Nine active duty Navy personnel underwent four resting immersion scenarios in a temperature-controlled 4900-gallon water tank after donning the same full-body tubsuit calorimeter (for diver heat delivery and measurement), undergarments, and a dry suit (total 1.2 Clo). Each subject achieved TB ( $\leq$  2hrs immersion). TB was defined as temperature equilibrium where core and mean skin temperatures varied  $\leq$  0.2°F over 20 minutes time. The four scenarios were combinations of the independent variables: 1) inlet tubsuit water temperature (89 and 102°F), and 2) immersion tank temperature (35 or 50°F). **RESULTS:** Metabolic compensation continuously increased over time (Fig 1a) in the 89°F tubsuit/35°F immersion temperature water group. At the fourth quartile time point (during achievement of thermal balance, Fig 1a - Fourth), subjects in the groups of greater tubsuit heat delivery (102°F) required significantly less metabolic activity than did the coldest scenario (89°F/35°F). Distal anatomical sites showed much lower temperatures than proximal sites (data not shown). Tubsuit heat delivery (Wattage) increased significantly (Fig 1b) with both greater tubsuit temperature (102°F vs 89°F) and in colder water immersion (35°F vs 50°F). Thermal balance was achieved in all scenarios thereby allowing steady-state assessment of heat input/extraction parameters. All \* indicate p<0.05. **CONCLUSIONS:** Given that thermal balance was achieved over the course of each  $\leq$  2-hr exposure, results suggest that using a lower tubsuit perfusion temperature (89°F vs 102°F) requires less Wattage provided a sufficient metabolic response is activated during the immersion.

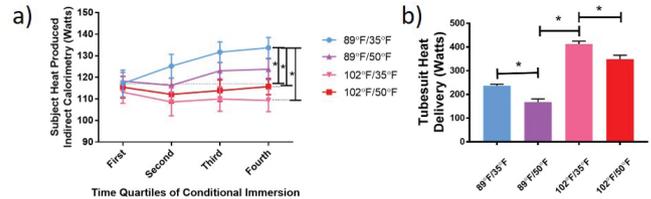


Figure 1

**1460 Board #222 May 30 9:30 AM - 11:00 AM**  
**Consecutive, Long-Duration Hyperoxic Immersions Effect on Skeletal Muscle Performance in Well Trained, Male Divers**

Christopher M. Myers<sup>1</sup>, Jeong-Su Kim, FACSM<sup>1</sup>, John Florian, FACSM<sup>2</sup>. <sup>1</sup>Florida State University, Tallahassee, FL. <sup>2</sup>Navy Experimental Dive Unit, Panama City Beach, FL. (Sponsor: John Florian, FACSM)  
 Email: cmm13c@my.fsu.edu  
 (No relevant relationships reported)

**PURPOSE:** The primary objective of this study was to investigate how resting, long-duration hyperoxic water immersions (WIs) at 1.35 atmospheres absolute (ATA) effected neuromuscular strength performance. We hypothesized that following five consecutive days of hyperoxic WIs, neuromuscular strength performance would be diminished post-WI and remain reduced longer than 72-hrs post-WI. **METHODS:** Thirteen (n=13), active male divers [31.3 ± 1.7 (24-43) yrs., mean ± SEM] completed five consecutive 6-hour resting WIs with 18-hour surface intervals while breathing 100% O<sub>2</sub> (n=13) at 1.35 ATA. Skeletal muscle performance assessments occurred immediately before and after each WI, and 24 and 72 hours after the final WI. Performance assessments included maximum voluntary isometric contraction (MVIC) and maximal isokinetic (IK) knee extensions and elbow flexions, and maximum handgrip strength (MHG). We measured neuromuscular activation of the quadriceps, biceps brachii, and brachioradialis via surface electromyography (sEMG). **RESULTS:** MHG declined by 7.8% (p<0.001) by WI 5 with performance returning to baseline by 24-hr post-WI. Brachioradialis neuromuscular activation increased by 42% (p<0.001) on WI 5. MVIC knee extension performance dropped by 4% (p=0.001) on WI 3 with an 11% overall decrease in quadriceps neuromuscular activation. Maximal IK knee extension dropped by 3.3% (p=0.008) on WI 5 with 9.3% (p=0.014) drop in overall quadriceps activation dropped by 7% (p=0.013) during the same period. MVIC elbow flexion performance declined by 5.1% (p<0.001) with an 18% decline in neuromuscular activation by WI 5 but returned to baseline by 72-hr post-WI. Maximal IK elbow flexion performance dropped by 8.6% (p<0.001) on WI 5 with a continual decline in biceps brachii neuromuscular activation by 24% (p<0.001) on WI 5. **CONCLUSION:** The decreases in neuromuscular activation and strength performance coinciding with the non-load bearing muscles affected more than the load-bearing muscles. Yet, the brachioradialis had increases in neuromuscular activation with decreases in performance. These types of hyperoxic WIs caused significant changes to neuromuscular performance after three days of WI with recovery varying with each measured variable with some decrements lasting until the 72-hr post-WI recovery period.

**1461 Board #223 May 30 9:30 AM - 11:00 AM**  
**Carotid Body Chemosensitivity is Not Attenuated During Hyperbaric Hypoxia**

Hayden W. Hess, Corey R. Carden, Brett A. Siders, Lindsey N. Russo, Brian M. Clemency, David Hostler, FACSM, Blair D. Johnson. University at Buffalo, BUFFALO, NY. (Sponsor: Dave Hostler, FACSM)  
 Email: haydenhe@buffalo.edu  
 (No relevant relationships reported)

Water immersion causes CO<sub>2</sub> retention, thus increasing the risk of CO<sub>2</sub> toxicity. Hyperoxia reduces carotid body (CB) tonic activity, which reduces the ventilatory response to hypercapnia. However, it is not known if CB chemosensitivity is altered during the high partial pressure of oxygen associated with hyperbaria. **PURPOSE:** We tested the hypothesis that oxygen breathing would lower CB chemosensitivity more than breathing air at 6.1 msw depth. **METHODS:** Five subjects (age: 23±2 y; BMI: 28±5 kg/m<sup>2</sup>) completed two, four-hour dry dives at 6.1 msw (1.6 ATA) breathing either 100% O<sub>2</sub> or air. CB chemosensitivity was assessed using hypoxic ventilatory response (CB<sub>o2</sub>) and brief hypercapnic ventilatory response (CB<sub>CO2</sub>) tests pre-dive, 75 and 155 min into the dives, immediately post-dive, and 60 min post-dive. CB<sub>o2</sub> consisted of

inhaling 100% N<sub>2</sub> for 2-6 breaths, repeated four times, with 2 min between hypoxic exposures. CB<sub>CO<sub>2</sub></sub> consisted of inhaling 13% CO<sub>2</sub>, 66% N<sub>2</sub>, 21% O<sub>2</sub> for one breath, repeated four times, with 2 min between hypercapnic exposures. CB chemosensitivity was calculated as the slope of the linear regression line of the peak minute ventilation (MV) in three consecutive breaths vs. the nadir oxygen saturation (pulse oximetry; SpO<sub>2</sub>) or peak end tidal CO<sub>2</sub> tension (capnography; PETCO<sub>2</sub>) for CB<sub>CO<sub>2</sub></sub> and CB<sub>CO<sub>2</sub></sub>, respectively. Data are reported as a change from pre-dive (mean±SD). **RESULTS:** SpO<sub>2</sub> was higher than pre-dive at all time points (all p<0.01), but was not different between conditions (p=0.24). The change in MV was not different over time (p=0.11) or between conditions (p=0.42). PETCO<sub>2</sub> increased during the dive at 75 (Air: 10±5 vs. O<sub>2</sub>: 7±4 mmHg) and 155 min (Air: 8±5 vs. O<sub>2</sub>: 5±3 mmHg; p<0.01), but did not differ between conditions (p=0.14). CB<sub>CO<sub>2</sub></sub> and CB<sub>CO<sub>2</sub></sub> were not different at any time point (p=0.29 and p=0.48, respectively) and were not different between 100% O<sub>2</sub> or air conditions (p=0.64 and p=0.32, respectively). **CONCLUSIONS:** These data indicate that CB chemosensitivity to hypoxia and hypercapnia is not attenuated during hyperbaric hyperoxia. Therefore, the carotid body chemoreceptors do not appear to contribute to CO<sub>2</sub> retention in hyperbaria.

**1462** Board #224 May 30 9:30 AM - 11:00 AM  
**Prolonged Hyperbaric Exposure Alters Gut Mucus, Microbiota Composition And Intestinal Antimicrobial Defense In Mice**

Dao Xiang<sup>1</sup>, Beibei Luo<sup>2</sup>, Yiqun Fang<sup>1</sup>, Ji Xu<sup>1</sup>, Jia He<sup>1</sup>, Peijie Chen<sup>2</sup>. <sup>1</sup>Second Military Medical University, Shanghai, China. <sup>2</sup>Shanghai University of Sport, Shanghai, China.  
 Email: x-a1@163.com

(No relevant relationships reported)

**PURPOSE:** Divers with prolonged hyperbaric exposure may suffer from digestive dysfunctions, which relate to impairment of intestinal mucosal immune system and gut microbiota homeostasis. We studied the effects of a 4-day hyperbaric exposure on gut microbiota and intestinal antimicrobial peptides (AMPs) in mice.

**METHODS:** 20 male C57 Mice, 8-week old, were randomly divided into hyperbaric exposure group (HE, n=10) and control group (CON, n=10). The Hyperbaric environment was established by compressed N<sub>2</sub>/O<sub>2</sub> mixed gas, and sustained the ambient pressure at 500kPa for 4 days in the pressure chamber. Intestines were excised and stained with Hematoxylin and Eosin (H&E) and alcian blue-periodic acid-schiff staining (AB-PAS). Feces and intestines were collected and extract gDNA and RNA respectively. We used qPCR to assay bacterial population (*Bacteroides*, *Clostridia*, *Lactobacilli*, *Enterobacteria*, and *Akkermansia muciniphila*) of the feces, and the AMPs (*Defa5*, *Defb1*, *Retnlb*, *Reg3b* and *Reg3g*) of small intestine and colon.

**RESULTS:** During the hyperbaric exposure, the mice did not exhibit any behavioral abnormality, including nitrogen narcosis. According to the AB-PAS staining, the mucus was reduced in colons post hyperbaric exposure. And there was no significant morphological difference between intestines and colons from the mice of HE group and CON by H&E staining. By comparing with the 16S rRNA genes, results revealed a significant increase in the relative abundances of *A. muciniphila* (9.28±5.67) and *Clostridia* (3.45±0.63) in HE. The relative abundance of *Lactobacilli* was lower (0.40±0.24) in HE. Moreover, a distinct increase of *Enterobacteria* (23.34±8.88) was observed in HE compared with CON. Gene expressions for *Defa5* and *Defb1* in HE were decreased in small intestine, while *Defb1* and *Reg3g* in HE were significantly decreased, and *Defa5* and *Reg3b* increased in colon.

**CONCLUSIONS:**

In sum, the data showed that a four-day hyperbaric exposure induced changes in the mucus of colon, the mRNA level of AMPs, and the gut microbiota composition in mice.

**1463** Board #225 May 30 9:30 AM - 11:00 AM  
**Individual Differences in Effects of Muscular Endurance Training under Hyperoxic Condition**

Yuta Kojima<sup>1</sup>, Chiho Fukusaki<sup>1</sup>, Naokata Ishii<sup>2</sup>. <sup>1</sup>The University of Tokyo, Chiba, Japan. <sup>2</sup>The University of Tokyo, Tokyo, Japan.  
 Email: 9302916162@edu.k.u-tokyo.ac.jp

(No relevant relationships reported)

Hyperoxic condition causes an acute enhancement of dynamic muscular endurance. We hypothesized that muscular endurance training under hyperoxic condition increases training volume, thereby results in larger improvement in muscular endurance as compared to training under normoxic condition. We also hypothesized that there would be considerable individual differences in the effects of the training under hyperoxia, because our previous studies have shown individual differences in the acute effects of hyperoxia.

**PURPOSE:** To investigate the effects of muscular endurance training under hyperoxic condition and individual differences in the effects.

**METHODS:** Fifteen healthy young men were assigned to two groups: one group conducted muscular endurance training under hyperoxic condition (30.0%O<sub>2</sub>; HOX group, n=7) and the other group conducted the same training under normoxic condition

(20.9%O<sub>2</sub>; NOX group, n=8). They performed one set of one-hand preacher curl at an intensity of 30%1RM until exhaustion, three times per week for six weeks. The number of repetition until exhaustion was recorded every training and summed up every six sessions (1st and 2nd weeks, 3rd and 4th weeks, and 5th and 6th weeks) to estimate training volume. Before and after the training period, maximal number of repetition (R<sub>max</sub>) was measured under both HOX and NOX conditions.

**RESULTS:** R<sub>max</sub> under NOX condition (R<sub>max-NOX</sub>) significantly increased after 6-week training in both HOX and NOX groups (P < 0.01). Increasing ratio of R<sub>max-NOX</sub> (R<sub>max-NOX</sub> after training / R<sub>max-NOX</sub> before training) was 683.3 ± 683.9% in HOX group and 171.2 ± 123.0% in NOX group. There was a significant correlation between the increase in R<sub>max-NOX</sub> after the training and the difference between R<sub>max</sub> under HOX and R<sub>max</sub> under NOX measured before the training (acute effect of hyperoxia; r = 0.872, P = 0.010). Four subjects in the HOX group who showed large (more than 150%) increases in R<sub>max-NOX</sub> after the training performed larger training volume than NOX group during 5th and 6th weeks of training period (P = 0.009).

**CONCLUSIONS:** These results indicated a large individual difference in the effects of muscular endurance training under hyperoxic condition. The difference may be related to the acute effect of hyperoxia on the training volume at the late stage of training period.

**C-41** Free Communication/Poster - Hypoxia/Altitude Physiology

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

**1464** Board #226 May 30 9:30 AM - 11:00 AM  
**Vagal Withdrawal Is Not Dependent On Oxygen Availability Or Exercise Intensity During Upper-Body Exercise**

Nicolas W. Clark<sup>1</sup>, Michael B. La Monica<sup>2</sup>, Valéria Panissa<sup>3</sup>, Tristan M. Starling-Smith<sup>1</sup>, Jeffrey R. Stout<sup>1</sup>, David H. Fukuda<sup>1</sup>. <sup>1</sup>University of Central Florida, Orlando, FL. <sup>2</sup>Missouri State University, Springfield, FL. <sup>3</sup>University of São Paulo, São Paulo, Brazil.

Email: nicolas.clark@knights.ucf.edu

(No relevant relationships reported)

Exercise in acute normobaric hypoxia has been shown to delay parasympathetic reactivation after submaximal but not supramaximal exercise; however, the behavior of parasympathetic withdrawal at the onset of exercise has yet to be fully explored.

**PURPOSE:** The purpose of this study was to evaluate trends for time-domain kinematics of parasympathetic withdrawal at the onset of high-intensity upper-body ergometry exercise during normobaric hypoxia and normoxia. **METHODS:** Nine recreationally-active men (21.6±1.3 y) performed a graded exercise test to determine peak power output under normobaric hypoxia (FiO<sub>2</sub> = 14.0±0.1%) and normoxia (FiO<sub>2</sub> = 20.1±0.2%) on different days, and four time to exhaustion trials randomized over two days at 90% and 110%, and 100% and 120% of peak power output, respectively, under similar conditions. A heart rate monitor recorded R-R intervals at 1000 Hz that were later analyzed using commercially-available software. Root mean square of the standard deviation of R-R intervals (RMSSD) values were calculated using a time-varying method with 64-s moving windows and a 3-s shift. A piecewise bilinear fitting function was utilized to determine the vagal response to high-intensity steady-state arm cranking. Two-way (condition × intensity) repeated measures ANOVA was used to compare estimates of the initial RMSSD (y-intercept of the first linear function), rate of RMSSD decline (slope of the first linear function), time to parasympathetic withdrawal (x-value at the intersection of the first and second linear functions), RMSSD at the time of parasympathetic withdrawal (y-value at the intersection of the first and second linear functions). **RESULTS:** No significant interactions or main effects were noted for initial RMSSD (p>0.05; 23.42 ± 3.2 ms), rate of RMSSD decline (p>0.05; -0.45 ± -0.08 ms/s), time to vagal withdrawal (p>0.05; 46.1 ± 2 s), and RMSSD at the time of vagal withdrawal (p>0.05; 3.79 ± 0.67 ms). **CONCLUSION:** Parasympathetic withdrawal does not seem to be affected during upper-body exercise under normobaric hypoxic or normoxic conditions at exercise intensities between 90% and 120% of peak power output in male participants. Funding disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

- 1465** Board #227 May 30 9:30 AM - 11:00 AM  
**The Effects Of Body Composition, Physical Fitness On Time Of Useful Consciousness In Hypobaric Hypoxia**  
 Jungwoon Kim, Junsik Kim, Jungjun Lim, Gunhee Kim, Yeonsoo Kim. *Seoul National University, Seoul, Korea, Republic of.*  
 (No relevant relationships reported)

**Abstract**

**PURPOSE:** The purpose of this study was to investigate the effect of body composition and physical fitness of Air Force pilots on hypoxic tolerance (Time of Useful Consciousness, TUC) under hypoxic conditions.

**METHODS:** At the sea level, we measured the body composition and physical fitness of 99 adults who were not exposed to hypoxic environment. In the hypoxia chamber, which can simulate high altitudes, we set the altitude to 25,000 feet and measured the TUC and the maximum heart rate (HRmax(H)). Pearson's Correlation was used to determine the relationship between TUC and other variables, and multiple regression was performed to determine the independent variables that best explain the TUC.

**RESULTS:** TUC is positively correlated with maximum oxygen uptake (VO<sub>2</sub>max), Stroke Volume (SV), arteriovenous oxygen difference (a-vO<sub>2</sub> diff) and endurance (Sit-up, Push-up). The maximum heart rate on the ground (HRmax(S)), HRmax(H), body fat mass, and percent body fat were negatively correlated with TUC. A regression analysis showed that 84.5% of the TUC can be explained by body composition and physical fitness.

**CONCLUSION:** Our results revealed that increased cardiorespiratory fitness and decreased fat could significantly impact TUC. Therefore, for Air Force pilots who are always at high altitudes and at risk for exposure to hypoxia, aerobic exercise is essential.

- 1466** Board #228 May 30 9:30 AM - 11:00 AM  
**Influence Of Acetazolamide On Manual Dexterity During 30-hour Exposure To Hypobaric Hypoxia (3,500 M)**  
 Adam C. Nixon, Beau R. Yurkevicius, Karleigh E. Bradbury, Katherine M. Mitchell, Billie K. Alba, Kirsten E. Coffman, Robert W. Kenefick, FACSM, Nisha Charkoudian, FACSM. *USARIEM, Natick, MA.* (Sponsor: Nisha Charkoudian, FACSM)  
 (No relevant relationships reported)

High altitude missions pose challenges not seen during sea level expeditions. In order for missions to be successful, it is imperative for Soldiers to maintain physical and cognitive performance. Acetazolamide (AZ) is known to decrease the effects of Acute Mountain Sickness (AMS), but reported side effects (e.g., drowsiness, peripheral paresthesias) could potentially impair manual dexterity. **PURPOSE:** The purpose of the study is to evaluate whether AZ treatment (250 mg bid) alters manual dexterity during 30 hours exposure to 3,500 m simulated altitude. **METHODS:** Six volunteers (6 males, 22.2 ± 3.2 y, 77.5 ± 11.5 kg, 176.2 ± 7.1 cm) took part in two separate 30 hour exposures to 3,500 m simulated altitude in the USARIEM hypobaric chamber. Volunteers received AZ (250 mg twice daily) or a placebo, in a single-blind crossover design. Prior to exposure, volunteers were trained at sea level in all procedures. Dexterity testing included the Purdue Pegboard (sum of rows completed in 30 seconds with right hand only, left hand only and both hands), and magazine/ cartridge loading (number of cartridges loaded in 2 minutes). **RESULTS:** Both Purdue Pegboard and magazine cartridge loading performance were not different between placebo and AZ trials (Purdue Pegboard: placebo: 38 ± 6 vs. AZ: 36 ± 7 rows, P > 0.05; cartridge loading: placebo: 57 ± 12 vs. AZ: 59 ± 13 cartridges, P > 0.05). **CONCLUSION:** Our results suggest that AZ treatment and potential side effects do not impair manual dexterity during a 30 hour exposure to 3500 m altitude. Future studies could evaluate whether higher (500 mg bid) doses of AZ would demonstrate different results. *Funded by USAMRMC; author views not official US Army or DOD policy.*

- 1467** Board #229 May 30 9:30 AM - 11:00 AM  
**Oxygen Consumption, Heart Rate and Work Rate During Maximal Exercise in Moderate Altitude Natives: Real versus Predicted Values**  
 Manuel Augusto Cárdenas-Romero, Juan Camilo Cardenas-Arciniegas, Manuela Zanoletti-Mannello, Julián Andrés Serrano-Giraldo, Julio César Bermúdez-Muñoz. *Pontificia Universidad Javeriana, Bogota DC, Colombia.*  
 Email: manuel.cardenas@javeriana.edu.co  
 (No relevant relationships reported)

Roughly 23% of Colombian population live at moderate altitude (>2500 m above sea level) and is exposed to 28% lower inspired oxygen pressure that affects oxygen delivery and utilization systems. Maximal heart rate (HRmax), maximal oxygen

consumption (VO<sub>2</sub>max), and maximal work rate (Wmax) during cardiopulmonary exercise testing (CPET) are key parameters for diagnostic and exercise prescription purposes, the last two of them have been reported to be about 10% lower in moderate hypobaric hypoxia. Predictive equations for VO<sub>2</sub>max, HRmax and Wmax have been developed mainly from sea-level populations.

**PURPOSE:** To evaluate the published predictive equations for VO<sub>2</sub>max, HRmax and Wmax in healthy young residents in moderate altitude.

**METHODS:** VO<sub>2</sub>max, HRmax and Wmax were measured during maximal ramp cycle ergometer CPET in 136 healthy subjects (62 females) 18-25 years old, born and raised at >2,500 m and living at 2600 m. From a systematic search on Medline and Embase databases 22 studies (71 predictive equations) with similar population (healthy, age group), CPET protocols (incremental/ramp maximal cycle ergometer test) and measured parameters (VO<sub>2</sub>max, HRmax, Wmax) were selected; all studies were conducted at low altitude. Normal distribution was tested by Shapiro-Wilk test and mean differences between direct measurements and estimated values were compared by paired T-Student test (alpha error = 0.05). Estimated values with no significant mean difference from direct measurements were further assessed by Pearson product-moment correlations.

**RESULTS:** Most real and estimated mean values were significantly different for VO<sub>2</sub> (male 19/21, female 16/19) and Wmax (male 7/8, female 6/9); for HRmax, significant differences were found in approximately half of them (male 3/8, female 6/9); of the remaining equations only one exhibited a strong correlation with direct values for VO<sub>2</sub>max in females (r=0.89, p<0.005).

**CONCLUSIONS:** In general, available predictive equations do not accurately estimate VO<sub>2</sub>max, Wmax or HRmax in a young, healthy Colombian population born and raised at moderate altitude. Differences in population characteristics (adaptation to hypobaric hypoxia, anthropometric differences, training level) can partially explain these results. Supported by COLCIENCIAS grant number 120356934972, 713-2013.

- 1468** Board #230 May 30 9:30 AM - 11:00 AM  
**Accumulated Oxygen Deficit During Arm Cranking: Effects Of Hypoxia And Methodological Considerations**  
 David Boffey<sup>1</sup>, Michael B. La Monica<sup>2</sup>, Tristan M. Starling-Smith<sup>1</sup>, Jeffrey R. Stout<sup>1</sup>, David H. Fukuda<sup>1</sup>. <sup>1</sup>University of Central Florida, Orlando, FL. <sup>2</sup>Missouri State University, Springfield, MO.  
 Email: dboffey@knights.ucf.edu  
 (No relevant relationships reported)

Under normobaric hypoxia, aerobic capacity is inherently limited, possibly leading to changes in energy system contribution. While most of the research has focused on lower body cycling or full-body exercise, upper body differences in muscle fiber type distribution and diffusion distance may require greater anaerobic energy provisions as reflected by accumulated oxygen deficit (AOD). **PURPOSE:** To observe the effects of normobaric hypoxia on AOD and energy system contribution during different intensities of upper-body arm cranking exercise. **METHODS:** Twenty-one recreationally active men (21.4 ± 1.4 yr.; 175.5 ± 5.7 cm; 84.8 ± 11.7 kg) performed a graded exercise test (GXT) in normobaric normoxia (N; FiO<sub>2</sub>~20%) and normobaric hypoxia (H; FiO<sub>2</sub>~14%) to determine peak power output (PPO). Time to exhaustion (TTE) trials were later conducted at 110% and 120% PPO under both N and H. AOD (in L·min<sup>-1</sup>) was calculated as the difference between predicted O<sub>2</sub> consumption (extrapolated from a regression equation calculated from GXT) and measured O<sub>2</sub> consumption during the TTEs, standardized to time. Anaerobic energy system contribution (%AN) was calculated as [1-(actual O<sub>2</sub> consumed/predicted O<sub>2</sub>)] × 100. AOD and %AN were calculated in three conditions: N, H, and H using the N regression equation (H<sub>N</sub>). Two-way (condition × intensity) repeated measures ANOVAs were conducted for AOD and %AN. **RESULTS:** There was a significant condition × intensity interaction for %AN (p=.009) and AOD (p=.007). At 110% PPO, %AN was significantly greater (p=.013) in H<sub>N</sub> compared to N (14% vs. 6.8%, respectively), but not H compared to N. At 120% PPO there were no differences in %AN between conditions. At 110% PPO, AOD was significantly greater (p=.029) in H<sub>N</sub> compared to N (0.33 vs. 0.19 L·min<sup>-1</sup>, respectively) but not H compared to N. At 120% PPO there were no differences in AOD between conditions. **CONCLUSION:** Calculating AOD for hypoxic exercise using a regression equation derived from normoxic conditions reveals a greater anaerobic contribution relative to normoxic exercise. The greater AOD and %AN in hypoxia compared to normoxia that was present at 110% PPO was not reproduced at 120% PPO. This may suggest a possible threshold at which hypoxia has no further effect on energy system contribution in this exercise modality.

1469 Board #231 May 30 9:30 AM - 11:00 AM

**The Effects of Altitude Training Masks Worn During Low-Intensity Bouts on Performance**

Haley N. Yohn, Eric M. Hultquist, Megan A. Morris, Kaitlin L. Barnett, Jacqueline Denning, Joshua G. Woolstenhulme. *The George Washington University, Washington, DC.*  
(No relevant relationships reported)

Altitude training masks (ATMs) are frequently used during exercise to enhance physiologic adaptations, yet few studies have examined the effects of ATMS when used during recovery periods.

**PURPOSE:** To examine the effects of ATMs used only during low-intensity recovery intervals in a high-intensity interval training (HIIT) program in healthy young adults. **METHODS:** Participants engaged in 18 HIIT over a 6-week period using a treadmill. HIIT sessions were comprised of 6-8, 60-second high-intensity bouts at a relative work rate corresponding to 95% of participants' maximal heart rates, alternating with 90-second low-intensity recovery bouts at a relative work rate corresponding to 20% VO<sub>2</sub>max. Participants were randomly assigned to an experimental group (EXP) which wore an ATM only during the low-intensity bouts or to a control group (CON) which did not use an ATM. Cardiopulmonary exercise tests (CPET) were performed before and after the HIIT.

**RESULTS:** 10 participants completed the study in the EXP group (6 females; 26±4.1 years; BMI: 24.2±1.6 kg/m<sup>2</sup>) and 10 in the CON group (7 females; 24.3±3.5 years; BMI: 22.8±2.1 kg/m<sup>2</sup>). Both groups experienced improvements in VO<sub>2</sub>max (EXP: 39.9±4.6 vs. 42.8±6.0 ml/kg/min, p=0.02; CON: 39.7±6.1 vs. 43.9±8.3 ml/kg/min, p=0.01; baseline vs. follow-up, mean±SD). The EXP group alone saw improvements after training in time to anaerobic threshold (169±31.2 vs. 213±56.2 sec, p=0.04), increased peak work rate during CPET (44±26.9 vs. 88±54.3 Watts, p=0.03), and increased minute ventilation during peak exercise (108±15.5 to 113.64±19.6 L/min, p=0.04). No other changes were observed in the CON group.

**CONCLUSIONS:** Using ATMs only during the low-intensity bouts of HIIT appears to have afforded participants with unique training adaptations not observed in standard HIIT. Conventional use of ATMs employs the masks during exertional portions of exercise training, not solely during recovery periods. These findings suggest that ATMs may serve as a valuable training adjunct even if used only during recovery periods in HIIT. Supported by: GWU SMHS Emerging Scholars Award 2016-2018

1470 Board #232 May 30 9:30 AM - 11:00 AM

**Effect Of Intermittent Hypoxic Exercise Training On Improving Altitude Acclimatization**

Xinxin Hao, Dalei Wang, Xiaofei Wang, Yubo Shen. *National University of Defense Technology, Changsha, China.*  
Email: haoxin010@126.com  
(No relevant relationships reported)

**PURPOSE:** The purpose of this study was to evaluate the effect of hypoxic exercise training towards altitude acclimatization through systematic literature synthesis, and establish a potential strategy to improve altitude acclimatization.

**METHODS:** A selective PubMed, CNKI and Google Scholar search on intermittent hypoxic exercise training and altitude acclimatization was conducted. By search and screening, 11 articles of PubMed/Google Scholar and 4 articles of CNKI were included for final analysis and assessment.

**RESULTS:** Moderate-intensity intermittent hypoxic exercise training could blunt oxidative stress and decrease Acute Mountain Sickness (AMS) at elevations of ~3200m, but it has little effect on physical performance compared to intermittent hypoxic exposure. Vigorous-intensity intermittent hypoxic exercise training can improve human endurance performance. None moderate exercise is performed to increase AMS or worsen AMS severity, while exceed health bearing can worsen symptoms of AMS.

**CONCLUSIONS:** 1) intermittent hypoxic exercise training can improve altitude acclimatization to AMS and physical health status. 2) A proper hypoxic exercise training intensity may be a crucial factor to maintain and raise human physical performance at high altitude.

Table 1 Basic Information of Included Literatures			
Author	Effect	Altitude	Training method
H. Maibasi et al. 2006	A positive effect of adaptation to altitude on exercise performance.	2300m	13days altitude training
Roach RC et al. 2000	Exercise exacerbates acute mountain sickness	4800m	1days, unacclimated at 50% altitude-specific maximal workload four times for 30 min
Baldeman BA et al. 2003	A positive effect was observed to affect muscular performance significant, but the difference was not significant between exercise and rest.	4300m	3weeks, cycled for 45-60 min/day at 60%-70% of maximal O2 uptake
Baldeman BA et al. 2009	Intermittent hypoxic exposure did not improve endurance performance.	4300m	7days exercise at approximately 90% of peak HR
Baldeman BA et al. 2006	A positive effect was observed to affect time-trial cycle exercise performance, but the effect of exercise or rest does not have a significant difference.	4300m	7 days two consecutive 15-min constant-work rate exercise bouts
Rupp T et al. 2012	AMS scores did not differ significantly between exercise and rest.	F102+12(6/4400m)	4-cycling at 45% F102(3)-specific maximal power output
Misner K et al. 2013	The influence of moderate exercise on AMS is minor.	F102+11.09(65 500 m)	Moderate intensity
Ebwell M et al. 2014	High-intensity exercise in hypoxia led to an increase in the development of pulmonary interstitial edema after subacute exposure but not during acute exposure.	4000 m	high-intensity intermittent exercise (HIE) test
Mellor A et al. 2014	AMS rates were higher after trekking days with higher levels of perceived exertion.	3833-4450-5129 m	10days, trekking
Rupp T et al. 2014	Exercise accentuated the effect of hypoxia by increasing total brain volume, but did not correlated with AMS symptoms.	F102+12(6/4400m)	11 hours
Delbecq T et al. 2014	AMS scores did not differ significantly between exercise and rest.	F102+13.0% (4000m)	10days, two training sessions per day at 50% of hypoxic maximal aerobic power
Chen Guoqin et al. 2014	Walking five kilometers improved headache symptom and tended to decrease AMS.	3200m	2days
PAN Xueqin. 2002	Intermittent hypoxia exercise enhanced the adaptation of organisms to hypoxia.	4800m	3 weeks, incremental hypoxic training(2100-3500-4000m), 20 min constant load exercise of aerobic pedaling with 60rpm and 80W
SHOU Wenling et al. 2010	Training in intermittent altitude exposure had remarkable effective for the hypoxia acclimation to AMS.	4800m	3 weeks, incremental hypoxic training(2500-3500-4000m) with 20min cycling (20 r / min, 4.5 kg / w)
MA Qiang et al. 2014	Plateau training contributed to high altitude acclimatization, but fails to improve physical fitness.	4050m	2 months, low-and-moderate-intensity physical fitness training

1471 Board #233 May 30 9:30 AM - 11:00 AM

**Lipolysis Mechanism By Down-regulating Mir-92a Activating Wnt/β-catenin Signaling Pathway In Hypoxic training Rats**

xuewen tian<sup>1</sup>, qipeng song<sup>1</sup>, yingli lu<sup>2</sup>, cui zhang<sup>1</sup>. <sup>1</sup>shandong institute of sport science, jinan, shandong, China. <sup>2</sup>China Institute of Sport Science, beijing, China.  
Email: xuewentian1978@163.com

(No relevant relationships reported)

**Lipolysis mechanism by down-regulating miR-92a activating Wnt/β-catenin signaling pathway in hypoxic training rats**

Studies showed that the loss of body weight in high altitude or hypoxic training conditions was more significant than that in normoxic training conditions. Wnt/β-catenin signaling is a molecular switch that governs adipogenesis. Some studies showed that hypoxia can induce lipolysis and inhibit fat synthesis and influence Wnt/β-catenin signaling.

**PURPOSE:** This study investigates the role of miR-92a via Wnt/β-catenin signaling in lipid metabolism of hypoxic training rats.

**METHODS:** Microarray and real-time polymerase chain reaction (RT-PCR) were used to detect the mRNA change of miR-92a in the perirenal fat and epididymis fat of hypoxic training and normoxic training rats. The downstream target mRNA of miR-92a was predicted using bioinformatics and further identified with dual luciferase assay. The Fzd10 and c-myc expression change was detected in the perirenal fat and epididymis fat by using RT-PCR and Western blot.

**RESULTS:** The microarray and RT-PCR results showed a significantly decreased expression of miR-92a in the fat tissues of hypoxic training rats more than that of normoxic training rats. Result of dual luciferase assay showed that the target gene of miR-92a is Fzd10, which is an acceptor in the Wnt pathway. Fzd10 expression was upregulated in hypoxic training rats. The mRNA expression of the c-myc located at downstream of Wnt pathway increased significantly.

The significantly increased mRNA and protein levels of Fzd10 and c-myc may be related to miR-92a downregulation, leading to lipolysis through Wnt/β-catenin signaling pathway regulation and subsequently causing rat's body weight loss of hypoxic training rats.

1472 Board #234 May 30 9:30 AM - 11:00 AM

**Effects Of Acute Intermittent Hypoxia (AIH) On Metabolism, Substrate Partitioning, And Dysglycemia In Obese Individuals With Spinal Cord Injury: A Case Series**

Jennifer L. Maher<sup>1</sup>, James L. Bilzon<sup>2</sup>, Mark S. Nash, FACSM<sup>1</sup>.  
<sup>1</sup>University of Miami, Miami, FL. <sup>2</sup>University of Bath, Bath, United Kingdom.

(No relevant relationships reported)

Innovative approaches are essential for achieving clinically meaningful improvements in cardiometabolic health in individuals with spinal cord injury (SCI).

**PURPOSE:** Examine changes in glycemic control and metabolism while at rest and during exercise after 4 days of resting exposure to AIH compared with a time-matched normoxic (SHAM) treatment.

**METHODS:** Participants were 4 males aged 34-57 with chronic (3-18 yrs) SCI at C6-T8. Participants reported to the laboratory after an 8-10 hour fast. After 30 minutes

of rest, participants performed a graded arm exercise test (GXT) to establish peak  $O_2$  consumption. Substrate oxidation rates were derived from cardiorespiratory data averaged over the last minute of each 3-minute stage where RER was < 1.0. On a non-consecutive day, participants underwent a baseline (BL) 75-gram oral glucose tolerance test (OGTT). Participants were exposed to AIH for 4 consecutive days involving hour long intervals of alternating 6-minute hypoxia ( $F_{iO_2} = 0.09-0.12$ ) and 3-minute normoxia ( $F_{iO_2} = 0.21$ ). The SHAM protocol was the same except with continuous normoxia. Following the final exposure of each intervention, participants performed a follow-up OGTT, and a GXT 24 hours later.

**RESULTS:** All participants were obese by population-specific criteria (BMI = 23.0-44.7 kg/m<sup>2</sup>) and two were insulin resistance per the Homeostatic Model-2 (HOMA2-IR) Assessment (HOMA-IR = 3.8-4.2). No changes were seen in HOMA-IR after intervention, however, post-AIH OGTT showed fasted insulin concentrations 31% lower than observed at BL, while glucose remained similar across both trials (2%  $\Delta$ ). Insulin area under the curve was 26% lower after AIH compared to BL with little change (11%) in glucose. There were no differences in metabolism and substrate utilization at rest or exercise across trials.

**CONCLUSION:** Lower pre-load insulin concentration and lower peak insulin values observed following AIH suggests an insulin-sensitizing effect of treatment. However, the duration of this benefit requires testing. No differences were reported in metabolism and substrate partitioning in four participants, however this needs to be investigated in a larger population. This case series demonstrates that in these individuals with SCL, AIH exposure was well tolerated and can be administered without adverse events.

**1473** Board #235 May 30 9:30 AM - 11:00 AM  
**Short-term Altitude Training Effects on Aerobic Performance Parameters in Collegiate Cross-country Runners**

Nauris Tamulevicius<sup>1</sup>, Tanuj Wadhi<sup>1</sup>, Guillermo R. Oviedo<sup>2</sup>, Ashmeet S. Anand<sup>1</sup>, Fraser Houston<sup>1</sup>, Eric Vlahov<sup>1</sup>. <sup>1</sup>The University of Tampa, Tampa, FL. <sup>2</sup>University Ramon Llull, Barcelona, Spain.

Email: ntamulevicius@ut.edu

(No relevant relationships reported)

Endurance athletes have been using altitude training for over half a century to improve sea-level performance. Live High-Train Low (LHTL), a contemporary form of altitude training, was proven best for long-distance (5000m) athletes. However, while athletes continue to use this training technique in an acute fashion (<2 weeks), no study has shown the effects of such a short-term use on aerobic performance. **PURPOSE:** To evaluate aerobic performance parameters, i.e., aerobic capacity ( $VO_{2peak}$ ) and ventilatory threshold (VT), after 6 days of LHTL altitude training in collegiate cross-country runners. **METHODS:** Fourteen male NCAA cross-country runners (age: 19.07±0.92 y.o.) with initial  $VO_{2peak}$  of 73.13 ± 5.65 ml/kg/min participated in the study.  $VO_{2peak}$  and VT were evaluated using a metabolic cart at sea-level, pre- and post-training. Runners from sea level traveled to high altitude where they lived at 1322m above sea-level for 6 days. Six training sessions were performed at altitudes ranging from 881.25±148.87m to 1047.70±237.29m above sea-level with training sessions averaging a duration of 75.25±7.04 mins, speed of 13.02±1.60 kmph and distance of 16.42±2.95 km. **RESULTS:** There was no significant effect on either absolute ( $p=0.325$ ) or relative  $VO_{2peak}$  ( $p=0.643$ ). A significant main effect of time was found for absolute VT ( $p<0.001$ ), which changed from 3.35±0.52 L/min to 3.89±0.55 L/min, and VT relative to  $VO_{2peak}$  ( $p<0.001$ ), which changed from 74.29±8.54% of  $VO_{2peak}$  to 87.57±3.48% of  $VO_{2peak}$ . Consequently, there was a significant main-effect of time for heart rate at VT ( $p=0.025$ ), which changed from 168.50±14.87 bpm to 176.07±11.02 bpm. **CONCLUSION:** Although there was no significant change in  $VO_{2peak}$ , short-term LHTL training had a positive effect on VT in trained cross-country runners. This is possibly due to the hemodilution resulting from return to sea level combined with the preserved ventilatory adaptations from altitude training.

**1474** Board #236 May 30 9:30 AM - 11:00 AM  
**Exogenous Glucose Oxidation During Endurance Exercise in Hypoxia**

Daichi Sumi, Nanako Hayashi, Haruka Yatsutani, Kazushige Goto. *Ritsumeikan University, Kusatsu, Japan.*

Email: sh0034vr@ed.ritsume.ac.jp

(No relevant relationships reported)

The exercise under hypoxic condition augmented carbohydrate (CHO) metabolism during exercise (Sumi et al. 2018). However, detailed CHO oxidation pattern during exercise under hypoxic condition remain unclear.

**PURPOSE:** The purpose of the present study was to evaluate the effect of endurance exercise under moderate hypoxic condition at the same energy expenditure or exercise intensity on exogenous glucose oxidation.

**METHODS:** Nine active healthy males completed three trials on different days, consisting of 30-min running at each exercise intensity of the following: 1) 65% of normoxic  $VO_{2max}$  under the normoxic condition ( $F_{iO_2} = 20.9\%$ ; NOR), 2) 65% of

hypoxic  $VO_{2max}$  under the hypoxic condition ( $F_{iO_2} = 14.5\%$ ; HYPOR), 3) 65% of normoxic  $VO_{2max}$  under the hypoxic condition ( $F_{iO_2} = 14.5\%$ ; HYPOA). Venous blood samples were collected before and after exercise. The subjects consumed <sup>13</sup>C-labeled glucose immediately before exercise, and we collected expired gas during exercise to determine <sup>13</sup>C-excretion (calculated by <sup>13</sup>CO<sub>2</sub>/<sup>12</sup>CO<sub>2</sub>).

**RESULTS:** Running velocity were significantly lower in the HYPOR (9.4 ± 0.3 km) than in the NOR (10.6 ± 0.3 km) and HYPOA (10.6 ± 0.3 km). Exercise-induced blood lactate elevation was significantly augmented in the HYPOA than in the NOR and HYPOR ( $P = 0.001$ ). The HYPOA showed significantly higher CHO oxidation (evaluated by  $VO_2$  and  $VCO_2$ ) during exercise compared with other two trials ( $P = 0.01$ ). In contrast, exogenous glucose oxidation (<sup>13</sup>C-excretion) during exercise was significantly lower in the HYPOA than in the NOR ( $P = 0.01$ ).

**CONCLUSIONS:** Endurance exercise under moderate hypoxic conditions promoted whole body CHO metabolism during exercise. However, exogenous glucose oxidation during exercise was attenuated compared with the same exercise under normoxic condition.

**1475** Board #237 May 30 9:30 AM - 11:00 AM

**Effect of Sprint Exercise in Hypoxia on Muscle Glycogen Utilization**

Nobukazu Kasai<sup>1</sup>, Fumiya Tanji<sup>2</sup>, Aya Ishibashi<sup>2</sup>, Hayato Ohnuma<sup>2</sup>, Hideyuki Takahashi<sup>2</sup>, Kazushige Goto<sup>1</sup>, Yasuhiro Suzuki<sup>2</sup>. <sup>1</sup>Ritsumeikan University, Kusatsu, Japan. <sup>2</sup>Japan Institute of Sports Sciences, Kitaku, Japan. (Sponsor: Robert Kraemer, FACSM)

Email: nobunbun100@gmail.com

(No relevant relationships reported)

The influence of maximal sprint exercise in hypoxia on muscle glycogen content muscle has not been directly evaluated.

**PURPOSE:** The purpose of the present study was to determine the effect of a single bout of maximal sprint exercise in hypoxia on muscle glycogen content among competitive athletes.

**METHODS:** Ten sprinters (height; 176.9 ± 1.9 cm, body weight; 66.9 ± 2.0 kg, BMI; 21.4 ± 0.5 kg/m<sup>2</sup>, athletic career, 10.3 ± 2.9 years) performed two exercise trials under either hypoxic [HYP, fraction of inspired oxygen ( $F_{iO_2}$ ): 14.5%, a simulated altitude of 3,000m] or normoxic (NOR,  $F_{iO_2}$ : 20.9%) conditions with a randomized, a single-blind and crossover design. The exercise in each trial consisted of three sets of 30-s maximal sprint. Muscle glycogen content was measured using carbon magnetic resonance spectroscopy (<sup>13</sup>C-MRS) in the vastus lateralis and vastus intermedius muscles before and after the exercise. Moreover, time-course changes in power output, percutaneous oxygen saturation (SpO<sub>2</sub>), blood lactate, metabolic responses and muscle oxygenation were evaluated.

**RESULTS:** The average SpO<sub>2</sub> value was significantly lower in the HYP trial (91.0 ± 0.3%) than in the NOR trial [95.9 ± 0.3%,  $P < 0.01$ , effect size (ES) = 5.08]. Mean power output did not differ significantly between the two trials ( $P = 0.80$ , ES = 0.01). There was a significant main effect for time ( $P < 0.01$ , ES = 0.97) for blood lactate concentration, but no significant difference between the two trials was observed ( $P = 0.31$ , ES = 0.12). Change in muscle glycogen content showed significant interaction ( $P = 0.03$ , ES = 0.40) and main effect for time ( $P < 0.01$ , ES = 0.89). Relative change in muscle glycogen content between before and after the exercise was significantly greater in the HYP trial (-43.5 ± 0.4%) than in the NOR trial (-34.0 ± 0.3%,  $P < 0.01$ , ES = 0.83).

**CONCLUSION:** Maximal sprint exercise in hypoxia caused further decrement of muscle glycogen content compared with the same exercise under normoxia.

**1476** Board #238 May 30 9:30 AM - 11:00 AM

**Effects Of Systemic Hypoxia-hyperoxia Preconditioning On Acute Heavy Resistance Exercise-induced Muscle Damage In Athletes**

Szu-Hsien Yu<sup>1</sup>, Peng-Wen Chen<sup>2</sup>. <sup>1</sup>National Ilan University, Yilan City, Taiwan. <sup>2</sup>University of Taipei, Taipei City, Taiwan.

(Sponsor: Chia-Hua Kuo, FACSM)

Email: meek168@hotmail.com

(No relevant relationships reported)

**PURPOSE:** Local ischemic preconditioning was shown to improve exercise performance in previous studies, but it also causes pain. The aim of the present study is to investigate the effects of systemic hypoxia-hyperoxia preconditioning on muscle damage caused by a bout of acute heavy resistance exercise (RE).

**METHODS:** In this double-blind, randomized-controlled crossover study design, 11 voluntary male athletes (20-24 years old) were recruited as participants. Subjects were randomly divided into normoxia and hypoxia-hyperoxia groups. For a duration of 50 min, the hypoxia-hyperoxia group was alternately supplied with 10% or 100% oxygen in 5 min intervals. The normoxia group was supplied with 20.9% oxygen for 50 min during the same period. 30 min after preconditioning, all subjects performed a bout of acute heavy RE. After a 14-day washout time, subjects swapped groups.

**RESULTS:** The results showed that the high intensity RE decreased peak torque and increased muscle pain in both groups. Circulating creatine kinase (CK), myoglobin and interleukin 6 (IL-6) also increased immediately after RE in normoxia subjects. CK, myoglobin and testosterone/cortisol ratio (T/C ratio) of hypoxia-hyperoxia group were lower than those of normoxia group 24 and 48 h after RE. However, IL-6 of hypoxia-hyperoxia group was higher than that of normoxia group 24 and 48 h after RE. No differences were found in thiobarbituric acid reacting substance (TBARS) levels or peak torque levels between normoxia and hypoxia-hyperoxia groups.

**CONCLUSIONS:** Systemic hypoxia-hyperoxia preconditioning could reduce muscle damage induced by high intensity RE. These effects may be due to increased anti-inflammatory cytokine secretion.

**1477** Board #239 May 30 9:30 AM - 11:00 AM  
**The Integrative Physiological and Neuromuscular Effects of High Altitude Cycling in World Class Endurance Athletes**

Craig E. Broeder, FACSM<sup>1</sup>, Dan Turner<sup>2</sup>, Per Lundstam<sup>3</sup>, Holden Macrae<sup>4</sup>. <sup>1</sup>Exercising Nutritionally, LLC, Naperville, IL. <sup>2</sup>Red-Bull Corporation, Santa Monica, CA. <sup>3</sup>RedBull Corporation, Santa Monica, CA. <sup>4</sup>Pepperdine University, Malibu, CA.  
 Email: en.llc@me.com

(No relevant relationships reported)

**PURPOSE:** Six pro endurance athletes (3 men, 3 female) participated in a study investigating the effects of cycling at high altitude on physiological & neuro-muscular systems.

**METHODS:** Athletes were tested in three locations using identical procedures and equipment. Baseline testing took place in Santa Monica, CA. Then, the entire lab's equipment was transported to two additional study locations (Death Valley and Mammoth Mountain, CA). Each athlete completed a 5-stage, 3-min/stage ramp exercise trial. Athletes performed the ramp test in duplicate at each test site (morning and afternoon). Respiratory-metabolic measurements, regional oxygen saturation (SMO2), substrate oxidation rates, and EMG activity were recorded continuously. Blood samples were taken the last 15-sec of each stage. Data were analyzed using repeated-measures ANOVA models and Turkey Post-Hoc test to identify specific areas of significance when appropriate.

**RESULTS:** The mean workload across all 5 stages was  $227 \pm 60$  watts (Stage 1 = 117 watts; Stage 5 = 287 watts). Compared to sea level, the over-all mean SMO2 saturation at the 227 watts mean was 24.5% lower at altitude ( $p = 0.04$ ) while deoxy hemoglobin was 18.5% higher ( $p=0.04$ ). Correspondingly, lactate concentrations were 27.2% greater, but this difference did not reach significance. However, lactate concentrations during stage 5 were 34% greater at altitude compared to sea level ( $p = 0.035$ ). At sea level, quadricep (Quad) muscle activation accounted for 58% of the total force produced while cycling at altitude quad work was reduced to 51%. Lactate concentrations had an inverse relationship with EMG Quad activity ( $p=0.03$ ) and direct relationship with hamstring force activation ( $p = 0.03$ ). RER values indicated greater CHO oxidation rates at altitude across all stages combined (Sea level: 2.127 gm/min; Altitude: 2.954 gm/min,  $p = 0.01$ ). For stages 4 & 5, despite greater respiration rates, over-all ventilation volumes declined cycling at altitude lowering oxygen uptake by 10.2% and 19.4% respectively despite being at the same workload compared to sea level.

**CONCLUSIONS:** These results indicate cycling at altitude requires greater physiological-metabolic response to maintain neuro-muscular function cycling at work rates up to 80% of max effort.

**1478** Board #240 May 30 9:30 AM - 11:00 AM  
**Effect of Acetazolamide on Hand and Finger Strength During 30 Hours Exposure to 3500m Altitude**

Beau R. Yurkevicius, Adam C. Nixon, Karleigh E. Bradbury, Katherine M. Mitchell, Billie K. Alba, Kirsten E. Coffman, Robert W. Kenefick, FACSM, Nisha Charkoudian, FACSM. USARIEM, Natick, MA. (Sponsor: Nisha Charkoudian, FACSM)  
 (No relevant relationships reported)

Activities that require rapid ascent to altitude, such as those that commonly occur in military, mountain rescue, and recreational settings, often require substantial hand and finger strength in order to complete tasks. Many who deploy quickly to altitude experience symptoms of acute mountain sickness (AMS), which have been shown to be decreased by acetazolamide (AZ). Although AZ may cause peripheral paresthesia, potential influences on hand and finger strength are currently unclear. **PURPOSE:** The purpose of this study was to test the hypothesis that AZ treatment during an acute, 30-hour exposure to 3500 m simulated altitude would decrease hand and finger strength relative to placebo treatment.

**METHODS:** Six male volunteers ( $22.2 \pm 3.2$  yrs,  $77.5 \pm 11.5$  kg,  $176.2 \pm 7.1$  cm) participated in two separate 30 hour altitude exposures (3500 m, 20°C, 20% RH) in the USARIEM hypobaric chamber. Participants were given either a placebo or 250 mg AZ twice a day for 3.5 days (2 sea-level days + the 30 hour altitude exposure) in

a randomized, single-blind crossover design. During each altitude exposure, strength tests were performed which comprised of maximal hand grip and finger pinch (palmar, key, tip) strength tests.

**RESULTS:** No volunteers reported sensations of peripheral paresthesia. There was no difference between altitude exposures in any of the measures of hand and finger strength (placebo vs. AZ; hand grip:  $43 \pm 7$  vs.  $43 \pm 8$  kg; palmar pinch:  $11 \pm 2$  vs.  $12 \pm 2$  kg; key pinch:  $11 \pm 1$  vs.  $11 \pm 1$  kg; tip pinch:  $8 \pm 1$  vs.  $8 \pm 1$  kg;  $p > 0.05$  for all).

**CONCLUSIONS:** Our results suggest that 500 mg/day AZ treatment does not influence hand and finger strength during a 30 hour exposure to 3500 m altitude. Future studies could evaluate if higher doses of AZ, that may induce more paresthesia, would influence hand and finger strength differently.

Funded by USAMRMC; author views not official US Army or DOD policy.

**1479** Board #241 May 30 9:30 AM - 11:00 AM  
**The Effect Of Moderate Hypoxia On Skeletal Muscle Cell Growth And Related Protein Expression**

Koki SAKUSHIMA<sup>1</sup>, Maki YOSHIKAWA<sup>1</sup>, Takeshi HASHIMOTO, FACSM<sup>2</sup>. <sup>1</sup>Ritsumeikan University, Kyoto, Japan. <sup>2</sup>Ritsumeikan University, Siga, Japan. (Sponsor: Takeshi Hashimoto, FACSM)  
 Email: saku00812@gmail.com

(No relevant relationships reported)

**PURPOSE:** Skeletal muscle atrophy is one of the adaptations of hypoxic environment. However, previous study showed resistance training under hypoxic environment (16% oxygen concentration) causes greater muscle hypertrophy than normoxic environment (Nishimura et al., 2010). Because direct effect of hypoxia on skeletal muscle cell growth remains unknown, in Vitro studies to investigate cell responses to hypoxia are needed. Although some studies reported that severe hypoxia (i.e., 1% to 5% oxygen concentration) attenuated cell growth (Marie Csete et al., 2001; Gustafsson et al., 2005), we hypothesized that moderate hypoxia (e.g., 10% oxygen concentration) might ameliorate muscle cell growth. The purpose of this study was to examine the effect of 10% oxygen environment on skeletal muscle cell growth and related protein expressions.

**METHODS:** C2C12 skeletal muscle cells were divided into two groups: control group cultured in 20.9% oxygen environment (CON) while hypoxia group cultured in 10% oxygen environment (HYP) during differentiation. We analyzed expressions of myogenesis-related proteins Myogenin, using Western blotting. As well, we analyzed mTOR signaling. We also conducted immunocytochemical analyses to assess myotube diameter and Differentiation Index (DI), an indicator of muscle differentiation (Oishi et al., 2015). The lactate concentration in the medium was measured every day.

**RESULTS:** The myotube diameter in the HYP was significantly greater than that in the CON ( $p < 0.05$ ). The DI was significantly higher in the HYP than in the CON ( $p < 0.05$ ). The protein expression of myogenin was significantly higher in the HYP than in the CON ( $p < 0.05$ ). The expression level of phosphorylated mTOR was significantly higher in the HYP than in the CON ( $p < 0.05$ ). The lactate concentration was higher in the HYP than in the CON ( $p < 0.05$ ). Myotube atrophy was observed 8 days after the differentiation in the CON, while moderate hypoxia maintained myotube thickness.

**CONCLUSIONS:** The findings suggest that 10% hypoxic environment may promote skeletal muscle cell growth and hypertrophy. Supported by Grant-in-Aid for Scientific Research from the Japanese Ministry of Education, Culture, Sports, Science, and Technology (Grants 26702029, 18K19762).

**1480** Board #242 May 30 9:30 AM - 11:00 AM  
**Effects of Chronic Continuous Exposure to Low Dose Carbon Monoxide on Hemoglobin Mass and Performance**

Walter FJ Schmidt<sup>1</sup>, Torben Hoffmeister<sup>1</sup>, Sandra Haupt<sup>1</sup>, Nadine Wachsmuth<sup>1</sup>, Dirk Schwenke<sup>2</sup>, William C. Byrnes, FACSM<sup>3</sup>. <sup>1</sup>University of Bayreuth, Bayreuth, Germany. <sup>2</sup>University of Dresden, Dresden, Germany. <sup>3</sup>University of Colorado at Boulder, Boulder, CO. (Sponsor: William C Byrnes, FACSM)  
 Email: walter.schmidt@uni-bayreuth.de

Reported Relationships: **W.F. Schmidt:** Receipt of Intellectual Property Rights/Patent Holder; **Walter Schmidt** is a managing partner of the company 'Blood tec GmbH', but he is unaware of any direct or indirect conflict of interest with the contents of this abstract..

Inhalation of carbon monoxide (CO) blocks the oxygen binding sites of the hemoglobin molecule and may produce similar effects as exposure to altitude. While single CO-doses and short-term application which are used in medicine and science do not exert measurable effects on erythropoiesis and performance, no data exists about chronic administration.

**PURPOSE:** To determine the effect of chronic low dose CO-application on hemoglobin mass and performance. **METHODS:** For three weeks, eleven male healthy and moderately trained subjects inhaled a CO-bolus five times the day to increase their HbCO concentration in blood by approx. 5%. Eleven matched subjects

received a placebo. Hemoglobin mass (Hbmass), serum erythropoietin concentration [EPO], ferritin, and basic hematological parameters were determined before and weekly during and until three weeks after the CO-inhalation period. An incremental step test until exhaustion on a cycle ergometer was performed before, at the end and one week after the CO administration period. **RESULTS:** During and after the intervention period, there were significant interactions between time and groups for Hbmass ( $p < 0.001$ ), ferritin ( $p < 0.05$ ), [EPO] ( $p < 0.001$ ), percentage (%) and immature reticulocytes (IRF) (both  $p < 0.05$ ). A tendency for an interaction was found for max. power and  $VO_{2max}$  ( $p = 0.1$ ). In the CO-group, Hbmass continuously increased from  $919 \pm 69$ g to  $962 \pm 78$ g in week 3, ( $p < 0.001$ ) and persisted for the following three weeks. Whole blood and plasma volume did not change. Reticulocytes (%) and IRF increased after one week (ret% from  $1.21 \pm 0.31\%$  to  $1.40 \pm 0.29\%$ ,  $p < 0.01$ ; IRF from  $5.1 \pm 1.7\%$  to  $7.0 \pm 2.7\%$ ,  $p < 0.05$ ). [EPO] tended to increase after one week ( $p = 0.07$ ) and was suppressed in the post period ( $p < 0.01$ ). Ferritin markedly decreased during the inhalation period (from  $106 \pm 37$ ng/ml to  $72 \pm 37$  ng/ml,  $p < 0.001$ ).  $VO_{2max}$  tended to increase from  $4230 \pm 280$  ml/min to  $4350 \pm 350$  ml/min ( $p < 0.1$ ) immediately after the inhalation period and showed a significant relationship to the change in Hbmass ( $y = 2.9x + 29$ ,  $r = 0.55$ ,  $p < 0.05$ ). In the placebo group no effect was observed. **CONCLUSIONS:** Chronic continuous exposure to low dose carbon monoxide increasing HbCO by  $\sim 5\%$  significantly increased erythropoietic activity and showed a positive effect on performance.

**1481** Board #243 May 30 9:30 AM - 11:00 AM  
**High Intensity Interval Training And Acute Altitude Exposure In A Masters Athlete: A Case Study**

Katherine Woolley, Thomas Martin. *Quinnipiac University, Hamden, CT.*

(No relevant relationships reported)

This study involved an experienced, 64 year-old male mountaineer who trained at sea-level and climbed Mount Kilimanjaro (5,895 m). High Intensity Interval Training (HIIT) is a time-saving mode of exercise consisting of bursts of all-out effort and active recovery which has shown to improve cardiovascular fitness and strength. Hypoxia induces Acute Mountain Sickness (AMS) which poses many health risks to individuals of all age. **PURPOSE:** To assess the effects of a HIIT protocol on a Masters climber and investigate physiologic changes due to altitude exposure and incidence of AMS. **METHODS:** The six-week training program consisted of six alternating rounds of 85-90% max HR progressing from 90-120 seconds followed by 3 minutes active recovery. Subject was tested at: baseline, post-training/pre-climb, and post-climb. For baseline and post-training body composition, pulmonary function, hematology, cognitive function, reaction time,  $VO_2$  max, and muscle strength were measured. Post-climb all measures were repeated except  $VO_2$  max and strength. While climbing, physiologic and GPS data were collected. At each basecamp, resting  $SpO_2$ , HR, Lake Louise Score (LLS), reaction time, cognitive function (Stroop test), and coordination tests were performed. The LLS is the standard for diagnosing AMS. **RESULTS:** Subject summited and returned healthy. HIIT increased  $VO_2$  max ( $36.4$  to  $47.1$  ml/kg/min), muscle symmetry, and FEV1/FVC increased  $0.86\%$ , body fat increased from  $7.2$  to  $8\%$ . Subject experienced mild AMS on days two and three of the ascent. Reaction time increased by 1 second, and the incongruent Stroop test time increased 57 seconds at high camp compared to baseline. On average,  $SpO_2$  and HR dropped  $3.2\%$  and  $5.8$  bpm respectively overnight at camps. HR, and RR increased with altitude. Upon return, serum Potassium and Creatine Kinase were elevated ( $5.4$ ,  $268$ ), and FEV1/FVC decreased  $4.1\%$ , body fat decreased to  $3.6\%$ . **CONCLUSIONS:** HIIT is a safe and effective way to train a Masters athlete for the rigor of high altitude. These findings are of clinical importance for athletes preparing for high altitude mountaineering. Masters athletes are capable of training for, experiencing, and surmounting AMS. With proper training a Masters athlete can complete a high-altitude climb.

**1482** Board #244 May 30 9:30 AM - 11:00 AM  
**Acute Effects Of Electrical Stimulation In Hypoxia On Arterial Stiffness**

Masato Nishiwaki<sup>1</sup>, Mami Fujibayashi<sup>2</sup>, Naoyuki Matsumoto<sup>3</sup>.  
<sup>1</sup>Osaka Institute of Technology, Osaka, Japan. <sup>2</sup>Setsunan University, Osaka, Japan. <sup>3</sup>Prefectural University of Kumamoto, Kumamoto, Japan.  
 Email: masato.nishiwaki@oit.ac.jp  
 (No relevant relationships reported)

**PURPOSE:** This study aimed to examine acute effects of electrical stimulation in hypoxia on arterial stiffness.

**METHODS:** Seven healthy male adults ( $21 \pm 1$ ) participated in experiments of four different protocols (*i.e.*, rest in normoxia (NR), rest in hypoxia (HR), electrical stimulation in normoxia (NES), and electrical stimulation in hypoxia (HES)) in random order on separate days. Throughout a 40-min trial, the subjects breathed normoxic ( $20.9\%O_2$ ) or hypoxic ( $15.3 - 15.5\%O_2$ ) gas via a facemask connected to the oxygen generator. Also, in NES and HES, a 20-minute electrical stimulation of 4 Hz was conducted

in a lower limb in the latter 20-min of the trial. Before (baseline) and after (Post) each trial, arterial stiffness was assessed by cardio-ankle vascular index (CAVI), which is theoretically adjusted by blood pressure.

**RESULTS:** During electrical stimulation, heart rate and oxygen uptake in NES and HES increased, compared with each baseline. However, no significant difference was observed in the mean heart rate between NES and HES. Conversely, oxygen uptake during electrical stimulation was significantly lower in HES than in NES. There was no significant change in CAVI of NR and HR. However, CAVI of HES and NES significantly reduced (HES, Baseline:  $5.9 \pm 0.1$ , Post:  $4.9 \pm 0.2$  vs. NES, Baseline:  $5.6 \pm 0.2$ , Post:  $5.1 \pm 0.2$ , both  $P < 0.05$ ), and the reduction in CAVI was significantly greater in HES than that in NES (%change, HES vs. NES:  $-16.4 \pm 8.9\%$  vs.  $-9.9 \pm 5.4\%$ ;  $P < 0.05$ ). In addition, lactate concentrations and respiratory exchange ratio were significantly higher in HES than the other three trials.

**CONCLUSIONS:** These findings suggest that electrical stimulation in hypoxia can induce greater reduction in arterial stiffness than those in normoxia.

**1483** Board #245 May 30 9:30 AM - 11:00 AM  
**Functional Inspiratory Muscle Training Improves The Strength of Inspiratory Muscles During Load Carriage In Cold-hypoxia**

Katrina Hinde<sup>1</sup>, Chris Low<sup>2</sup>, Ray Lloyd<sup>3</sup>, Carlton Cooke<sup>3</sup>.  
<sup>1</sup>University of Chichester, Chichester, United Kingdom. <sup>2</sup>Leeds Beckett University, Leeds, United Kingdom. <sup>3</sup>Leeds Trinity University, Leeds, United Kingdom.  
 Email: k.hinde@chi.ac.uk  
 (No relevant relationships reported)

**PURPOSE:** Load carriage (LC) exceeding 20kg elicits respiratory muscle fatigue (RMF) in sea level thermo-neutral conditions. Sub-maximal physical activity in cold-hypoxia has shown to elicit RMF. Inspiratory muscle training (IMT) combined with LC has failed to reduce RMF. Functional IMT (FIMT) may activate non-respiratory roles of the diaphragm and respiratory muscles resulting in adaptations beyond that of static IMT. **METHODS:** Loaded (18.2kg) walking trials were completed pre, mid and post training (trial 1, 2 and 3, respectively). Participants ( $n = 15$ ) performed a 6km loaded walk at  $50\%VO_{2max}$  over 4 stages 0 - 6km in 0.5 increments at 0, 5, and 10% gradient in cold-hypoxia ( $4300m$  in  $-10^\circ C$ ). Following trial 1, participants were randomly assigned to control (Con= $7$ ) or experimental (Exp= $8$ ) to undertake 4 weeks of IMT using a pressure threshold training device. The Exp performed 2 x 30 breaths daily at  $50\%$  maximal inspiratory pressure ( $P_{imax}$ ) and Con performed 60 daily breaths at  $15\%P_{imax}$ . FIMT (5 exercises designed to engage core muscles, 3 involved LC) was then performed 3 times weekly at the same intensities as IMT. **RESULTS:** Inspiratory muscle fatigue was prevalent following trial 1 ( $p < .001$ ). Relative to baseline ( $126.9 \pm 15.7$  cmH<sub>2</sub>O) trends were identified for greater  $P_{imax}$  in Exp post-IMT ( $145.5 \pm 20.5$  cmH<sub>2</sub>O,  $p = .066$ ) with no changes in Con. FIMT showed no further significant increase in  $P_{imax}$  ( $p = .104$ ).  $P_{imax}$  values post-6km in Exp were significantly greater than Con and higher than pre-6km pre-intervention values ( $p = .007$ ). However,  $\Delta P_{imax}$  was unchanged in Exp ( $p \geq .214$ ). No significant relationships were observed between  $\Delta P_{imax}$  vs baseline  $P_{imax}$  and  $VO_{2max}$  vs  $\Delta P_{imax}$ . **CONCLUSION:** Four weeks of IMT and FIMT strengthened inspiratory muscles by 23%. Despite no reduction in RMF,  $P_{imax}$  values were significantly greater post-6km in Exp and higher than pre-6km pre-intervention values. Protocols employing more progressive training loads may reduce RMF. Due to the low intensity and prolonged nature of LC in cold-hypoxia, respiratory muscle endurance may be more dominant than strength. Thus, requiring further investigation.

**1484** Board #246 May 30 9:30 AM - 11:00 AM  
**Comparing Physiological Responses to Single and Double Leg Submaximal Cycling in Normoxia and Hypoxia**

Shane N. Draper<sup>1</sup>, Tyler Singer<sup>2</sup>, Cody Dulaney<sup>2</sup>, Sarah Kearney<sup>2</sup>, John McDaniel<sup>2</sup>. <sup>1</sup>Utah Valley University, Orem, UT. <sup>2</sup>Kent State University, Kent, OH.  
 Email: ShaneD@uvu.edu  
 (No relevant relationships reported)

**INTRODUCTION:** It has been well established that exercise intensity as well as exercise performance declines at altitude. However, it has yet to be determined how femoral blood flow and muscle oxygenation kinetics (total tissue saturation, oxy- and deoxygenated hemoglobin, as well as total hemoglobin) are influenced by altitude during submaximal and maximal performances. Furthermore, it has yet to be determined if the utilization of small muscle mass exercise, which allows for greater blood flow to the active muscle, will allow an individual to generate the same muscle oxygenation kinetics in hypoxic conditions that is achieved during larger muscle mass activities in normoxia. **PURPOSE:** Thus, the purpose of this study was to determine if tissue oxygenation was compromised at altitude during submaximal bouts of exercise and whether reducing the active muscle mass exercise could be used to offset any observed decrement due to increases in blood flow.

**METHODS:** 10 individuals performed double leg cycling for four minutes at 50%, 60%, 70% and 80% of their maximal oxygen consumption, rested for 15 minutes and then performed single leg cycling utilizing the same protocol but at half the double leg work rate in both normoxic and hypoxic conditions (oxygen concentration of 15% which simulated an altitude of 2,740 meters).

**RESULTS:** The amount of blood flow during the single leg trial in hypoxia was significantly higher compared to blood flow during double leg cycling in hypoxia ( $p = 0.02$ ). There was no significant difference between the single leg trial in hypoxia and the double leg trial in normoxia ( $p = 0.36$ ) nor between the two double leg trials in normoxia and hypoxia ( $p = 0.87$ ). No difference was found in the amount of oxygenated hemoglobin when comparing the single leg trial in hypoxia to the double leg trials in normoxia ( $p = 0.36$ ) and hypoxia ( $p = 0.13$ ).

**CONCLUSIONS:** The results suggest that elevated hemoglobin saturation and femoral blood flow during the single leg condition in hypoxia are similar to that observed during double leg cycling in normoxia and may prove to be a viable training modality that would offset the main disadvantage of living at altitude by enabling an individual to exercise at the same level of intensity achieved at normoxia.

## C-42 Free Communication/Poster - Microgravity/Space Physiology

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

### 1485 Board #247 May 30 9:30 AM - 11:00 AM Impact Of Long-acting Reversible Contraceptives On Bone Density During Simulated Microgravity

Heather C.M. Allaway, Sarah E. Little, Harry A. Hogan, Susan A. Bloomfield, FACSM. *Texas A&M University, College Station, TX.*

(No relevant relationships reported)

Hormonal contraception is routinely used by premenopausal women, including female astronauts, to suppress ovarian function and menstrual cycling. Combined oral contraceptive pill (COC, ethinyl estradiol and progestin) use leads to a suppression of bone turnover and reduced bone mineral density (BMD) gain with long-term exercise. Long-acting, reversible contraceptives (LARC, progestin-only) provide many practical advantages over COC. With increasing numbers of women in the US astronaut corps, we risk sending female crew members into microgravity without a clear understanding of the impact of LARC use on bone health.

**Purpose:** We hypothesize that LARC use will blunt decreases in BMD associated with hindlimb unloading (HU).

**Methods:** Virgin female Sprague-Dawley rats ( $n=26$ ; 4-mo-old) were singly housed and randomly assigned to placebo and LARC groups, via a slow-release etonogestrel pellet (0.00ug/d vs. 0.30ug/d) implanted under the skin. Animals were further randomized into ambulatory and HU subgroups ( $n=6-7$ /subgroup), with HU initiated a week following pellet insertion and lasting for 6 weeks. Pre/post HU, proximal tibia metaphysis (PTM) were scanned in vivo with peripheral quantitative computed tomography (pQCT). Univariate and repeated measures 2-way ANOVA were used.

**Results:** There was a time\*loading group interaction ( $p<0.01$ ) for body weight and food consumption. HU animals weighed less over the last 4 weeks of the study but consumed more food over 6 weeks of HU vs. ambulatory animals. Soleus wet weights were significantly lower in HU compared to ambulatory animals ( $p<0.001$ ). There was a main effect of time for ( $p<0.001$ ) PTM total, cancellous, and cortical volumetric BMD and total and cortical areas. For marrow area at the PTM there was a time\*loading group interaction ( $p=0.044$ ), such that over time the HU animals had a decrease in marrow area compared to the ambulatory animals. No impact of LARC on these outcomes was detected.

**Conclusions:** Early results indicate that LARC use does not alter the PTM bone response to mechanical unloading of simulated microgravity assessed by in vivo pQCT.

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

1486 Board #248 May 30 9:30 AM - 11:00 AM

### Can Acute Galactic Cosmic Radiation-induced Bone Loss Be Mitigated By Dietary Modulation Of Inflammatory Cytokines?

Sarah E. Little<sup>1</sup>, Heather CM Allaway<sup>1</sup>, Rihana S. Bokhari<sup>1</sup>, Derek V. Seidel<sup>1</sup>, Kimberly L. Wahl<sup>1</sup>, Nancy D. Turner<sup>2</sup>, John R. Ford<sup>1</sup>, Larry Suva<sup>1</sup>, Susan A. Bloomfield, FACSM<sup>1</sup>. <sup>1</sup>Texas A&M University, College Station, TX. <sup>2</sup>Michigan State University, College Station, TX.

Email: selittle@tamu.edu

(No relevant relationships reported)

The space environment includes weightlessness and galactic cosmic radiation (GCR), both of which can have a negative impact on bone parameters. In particular, acute exposures to space-relevant doses (2 Gy or less) of simulated GCR lead to a rapid acceleration of bone resorption activity and suppression of bone forming osteoblasts, resulting in diminished bone mineral density (BMD), strength and altered microarchitecture. A key mechanism driving these changes may be a radiation-induced increase in pro-inflammatory cytokines, such as TNF- $\alpha$ . Consuming a diet rich in omega-3 fatty acids has been associated with attenuated reductions in bone parameters in astronauts, mice and elderly humans with corresponding reductions in circulating inflammatory cytokines. **PURPOSE:** To test the hypothesis that a diet high in omega-3 fatty acids will mitigate radiation-induced bone loss and reduce inflammatory cytokines in bone osteocytes and serum.

**METHODS:** Adult (30- to 50-week-old) female Lgr5-EGFP C57BL/6 mice ( $n=4-6$  per group) were acclimated to a corn oil/cellulose (COC) or fish oil/pectin (FOP) diet for 3 weeks. Animals were subsequently randomized to total body low dose high-energy radiation (0.1, 0.25, 0.5 Gy of 1000 MeV/n <sup>60</sup>Fe at 25 cGy/min at Brookhaven National Lab) or non-irradiated control (sham) and euthanized 8 weeks later. MicroCT (ScanCo, Switzerland) analyses were performed to assess bone geometry and microarchitecture at the mid-shaft and distal end of the femur. Significance was assessed using an  $\alpha$  of 0.10.

**RESULTS:** There was a significant main effect of diet on mid-shaft femur periosteal diameter (Peri.Dm) ( $p=0.001$ ) and endocortical diameter (Endo. Dm.) ( $p<0.001$ ). The FOP diet led to larger Peri.Dm. ( $p<0.051$  for all) and Endo.Dm. ( $p<0.041$  for all) than did the COC diet at all doses. We could not detect an impact of <sup>60</sup>Fe on cortical area or cancellous bone volume at the distal femur. Irradiation with 0.25 and 0.5 Gy in the FOP mice showed significant increases in distal femur volumetric BMD ( $p=0.014$ ,  $p=0.063$ ) and trabecular thickness ( $p=0.058$ ,  $p=0.028$ ), as compared with sham FOP mice.

**CONCLUSIONS:** Though we did not detect a significant impact of radiation on bone parameters, these early data analyses suggest some modest benefits from a diet high in omega-3 fatty acids on cortical and cancellous bone parameters.

1487 Board #249 May 30 9:30 AM - 11:00 AM

### Circulating MicroRNA Expression and Serum Biomarker Changes After 30 Days of Head-Down Bed Rest

Samuel R. Buchanan<sup>1</sup>, Carl Ade<sup>2</sup>, Breanne Baker<sup>1</sup>, Debra Bembem, FACSM<sup>1</sup>. <sup>1</sup>The University of Oklahoma, Norman, OK. <sup>2</sup>Kansas State University, Manhattan, KS. (Sponsor: Debra Bembem, FACSM)

Email: samuel.r.buchanan-1@ou.edu

(No relevant relationships reported)

Microgravity is known to have negative effects on bone health. Circulating microRNAs (c-miRNA) are non-coding RNA molecules assessed in blood that have potential as biomarkers of osteoporosis and may be beneficial for tracking changes in bone status. **PURPOSE:** To examine selected c-miRNAs and serum markers of inflammation and bone turnover responses to a 30 day six-degree head-down bed rest protocol at an ambient 0.5% CO<sub>2</sub>. **METHODS:** 11 adults (6 males, 5 females), 25-50 years, participated in the study at the Institute for Aerospace Medicine in Germany. Participants had fasted blood draws collected 3 days before, and on the final day of bed rest. Serum samples were assayed for relative expression of miR-21-5p, -100-5p, -125b-5p, and -126-3p using qPCR. Bone markers (Bone ALP, P1NP, TRAP 5b, sclerostin), inflammation markers (TNF $\alpha$ , IL-6), and Vitamin D were measured using ELISA. **RESULTS:** Only miR-21-5p increased relative expression pre to post ( $p=0.02$ ). TNF $\alpha$  and calcium increased, and all bone marker concentrations increased pre to post, except Bone ALP. Baseline relative expression of miR-21-5p was correlated with pre calcium ( $r_s=0.745$ ,  $p<0.01$ ), miR-100-5p with sclerostin ( $r_s=0.627$ ,  $p=0.04$ ), pre IL-6 ( $r_s=0.661$ ,  $p=0.03$ ), and vitamin D ( $r_s=0.645$ ,  $p=0.03$ ), and miR-125b-5p with osteocalcin ( $r_s=0.864$ ,  $p<0.01$ ). Log<sub>2</sub> fold changes in miR-125-5p and absolute change in TRAP 5b were negatively correlated ( $r_s=-0.782$ ,  $p<0.01$ ), and Log<sub>2</sub> fold changes in miR-21 and absolute change in vitamin D were positively correlated ( $r_s=0.609$ ,  $p=0.047$ ). **CONCLUSION:** 30 days of 6-degree head-down bed rest significantly increased bone turnover as evidenced by increases in both P1NP and TRAP5b. Baseline c-miRNAs significantly correlated with multiple measures of bone

metabolism. MiRNA fold changes were correlated with absolute changes in Vitamin D (miR-21-5p) and TRAP5b (miR-125-5p), warranting further investigation into the use of miRNAs as biomarkers of space flight.

**Table 1. Serum Biomarkers Pre and Post Bed Rest (mean ± SD).**

Variable	Pre			Post			mean change		
							Log2 Fold Change		
miR-21-5p	-0.54	±	0.49	-0.07*	±	0.36	0.29	±	0.60
miR-100-5p	-8.93	±	1.04	-8.49	±	1.03	0.32	±	0.61
miR-125b-5p -5.67 ± 0.77 -5.34					±	0.62	0.43	±	1.36
miR-126-3p	-0.90	±	0.41	-0.61	±	0.52	0.47	±	0.55
							Absolute Change		
Sclerostin	0.47	±	0.14	0.53*	±	0.17	0.06	±	0.08
TRAP5b	2.59	±	0.67	3.22**	±	0.73	0.63	±	0.36
P1NP	56.25	±	13.29	63.59*	±	14.53	7.34	±	7.60
Bone ALP	8.83	±	3.67	10.18	±	3.74	1.34	±	4.46
TNFα	6.37	±	4.35	9.51*	±	8.36	3.13	±	4.16
IL-6	1.05	±	0.10	1.11	±	0.16	-0.06	±	0.22
Vitamin D	33.07	±	4.27	31.32	±	5.46	-1.74	±	3.93
Calcium	2.34	±	0.07	2.38*	±	0.06	0.05	±	0.05
Osteocalcin	12.59	±	2.30	11.80	±	1.85	-0.79	±	1.69

\*p<0.05, \*\*p<0.01 significant vs. Pre, TRAP5b = Tartrate-resistant acid phosphatase 5b; P1NP= Procollagen type I N propeptide; Bone ALP = Bone-specific alkaline phosphatase; TNFα = Tumor necrosis factor alpha; IL-6 = Interleukin-6.

**1488 Board #250 May 30 9:30 AM - 11:00 AM**  
**Relationships Between Circulating MicroRNA and Muscular Performance Responses to a 30 Day Bed Rest Protocol**  
 Cameron Combs<sup>1</sup>, Carl Ade<sup>2</sup>, Samuel Buchanan<sup>1</sup>, Debra Bembem, FACSM<sup>1</sup>. <sup>1</sup>University of Oklahoma, Norman, OK. <sup>2</sup>Kansas State University, Manhattan, KS. (Sponsor: Dr. Debra Bembem, FACSM)  
 Email: cameron.s.combs-1@ou.edu  
 (No relevant relationships reported)

Microgravity is known to have detrimental effects on muscle tissue, leading to atrophy and a decline in performance. Although underlying mechanisms are not clear, microRNAs (miRNA) may play a role as they have regulatory effects on skeletal muscle gene expression. **PURPOSE:** To determine the effects of a 30 day six-degree head-down bed rest protocol at an ambient 0.5% CO<sub>2</sub> on lower body muscular performance. Relationships between circulating miRNAs and changes in muscle variables were also examined. **METHODS:** 11 healthy subjects, 5 males and 6 females, were recruited for this study. The intervention involved a 30 day, six-degree head-down bed rest platform to simulate International Space Station flight. Maximal muscular performance was assessed for isokinetic knee extension (IsokKE), isokinetic knee flexion (IsokKF), isometric knee extension (IsomKE), isometric knee flexion (IsomKF), jump velocity (JV), absolute jump power (AbJP), and relative jump power (RelJP) 5 days before and 2 days after bed rest. Serum miRNAs (miR-21-5p, -100-5p, -125b-5p, -126-3p) were assessed by qPCR and fold changes (FC) were correlated with muscle performance variables. **RESULTS:** All muscular performance measures decreased (p<0.05) after bed rest (absolute changes: IsokKE -36±27N, IsokKF -16±17N, IsomKE -28±22N, IsomKF -12±14N, JV -0.21±0.08m/s, AbsJP -0.45±0.19kW, RelJP Power -5.23±1.88W/kg). Pre bed rest miR-100-5p relative expression was positively correlated with Pre strength measures and jump power (r=0.603 to 0.727, p<0.05). MiR-126-3p FC was negatively related to absolute change in relative power (r=-0.705, p<0.05), and miR-125b-5p FC was positively correlated (p<0.05) with absolute changes in IsomKE (r=0.627), IsomKF (r=0.817), and JV (r=0.700). MiR-100-5p FC was positively correlated (p<0.05) with absolute changes in IsomKE (r=0.652) and IsomKF (r=0.759). **CONCLUSION:** As expected, muscle performance significantly declined after 30 days of bed rest. Significant relationships were found between miRNAs and muscle variables at baseline (miR-100-5p), and miRNA fold changes (miR-100-5p, -125b-5p, -126-3p) were correlated with absolute changes in muscle strength and power. These miRNAs require further investigation to explore their possible mechanistic roles in muscle performance declines after bed rest.

**1489 Board #251 May 30 9:30 AM - 11:00 AM**  
**Cerebral Blood Flow Responses To Long Term Head-down Bed Rest**  
 Shigehiko Ogoh, FACSM<sup>1</sup>, Kohei Sato<sup>2</sup>, Steven de Abreu<sup>3</sup>, Pierre Denise<sup>3</sup>, Hervé Normand<sup>3</sup>. <sup>1</sup>Toyo University, Kawagoe, Japan. <sup>2</sup>Tokyo Gakugei University, Tokyo, Japan. <sup>3</sup>Caen Normandie University, Caen, France.  
 Email: ogoh@toyo.jp  
 (No relevant relationships reported)

**PURPOSE:** The present study was designed to investigate the effect of a 60-days, -6° head-down bed rest (HDBR) on both arterial and venous cerebral blood flows. **METHODS:** Twenty male healthy volunteers were evaluated. Blood flow in right side of the neck arteries (internal carotid artery; ICA and vertebral artery; VA) and veins (internal jugular vein; IJV and vertebral vein; VV) was measured by using ultrasonography on the day before HDBR (baseline); 30<sup>th</sup> day and 57<sup>th</sup> day of HDBR. **RESULTS:** ICA blood flow decreased at 30<sup>th</sup> day of the HDBR compared with baseline (P = 0.002), and returned to baseline at 57<sup>th</sup> day of the HDBR. On the other hand, VA blood flow was unchanged throughout the HDBR (P=0.402). At the venous side, IJV blood flow decreased at both 30<sup>th</sup> and 57<sup>th</sup> day of the HDBR (P = 0.002 and P = 0.005, respectively), in contrast, VV blood flow increased at 30<sup>th</sup> day (P=0.004) and was unchanged at 57<sup>th</sup> day compared with baseline. **CONCLUSIONS:** These findings suggest that the long-term HDBR decreased anterior cerebral arterial and venous blood flows, while posterior cerebral arterial and venous blood flows were well maintained. The heterogeneous blood flow response of the cerebral arteries may be associated with cerebral venous outflow but its physiological mechanism remains unclear.

**1490 Board #252 May 30 9:30 AM - 11:00 AM**  
**Sarcolab-3: Changes In Knee Flexor And Extensor Torque Generation During A Six-month Space Flight Mission**  
 Justin T. Reed<sup>1</sup>, Charles S. Layne<sup>1</sup>, Yuri Koryak<sup>2</sup>, Mark S. Clarke<sup>1</sup>, Elena Tomilovskaya<sup>2</sup>, Kirsten Albracht<sup>3</sup>, Boris Shenkman<sup>2</sup>, Benjamin Stäudle<sup>3</sup>, Jörn Rittweger<sup>4</sup>, Inessa Kozlovskaya<sup>2</sup>, Mitzi S. Laughlin<sup>1</sup>. <sup>1</sup>University of Houston, Houston, TX. <sup>2</sup>IMBP, Moscow, Russian Federation. <sup>3</sup>University of Applied Sciences, Aachen, Germany. <sup>4</sup>German Aerospace Center (DLR), Cologne, Germany. (Sponsor: Richard Simpson, FACSM)  
 Email: jtreed@uh.edu  
 (No relevant relationships reported)

**Purpose**  
 To examine the effects of space flight on knee extensors and flexors over six month flight missions.  
**Methods**  
 Four crewmembers were tested on board the International Space Station (ISS) after 8.9 (SD 3.0), 49.1 (SD 10.1) and 131.5 (SD 27.7) days in-flight, as well as pre- and post-flight, using the Muscle Atrophy Research and Exercise System (MARES). Voluntary isometric torque during maximal knee extension and flexion was obtained at starting positions of 90, 60 and 45 degrees of flexion. Surface EMG was simultaneously measured for the biceps femoris, semitendinosus, vastus lateralis and rectus femoris. Root mean squared (RMS) EMG within a 500 ms window centered on the time of peak torque was identified, and ratios of EMG to peak torque (EMG/T) were calculated for each isometric contraction.  
**Results**  
 Peak knee extension and flexion force declined immediately in-flight from pre-flight values. Knee extension decreased by 35.25%, 23.52% and 35.71% while flexion decreased by 25.55%, 27.59%, and 30.76% at 90, 60 and 45 degrees, respectively. Peak torque during knee extension progressively increased during flight such that the differences between pre-flight values and those of the third in-flight testing session were reduced to deficits of 25.65%, 11.37% and 0% for 90, 60 and 45 degrees, respectively. Knee flexion declined slightly at both 90 and 60 degrees (30.84% and 28.18%) however improved slightly at 45 degrees (25.39%) for in-flight 2 with a reciprocal change at in-flight 3 to 23.68%, 22.97% and 34.2% at 90, 60 and 45 degrees, respectively. By the second in-flight test, EMG/T ratios reflected a changing relationship between neuromuscular activation and torque production, with greater relative activation required to produce similar levels of torque when compared to pre-flight values.  
**Conclusions**  
 Results suggest that space flight results in an immediate decline of peak torque production for both knee extension and flexion. Current in-flight countermeasures appear to trend towards functional restoration of knee extension while knee flexion remained relatively unchanged.

1491 Board #253 May 30 9:30 AM - 11:00 AM

**The Hypercapnic Ventilatory Response and Cerebrovascular Reactivity to CO<sub>2</sub> during Waist Water Immersion with Acute Hypercapnia and Head Out Water Immersion**

James R. Sackett<sup>1</sup>, Zachary J. Schlader, FACSM<sup>2</sup>, David Hostler, FACSM<sup>2</sup>, Blair D. Johnson<sup>2</sup>. <sup>1</sup>Cornerstone University, Grand Rapids, MI. <sup>2</sup>University at Buffalo, Buffalo, NY.  
Email: james.sackett@cornerstone.edu  
(No relevant relationships reported)

During head out water immersion (HOWI), the hypercapnic ventilatory response (HCVR) is augmented and cerebrovascular reactivity to CO<sub>2</sub> (CVR) is attenuated; possibly due to water pressure exerted on the chest wall, central hypervolemia, and/or hypercapnia. Waist water immersion with acute hypercapnia (WWI+CO<sub>2</sub>) causes central hypervolemia and hypercapnia without exerting water pressure on the chest wall. However, it is unknown if HCVR and CVR are different during WWI+CO<sub>2</sub> vs. HOWI. **PURPOSE:** We tested the hypotheses that the HCVR is augmented and CVR is attenuated during WWI+CO<sub>2</sub> and HOWI. **METHODS:** Twelve subjects (age: 24±3 y, BMI: 25±3 kg/m<sup>2</sup>, 6 women) completed one hour of thermoneutral (35±0°C) WWI+CO<sub>2</sub> and HOWI. The partial pressure of end tidal CO<sub>2</sub> (PETCO<sub>2</sub>; capnograph), minute ventilation (MV; pneumotachometer), and middle cerebral artery blood velocity (MCAv; transcranial doppler) were recorded. CO<sub>2</sub> was added to the inspirate during WWI+CO<sub>2</sub> to match the increase in PETCO<sub>2</sub> during HOWI. Subjects rebreathed 7% CO<sub>2</sub> and 93% O<sub>2</sub> from a 10 L bag for 3.5 min at baseline, 10 min, 30 min, and 60 min of water immersion. The HCVR and CVR were calculated as the slope of the linear regression line of MV vs. PETCO<sub>2</sub> and MCAv vs. PETCO<sub>2</sub> every 30 s throughout the test. Data are reported as a change from baseline (mean±SD). **RESULTS:** PETCO<sub>2</sub> increased from baseline during WWI+CO<sub>2</sub> and HOWI at every time point (p<0.01) and was matched between conditions (p≥0.26). MV increased from baseline during WWI+CO<sub>2</sub> at 60 min (p=0.03) but did not change during HOWI at any time point (p≥0.38). MCAv increased from baseline during WWI+CO<sub>2</sub> at every time point and during HOWI at 10 min and 30 min (all p<0.01). The HCVR did not change from baseline during WWI+CO<sub>2</sub> at any time point (all p≥0.35) but increased from baseline during HOWI at every time point (10 min: 0.59±0.34, 30 min: 0.58±0.46, 60 min: 0.63±0.45 L/min/mmHg; p<0.01). The HCVR was lower during WWI+CO<sub>2</sub> vs. HOWI at 10 min, 30 min, and 60 min (p<0.01). CVR decreased from baseline during WWI+CO<sub>2</sub> and HOWI at every time point (p<0.01) but was not different between conditions at any time point (p≥0.16). **CONCLUSIONS:** The elevated HCVR during HOWI is likely caused by water pressure exerted on the chest wall. However, reductions in CVR during HOWI are likely caused by central hypervolemia and/or hypercapnia.

**C-43 Free Communication/Poster - Immunology II**

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

1492 Board #254 May 30 10:30 AM - 12:00 PM

**Inflamm-aging Is Associated With Impairing The Process Of Maintaining Telomere Length In LPS Stimulated PBMCs**

Charles S. Schwartz<sup>1</sup>, Aaron Slusher<sup>2</sup>, Tiffany Zúñiga<sup>3</sup>, Keshu Shah<sup>1</sup>, Edmund Acevedo, FACSM<sup>1</sup>. <sup>1</sup>Virginia Commonwealth University, Richmond, VA. <sup>2</sup>University Of Michigan, Ann Arbor, MI. <sup>3</sup>University of Arizona, Tucson, AZ. (Sponsor: Edmund Acevedo, FACSM)  
Email: schwartzcs@vcu.edu  
(No relevant relationships reported)

**PURPOSE:** This study examined the impact of the inflamm-aging phenotype on the capacity of isolated PBMCs to express a key mechanistic component involved in maintaining longer telomere lengths, human telomerase reverse transcriptase (hTERT), following *ex vivo* cellular stimulation with lipopolysaccharide (LPS). **METHODS:** Plasma inflammatory cytokines (i.e., IL-6, IL-10, TGF-β, and TNF-α), PBMC telomere lengths, and LPS-stimulated hTERT mRNA expression following *ex vivo* stimulation of PBMCs with LPS in 15 middle-aged (40-64 years) and 15 young adults (20-31 years) were quantified. **RESULTS:** Aging was accompanied by the accumulation of centrally located visceral adipose tissue (p ≤ 0.005), in the absence of weight gain (p = 0.932) or changes in BMI (p = 0.081), and alterations in the systemic inflammatory milieu (decreased plasma concentrations of the anti-inflammatory cytokine TGF-β; increased plasma concentrations of the pro-inflammatory cytokine TNF-α [p ≤ 0.050]). Likewise, shorter telomere lengths in middle-aged compared to young adults (p = 0.011) were associated with increased age, body fat percentages, and plasma TNF-α concentrations (r =

-0.404, p = 0.027; r = -0.427, p = 0.019; r = -0.323, p = 0.041, respectively). Finally, the capacity of PBMCs to express hTERT mRNA following cellular stimulation was impaired in middle-aged compared to young adults (p = 0.018), and negatively associated with telomere lengths (r = 0.353, p = 0.028).

**CONCLUSIONS:** Inflamm-aging is associated with the impaired the capacity of PBMCs to express hTERT mRNA and provides a mechanistic target to counter age-related telomere attrition and disease.

1493 Board #255 May 30 10:30 AM - 12:00 PM

**Effect Of Self control Exercise On Lymphocyte Subsets Of Lung Cancer Patients During Rehabilitation**

JIBING WANG<sup>1</sup>, Weimo Zhu, FACSM<sup>2</sup>, Renwei Wang<sup>3</sup>, Jiaying Lang<sup>1</sup>. <sup>1</sup>Tongji University, Shanghai, China. <sup>2</sup>University of Illinois at Urbana-Champaign, urbana, IL. <sup>3</sup>Shanghai University of Sport, Shanghai, China.  
(No relevant relationships reported)

**PURPOSE:** Self-Control Exercise (SCE), known also as Guolin Qigong, is a mind-body exercise being used in China for cancer survival for more than 40 years. This study was to examine the effect of SCE on lymphocyte subsets of lung cancer patients and the possible mechanisms.

**METHODS:** 26 lung cancer patients (8 males & 18 females; Age in yr: 60.08±5.41; Cancer survival yr: 1.69±0.72) were recruited from the Shanghai Cancer Club. All the patients were diagnosed pathologically. The patients began to learn SCE for 3 weeks and then performed 6 months SCE at their will. Cancer history was surveyed, physical activity including SCE was recorded during the intervention. The lymphocyte surface antigen CD3/CD4/CD8/CD28/CD(16+56)/CD19/CD4CD25Foxp3 were examined by direct immunofluorescence staining and flow cytometry. Paired-samples t test was performed to compare the change of lymphocyte surface antigen before and after the intervention.

**RESULTS:** It was found that CD3<sup>+</sup> increased significantly (50.52±13.09, 56.77±11.56 p &lt; 0.05), CD4<sup>+</sup> (22.54±6.70, 33.21±7.55) and CD4<sup>+</sup>/CD8<sup>+</sup> (1.05±0.46, 1.80±0.69) increased significantly (p &lt; 0.01), CD4<sup>+</sup>/CD25<sup>+</sup>Foxp3 declined significantly (18.99±8.55, 13.04±5.86, p &lt; 0.05), CD16<sup>+</sup>/CD56<sup>+</sup> increased significantly (17.58±8.35, 21.48±8.81, p &lt; 0.05) after the intervention. CD8<sup>+</sup>, CD8<sup>+</sup>/CD28<sup>+</sup> and CD19<sup>+</sup> showed no statistical difference (p &gt; 0.05) before and after intervention. **CONCLUSIONS:** SCE intervention improved the cellular immune function which mediated by T cell and NK cell, and it may be related to the suppression and down-regulation of the T regulatory cells to the cell immunity.

1494 Board #256 May 30 10:30 AM - 12:00 PM

**Effects Of Endurance Exercise Under Heat And Hypoxia On Hecpidin Responses**

Nanako Hayashi, Haruka Yatsutani, Hisashi Mori, Hiroto Ito, Kazushige Goto. *Ritsumeikan University, Kusatsu, Japan.*  
Email: sh0108hx@ed.ritsumei.ac.jp  
(No relevant relationships reported)

Interleukin-6 (IL-6) promotes exercise-induced hepcidin elevation which is an iron regulating hormone, leading to increased risk of iron deficiency in athletes.

**PURPOSE:** The purpose of the present study was to compare exercise-induced hepcidin elevation between "heat and hypoxic condition" or "hypoxic condition". **METHODS:** Twelve males (21.5 ± 0.3 years, 168.1 ± 1.2 cm, 63.6 ± 2.0 kg) participated in the present study. They conducted a 60 min of cycling at 60% of VO<sub>2max</sub> under either "heat and hypoxia" (HHYP; FiO<sub>2</sub> 14.5%, 32°C), "hypoxia" (HYP; FiO<sub>2</sub> 14.5%, 23°C) or "normoxia" (NOR; FiO<sub>2</sub> 20.9%, 23°C). Exercise intensity was relatively matched for VO<sub>2max</sub> under each environment, and the respective values of VO<sub>2max</sub> were 42.7 ± 1.4 (HHYP), 41.2 ± 1.3 (HYP) and 50.8 ± 2.1 (NOR) ml/kg/min. After completing exercise, subjects stayed under the prescribed conditions during 3 h of post-exercise. Blood samples were collected before exercise, immediately after and 3 h after exercise. **RESULTS:** Blood lactate levels were significantly elevated with progress of exercise (P < 0.05), however, there was no significant difference among the three trials (P > 0.05). Serum ferritin level did not differ significantly among the trials (P > 0.05). Serum iron level did not change after exercise and no significant difference was observed among the trials (P > 0.05). In NOR, plasma IL-6 levels were significantly increased immediately after exercise and 3 h after exercise (P < 0.05), with no significant difference among the trials (P > 0.05). Serum hepcidin level was increased 3 h after exercise in all trials (P < 0.05). However, there was no significant difference among the trials during post-exercise (P > 0.05).

**CONCLUSIONS:** Endurance exercise under heat and hypoxia did not facilitate exercise-induced hepcidin elevation compared with the same exercise under hypoxia.

**1495** Board #257 May 30 10:30 AM - 12:00 PM  
**Time-course Of Physiological Changes Following An Extreme Conditioning Competition**

Ramires A. Tibana<sup>1</sup>, Nuno Manuel Frade de Sousa<sup>2</sup>, Matheus Baffi<sup>3</sup>, Gabriel Veloso Cunha<sup>4</sup>, Fabricio Azevedo Voltarelli<sup>1</sup>.  
<sup>1</sup>Federal University of Mato Grosso, Cuiabá, Brazil. <sup>2</sup>Faculty Estacio de Vitoria, Vitoria, Brazil. <sup>3</sup>Laboratório de Corréas, Rio de Janeiro, Brazil. <sup>4</sup>Catholic University of Brasilia, Brasilia, Brazil.

(No relevant relationships reported)

**Purpose:** Extreme conditioning programs (ECPs) are characterized by utilizing a high volume of training and using a variety of high intensity exercises. The purpose of the present study was to monitor the time-course response of cytokines (IL-10 and IL-1 $\beta$ ), immune variables (C-reactive protein -CRP and immunoglobulin A-IgA), hormonal milieu (cortisol-C, total testosterone-TT, free testosterone-FT and testosterone/cortisol-T/C ratios), creatine kinase-CK, muscle performance (jump height) and perceived well-being (WB) following an ECP competition. The initial hypothesis is that an extreme conditioning competition increases inflammatory response as well as metabolic stress, impairing the hormonal milieu, and decreasing muscle performance. **Methods:** Nine amateur male athletes (age 27.1  $\pm$  4.1 years; training experience 2.2  $\pm$  1.3 years) completed five workouts over three consecutive days of EC-competition. All variables were measured before, 24 h, 48 h and 72 h following the last day of competition. **Results:** The EC-competition induced a decrease in IL10/IL1 $\beta$  ratio approximately 5% after 24h, 21% after 48h and 31% after 72h. Delta T/C ratio remained unchanged during the post-competition period. IgA displayed a significant increase 24h and 72h post-EC-competition. The WB status score was higher 72h after the ECP as compared with pre-competition. **Conclusion:** The present findings suggest that ECP induces transient changes in some inflammatory and hormonal biomarkers, and perceived well-being seems to be efficient to detect changes in muscle performance. These data may be useful to coaches for monitoring fatigue and prescribing training (lower intensity sessions and/or resting days) in days following an EC competition. Furthermore, psychometric measurement tools seem to be an effective and easy method for assessing fatigue in participants after the competition.

**1496** Board #258 May 30 10:30 AM - 12:00 PM  
**Impact Of Exercise Intensity And Resting Intervals During Resistance Exercise On Acute Sparc Secretion In Healthy Young Males: A Pilot Study**

Shohei Dobashi, Masato Hashimoto, Toshiki Kaneuchi, Katsuhiko Koyama, Daisuke Ando. *University of Yamanashi, Kofu, Japan.*

(No relevant relationships reported)

**PURPOSE:** Recently, it is going noteworthy that an exercise-induced novel myokine, secreted protein acidic and rich in cysteine (SPARC) has the potential to prevent colon cancer. Moreover, regular resistance exercise (RE) has been known to reduce the mortality risk of cancer. From these points of view, RE might prevent colon tumorigenesis via increasing SPARC, while it is unclear whether resistance exercise can promote SPARC secretion in human. Thus, the purpose of this study was to investigate the both effects of exercise intensity and duration of rest interval between exercise sets on acute response of RE-induced SPARC secretion.

**METHODS:** We designed two experiments in this study. In study 1, 7 subjects completed three experiments in a random order. They performed two RE at both 70% (High) and 35% (Low) of the individual's one repetition maximum (1-RM), and stayed rest condition without RE (Rest). The RE consisted of 8 kinds of exercise (double arm curl, shoulder press, double knee extension, chest press, lat-pull down, triceps press down, parallel squat, and seated rowing), for 3 sets of 7 repetitions. We recruited different 7 subjects in study 2, and let them conduct three experiments in a random order: RE (the same 8 kinds of exercise as described in study 1, 16 repetitions  $\times$  3 sets at 50% 1-RM) with long inter-set rest interval (LIE, 150 s), RE with short inter-set rest interval (SIE, 50 s), and rest with no-exercise (NE). Blood samples were obtained before, immediate after, and 1h after RE in both study.

**RESULTS:** In study 1, serum SPARC concentration immediately after RE was significantly increased from baseline in High trial ( $P < 0.05$ ), and that level was significantly higher than those in Rest and Low trials ( $P < 0.05$ , in both). In study 2, serum SPARC level immediately after RE in SIE trial significantly elevated compared with baseline ( $P < 0.05$ ), and the increase was also significantly higher than NE trial ( $P < 0.05$ ). However, the elevated SPARC concentrations in both High and SIE trials were swiftly returned to baseline within 1 h after RE.

**CONCLUSIONS:** Our findings indicate that RE can induce temporally SPARC secretion. It is also conceivable that increasing exercise load and/or shortening rest intervals between exercise sets during RE might enhance SPARC production.

**1497** Board #259 May 30 10:30 AM - 12:00 PM  
**Serum Uric Acid Levels and Cardiometabolic Risk Among Adolescents**

Josi R. Gabaldon<sup>1</sup>, Nate T. Berry<sup>1</sup>, Jessica Dollar<sup>1</sup>, Lilly Shanahan<sup>2</sup>, Susan Keane<sup>1</sup>, Lenka Shriver<sup>1</sup>, Susan Calkins<sup>1</sup>, Laurie Wideman<sup>1</sup>. <sup>1</sup>University of North Carolina at Greensboro, Greensboro, NC. <sup>2</sup>University of Zurich, Zurich, Switzerland.  
 Email: jrgabald@uncg.edu

(No relevant relationships reported)

Uric acid (UA) is a biomarker of inflammation that has been linked to obesity, hypertension, metabolic syndrome (MetS) and other factors associated with cardiometabolic risk (CMR). UA levels are often elevated in minority populations and tend to increase in response to poor lifestyle behaviors (i.e diet, inactivity, sleep). Multiple definitions exist for MetS—some of which include UA—but it is really the clustering of CMR factors in adolescence that is crucial for identification of disease risk and prevention. However, little is known about the relation between UA across the CMR spectrum in adolescents. **PURPOSE:** To investigate the relations between CMR classification, sex, physical activity, and sleep on UA among adolescents. **METHODS:** At age 16, subjects [Caucasian=45.9%; Male: N=47, BMI=24.6 $\pm$ 6.7; Female: N=67, BMI=23.9 $\pm$ 9.3] came to the lab for a fasted blood draw, anthropometric measures and assessment of physical activity (PA) and sleep [Godin and Pittsburgh Sleep Quality Index (PSQI), respectively]. CMR biomarkers were assessed using multiplex assays and ELISAs. Serum UA was assessed using a commercial EIA. A linear mixed model was used to investigate UA by CMR profile (low, dyslipidemia, high) and sex, controlling for BMI, PA and sleep. **RESULTS:** Similar to previous studies in adolescents, the mean UA level was higher for males (7.11 $\pm$ 1.19) compared to females (5.59 $\pm$ 0.85). While men had a higher mean UA concentration, females had a higher UA after adjusting for BMI, PA, and sleep ( $p=0.056$ ). More specifically, females in the low ( $p<0.001$ ) and dyslipidemia risk ( $p<0.001$ ) groups had higher UA compared to their male counterparts. Also, BMI was significantly associated with UA regardless of group or sex ( $p=0.047$ ). **CONCLUSIONS:** These findings suggest that 1) subjects in the dyslipidemia profile had higher UA after controlling for BMI, PA and sleep compared to subjects in either the low or high CMR profiles and 2) while males may have higher mean UA concentrations on average, females have higher UA concentrations after adjusting for BMI, PA, and sleep. Future studies should track UA levels across adolescence and investigate whether or not the relation between CMR profiles and UA levels changes from adolescence in to adulthood. Funded by NIH R01HD78346

**1498** Board #260 May 30 10:30 AM - 12:00 PM  
**Exercise-mediated Apoptotic And Autophagic Responses Are Differentially Modulated In Pbmcs Of Obese Individuals**

Chun-Jung Huang, FACSM<sup>1</sup>, Alexandra L. Rodriguez<sup>1</sup>, Nishant P. Visavadiya<sup>1</sup>, Brandon G. Fico<sup>2</sup>, Aaron L. Slusher<sup>3</sup>, Peter J. Ferrandi<sup>4</sup>, Michael Whitehurst, FACSM<sup>1</sup>. <sup>1</sup>Florida Atlantic University, Boca Raton, FL. <sup>2</sup>University of Texas, Austin, TX. <sup>3</sup>University of Michigan, Ann Arbor, MI. <sup>4</sup>Purdue University, West Lafayette, IN.  
 Email: chuang5@fau.edu

(No relevant relationships reported)

**PURPOSE:** Obesity is associated with over activation of the pro-apoptotic pathway, implicating in the development of various comorbidities, such as insulin resistance and cardiovascular disease. While autophagy has been recently discovered as a critical molecular process in promoting cell survival against apoptosis, increased autophagic activation in obese individuals may serve as a pro-survival regulator to eliminate damaged proteins, organelles, or aggregates, and/or to enhance the cellular metabolic responses associated with physical stressors. Therefore, the purpose of this study was to examine whether or not maximal aerobic exercise-mediated apoptosis in obesity might be underlying the involvement of autophagy in the peripheral blood mononuclear cells (PBMCs).

**METHODS:** Twelve healthy male subjects (6 obese and 6 normal-weight) were recruited to participate in a maximal graded exercise test on a treadmill. Western blot analysis was used to determine the level of apoptotic and autophagic markers (Bax/Bcl-2 and LC3-II/LC3-I; respectively) in PBMCs prior to, immediately following exercise, and one and two hours into recovery from exercise.

**RESULTS:** Obese subjects exhibited a significantly lower Bax ( $p = 0.028$ ), but a higher Bcl-2 protein level ( $p = 0.006$ ) in conjunction with a reduced Bax/Bcl-2 area-under-the-curve "with respect to increase" (AUCi) ( $p = 0.024$ ) compared to normal-weight subjects following maximal aerobic exercise. Furthermore, a greater LC3-II/LC3-I ratio and LC3-II/LC3-I AUCi was observed in obese subjects compared to normal-weight subjects in response to exercise ( $p = 0.003$  and  $p = 0.005$ ; respectively). LC3-II/LC3-I AUCi was also positively associated with obesity-associated parameters (BMI, waist/hip circumference, and fasting insulin level), but was negatively correlated with Bax/Bcl-2 AUCi ( $r = -0.835$ ,  $p = 0.001$ ).

**CONCLUSIONS:** These findings demonstrate that maximal aerobic exercise differentially mediates the intrinsic apoptotic pathway and autophagic activity in human PBMCs isolated from obese compared to normal-weight individuals, suggesting the importance of autophagy as a critical molecular process in promoting cell survival against exercise-induced apoptosis.

**1499** Board #261 May 30 10:30 AM - 12:00 PM  
**Exercise Training Modulates Metabolic Inflammation In Kidney Of Diabetic Db/db Mice**

HUNG-WEN LIU. *National Taiwan Normal University, Taipei, Taiwan.*  
Email: hwliu@ntnu.edu.tw  
(No relevant relationships reported)

**PURPOSE:** Chronic inflammation and metabolic dysregulation may eventually cause tissue damage in type 2 diabetes. We examined the protective effects of moderate intensity aerobic exercise on kidney function in diabetic db/db mice.

**METHODS:** Functional and morphological alterations and metabolic and inflammatory signaling were examined in type 2 diabetic db/db mice with or without exercise training (5.2m/min, 1h/day, and 5days/week for a total of 8weeks).

**RESULTS:** Exercise training prevented weight gain (-7.0%) in db/db+Ex mice, but it did not reduce glucose and insulin levels. Exercise lowered serum creatinine, urea, and triglyceride levels in db/db+Ex mice. Reduced kidney size (0.37 vs 0.4g,  $P=0.036$ ) and morphological alterations including decreased glomerular cross-sectional area (0.0235 vs 0.0367mm<sup>2</sup>,  $P<0.001$ ) were observed in db/db+Ex mice compared with untrained db/db mice. Mechanistically, preventing loss of SIRT1 (+62%,  $P=0.048$ ) through exercise was linked to reduced acetylation of NF- $\kappa$ B (-48%,  $P=0.002$ ) in kidney of db/db+Ex mice. Exercise increased citrate synthase (+132%,  $P=0.038$ ) and mitochondrial complex I activity (+80%,  $P=0.004$ ), subunits of mitochondrial complexes (I, II, and V) and PGC1 $\alpha$  (+24%,  $P=0.039$ ) at protein level in kidney of db/db+Ex mice compared with non-exercise db/db mice.

**CONCLUSIONS:** Moderate exercise training modulates metabolic dysfunction and inflammatory process, thereby attenuating the progression of diabetic nephropathy in type 2 diabetes mellitus.

**C-44** Free Communication/Poster - Concussion I

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

**1500** Board #262 May 30 10:30 AM - 12:00 PM  
**Static Cerebral Autoregulation is Not Altered in Symptomatic Concussed Athletes During Acute Central Hypervolemia**

Morgan L. Worley, Morgan C. O'Leary, James R. Sackett, Zachary J. Schlader, FACSM, John J. Leddy, Blair D. Johnson. *University at Buffalo, Buffalo, NY.*  
Email: mworley@buffalo.edu  
(No relevant relationships reported)

Dynamic cerebral autoregulation is impaired in concussed individuals. However, less is known regarding static cerebral autoregulation in symptomatic concussed athletes during a central hypervolemic challenge that increases blood pressure. **PURPOSE:** We tested the hypothesis that static cerebral autoregulation during a central hypervolemic challenge is impaired in symptomatic concussed college athletes (CA) vs healthy controls (HC). **METHODS:** Seven CA (age: 19 $\pm$ 2 y, 5 females) and ten HC (age: 21 $\pm$ 2 y, 6 females) completed one study visit. After 5 min of resting baseline, 20 mmHg of lower body positive pressure (LBPP) was applied for 5 min using an airtight chamber. Beat to beat blood pressure (photoplethysmography) and middle cerebral artery blood velocity (MCAv; transcranial Doppler) were recorded continuously. Static cerebral autoregulation was calculated using Fourier transfer function analysis with 3 min segments at baseline and after mean arterial pressure (MAP) stabilized during LBPP. Cerebral vascular resistance (CVR) was calculated as MAP/MCAv. Pulsatility index (PI) was calculated as the difference of peak systolic MCAv and end diastolic MCAv, divided by mean MCAv. Values are reported as a change from baseline. **RESULTS:** MAP (CA: 90 $\pm$ 6 vs HC: 92 $\pm$ 11 mmHg;  $P=0.32$ ), MCAv (CA: 58.7 $\pm$ 19.4 vs HC: 62.6 $\pm$ 11.1 cm/s;  $P=0.30$ ), gain (CA: 0.7 $\pm$ 0.2 vs HC: 0.8 $\pm$ 0.2 cm/s/mmHg;  $P=0.17$ ), coherence (CA: 0.5 $\pm$ 0.1 vs HC: 0.5 $\pm$ 0.1;  $P=0.21$ ), CVR (CA: 1.7 $\pm$ 0.6 vs HC: 1.5 $\pm$ 0.3 mmHg/cm/s;  $P=0.21$ ), and PI (CA: 0.9 $\pm$ 0.1 vs HC: 0.9 $\pm$ 0.2;  $P=0.31$ ) were not different at baseline. The change in MAP was not different between CA (12 $\pm$ 6 mmHg) and HC (8 $\pm$ 6 mmHg;  $P=0.12$ ). The change in MCAv was greater in CA (CA: 4.8 $\pm$ 4.6 vs HC: -4.3 $\pm$ 8.7 cm/s;  $P=0.01$ ). There were no differences in the change from baseline for gain (CA: 0.1 $\pm$ 0.2 vs HC: 0.1 $\pm$ 0.5 cm/s/mmHg;  $P=0.49$ ) or coherence (CA: -0.0 $\pm$ 0.1 vs HC: -0.0 $\pm$ 0.1;  $P=0.40$ ). The increase in CVR was attenuated in CA (CA: 0.0 $\pm$ 0.2 vs HC: 0.3 $\pm$ 0.3 mmHg/cm/s;  $P=0.04$ ). The decrease in PI was greater in

CA (CA: -0.1 $\pm$ 0.0 vs HC: 0.0 $\pm$ 0.1;  $P=0.02$ ). **CONCLUSION:** These data indicate that indices of static cerebral autoregulation are not different between CA and HC during an acute increase in MAP. The blunted increase in CVR and greater decrease in PI appears to allow for a rise in MCAv during an acute increase in MAP in CA.

**1501** Board #263 May 30 10:30 AM - 12:00 PM  
**Whole-Body Reactive Agility Asymmetries among Athletes with Concussion History Are Modifiable**

Gary B. Wilkerson<sup>1</sup>, Dustin C. Nabhan, FACSM<sup>2</sup>, William J. Moreau<sup>2</sup>. <sup>1</sup>University of Tennessee at Chattanooga, Chattanooga, TN. <sup>2</sup>United States Olympic Committee, Colorado Springs, CO. (Sponsor: Gregory Heath, FACSM)  
Email: Gary-Wilkerson@utc.edu  
(No relevant relationships reported)

**PURPOSE:** This study assessed associations between self-reported concussion history and measures of perception-action coupling, as well as changes in reactive responses after upper extremity training that imposed both cognitive and visuomotor demands.

**METHODS:** A cohort of 22 elite athletes representing 6 Olympic sports (14 males & 8 females; 26.1  $\pm$  5.1 years) performed pre- and post-training tests of upper extremity choice reaction time (RT) and whole-body reactive agility. The choice RT test used 10 congruent and 10 incongruent Eriksen flanker 5-arrow displays to designate correct left versus right manual responses for deactivation of illuminated buttons. Whole-body tests required lateral movement responses to 20 left or right visual targets and diagonal movement responses to 12 visual targets presented in right/left and forward/backward combinations. One-minute cognitive-visuomotor training sessions were completed 2-3 times per week over 4 weeks, which involved simultaneous manual responses (button deactivations) and verbal responses (center arrow direction for 20 5-arrow displays).

**RESULTS:** At least 6 training sessions were completed by each athlete (7.7  $\pm$  0.6). Concussion history was reported by 55% (12/22; 5.0  $\pm$  4.9 years; range: 0.3 - 16.5 years), which was strongly associated with asymmetries in both lateral and diagonal/backward reactive agility measures of RT, speed, acceleration, and deceleration (AUC=.808). The average of the 8 asymmetry values  $\geq$  .18 discriminated with 89% PPV, 69% NPV, and OR=18.0 (90% CI Lower Limit: 2.4;  $\chi^2$  Exact 1-Sided  $P=0.01$ ). Upper extremity choice RT incongruent-congruent difference  $\geq$  80 ms classified concussion history status with PPV=69%, NPV=67%, and OR=4.5 (90% CI Lower Limit: 1.0;  $\chi^2$  Exact 1-Sided  $P=0.11$ ). Among the athletes with concussion history, 7 of 8 reactive agility asymmetries were reduced after training. Standardized response means for reactive agility asymmetry reduction ranged from .17 to .48, and average choice RT incongruent-congruent difference improved from 103  $\pm$  51 ms to 54  $\pm$  79 ms (SRM=.53).

**CONCLUSIONS:** Asymmetry in reactive responses may be a manifestation of dysfunctional interhemispheric brain connectivity. Our findings suggest that cognitive-visuomotor training with the upper extremities can reduce whole-body movement asymmetries.

**1502** Board #264 May 30 10:30 AM - 12:00 PM  
**Normative Values on the King-Devick Screening Test in Wheelchair Basketball Players**

J.P. Barfield<sup>1</sup>, Angela Mickle<sup>2</sup>, Laura Newsome<sup>2</sup>. <sup>1</sup>Emory & Henry College, Emory, VA. <sup>2</sup>Radford University, Radford, VA. (Sponsor: Hank Williford, FACSM)  
Email: jpbarfield@ehc.edu  
(No relevant relationships reported)

The King-Devick (KD) test of rapid eye movement is a common instrument used to assess concussion in able-bodied (AB) sport but data are limited for disability sport athletes. **PURPOSE:** The purpose of this study was to report updated normative KD values for wheelchair basketball sport participants. **METHODS:** One-hundred twenty wheelchair basketball players (101 males, 18 females, 1 non-report) completed baseline KD assessments via an iPad application approximately 10 minutes before a scheduled practice or competition. Because some athletes had limited or impaired grip, iPads were placed on music stands or in iPad clips on a tripod at a standardized height and distance from each participant. Per KD protocol, two baseline assessments were administered with the lowest score reflecting true baseline. **RESULTS:** Mean KD baseline score was 62  $\pm$  24 sec. No significant difference on mean KD baseline score existed between genders or prior concussion experience. However, significant differences on baseline KD existed between age groups (adults = 55  $\pm$  17 sec; youth = 71  $\pm$  27 sec;  $F=14.92$ ,  $p=0.00$ ) and among impairment types (spinal cord injury = 52  $\pm$  13 sec, spina bifida = 71  $\pm$  25 sec, amputee = 53  $\pm$  11 sec, cerebral palsy = 88  $\pm$  31 sec;  $F=14.92$ ,  $p=0.00$ ). **CONCLUSIONS:** KD normative scores were meaningfully higher than previously reported norms in AB sport for both adults and youth. Baseline KD scores varied by impairment type which is an important consideration for normative development in wheelchair basketball athletes.

**1503** Board #265 May 30 10:30 AM - 12:00 PM  
**Previous Concussion History Influences Health-related Quality Of Life Among Collegiate Student-athletes: Baseline Findings From The Active Rehab Study**

Johna K. Register-Mihalik<sup>1</sup>, Shabbar Ranapurwala<sup>1</sup>, Kevin Guskiewicz, FACSM<sup>1</sup>, Paula Gildner<sup>1</sup>, Stephen Marshall<sup>1</sup>, Karen McCulloch<sup>1</sup>, Jason Mihalik<sup>1</sup>, Julianna Primm<sup>1</sup>, Christina Vander Vegt<sup>1</sup>, Michael McCrea<sup>2</sup>, The Active Rehab Study Consortium<sup>1</sup>.  
<sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC.  
<sup>2</sup>Medical College of Wisconsin, Chapel Hill, NC.  
 Email: johnakay@email.unc.edu  
 (No relevant relationships reported)

Prior concussion history is posited to influence many outcomes. Understanding how concussion history affects quality of life may identify student-athletes needing intervention and those predisposed to other conditions. **PURPOSE:** To examine how prior concussion history influences college athletes' pre-season baseline health-related quality life (HRQOL). **METHODS:** Student-athletes (n = 1599) from six Canadian and US college institutions and 24 college sports, completed a comprehensive concussion baseline assessment including an HRQOL evaluation (PROMIS-29, Neuro-QOL Fatigue, and Neuro-QOL Cognition Scales). The primary predictor was concussion history and covariates included age, sex, BMI, and contact sport participation. Primary outcomes were Anxiety, Physical Function, Depression, Sleep Disturbance, Social Role/Activities, Pain Interference, Pain Intensity, Cognition, and Neuro-related Fatigue raw scores. Linear regression models clustered on study site using generalized estimating equations examined the association between concussion history and HRQOL outcomes. **RESULTS:** Analysis was limited to 1509 (94%) participants with complete outcome and covariate data [538 females (35.6%); median age = 19 years (range: 18-27); 553 (36.7%) with 1+ prior concussions]; 1154 (76.5%) played a contact sport]. Concussion history, adjusted for age, sex, BMI, and contact sport participation, were associated with greater anxiety, sleep disturbance, depressive feelings, fatigue, and worse cognition function. However, these differences were mostly minor. Clinically meaningful mean differences (MD) suggest those with multiple concussions report worse cognitive function (MD=-1.2; 95%CI: -2.4, -0.1 for 3+ vs 0 concussions; MD=-1.1, 95% CI:-2.3, 0.1 for 2 vs. 0 concussions) and greater neuro-related fatigue (MD=1.3, 95% CI: -0.1, 2.7 for 3+ vs 0 concussions; MD=0.9, 95% CI: 0.1, 1.7 for 2 vs 0 concussions). **CONCLUSIONS:** After controlling for covariates, these data suggest that following primary recovery, those with prior concussions may exhibit increased cognitive and fatigue related complaints. These residual effects may confound incident concussion assessments, particularly when pre-season baseline measures are not available.

Supported in part by a grant from the National Football League

**1504** Board #266 May 30 10:30 AM - 12:00 PM  
**Long Term Effects of Concussion on Eye Tracking Patterns**

Lauren A. Dougherty, Kathryn L. Van Pelt, Andrew P. Lapointe, Griffin J. Feinberg, Allyssa K. Memmini, Katherine M. Breedlove, Steven P. Broglio, FACSM. *University of Michigan, Ann Arbor, MI.* (Sponsor: Steven Broglio, FACSM)  
 (No relevant relationships reported)

**Purpose:** The purpose of this study is to investigate long-term changes in eye-tracking patterns in previously concussed individuals (>1-year post-injury) compared to non-concussed controls. **Methods:** This case control study will include 40 total participants, but currently includes 12 participants with (n=5 concussed, 3.00±1.79 concussions, 4.92±2.43 years post-injury, 22.80±2.23 years, 170.18±6.62 cm, 71.49±9.19 kg) and without (n=7; 27.00±4.96 years, 177.8±9.40 cm, 77.69±12.83 kg) a concussion history were evaluated. Participants were excluded if they only had a previously undiagnosed concussion, were currently playing contact sports, did not have normal or corrected to normal vision without glasses. Participants completed two eye-tracking tasks: an anti-saccade task consisting of 5 test blocks, 40 trials each and a circle tracking task consisting of 3 trials. The anti-saccade task measured saccadic and anti-saccadic movements, while the circle tracking task measured smooth pursuit eye movements. In both groups, results were analyzed using independent T-tests. **Results:** The mean reaction and processing times in the saccade task in formerly concussed subjects was significantly different from controls (p=0.02 and p<0.01). The control group had a 7.41% slower reaction time and 12.64% slower processing time than the concussed group. Other anti-saccade task variables (i.e. movement time, number of correct saccades, number of trials where saccade ended outside of the target zone, percent of accurate saccades, distance from target block, distance from target block for correct trials) and circle tracking (i.e. horizontal root mean squared error (RMSE), vertical RMSE, horizontal delay, mean vertical delay) were not significant (p's>0.05). **Conclusions:** Counter to work on the acute effects of concussion, the preliminary findings of this study indicate that concussion may not have a long-term effect on eye-tracking reaction and processing time. Additional work in this area with larger samples is warranted.

**1505** Board #267 May 30 10:30 AM - 12:00 PM  
**Examining Differences Between Patient and Clinician Measurements of Post-Concussion Near-Point of Convergence Distance**

Nathan D'Amico<sup>1</sup>, Melissa Womble<sup>2</sup>, Katie Stephenson-Brown<sup>1</sup>, Anthony Kontos<sup>3</sup>, RJ Elbin<sup>1</sup>. <sup>1</sup>University of Arkansas, Fayetteville, AR. <sup>2</sup>Inova Sports Medicine, Fairfax, VA. <sup>3</sup>University of Pittsburgh Medical Center, Pittsburgh, PA.  
 (Sponsor: Dr. Brendon McDermott, FACSM)  
 Email: nrdamico@uark.edu  
 (No relevant relationships reported)

Near-point of convergence (NPC) is the distance an individual can view a target without diplopia. The assessment of NPC distance is an important component of the Vestibular Ocular Motor Screening (VOMS) for sport-related concussion (SRC). The VOMS requires that the NPC distance is obtained by the patient and recorded by the clinician. However, some clinicians anecdotally report obtaining a more accurate and consistent measurement than patients due to more training and experience. Measurement differences between these two administration methods are important to investigate, as a NPC distance less than 5cm is predictive of SRC. No study to date has compared patient and clinician measurements of NPC distance following concussion. **PURPOSE:** To examine differences between patient and clinician measurements of post-concussion NPC distance.

**METHODS:** One hundred and two patients (17.80±7.43 years) seeking care for a medically diagnosed SRC participated in this study. For the patient measurement, the patient focused his/her eyes on a 14-point font target (i.e., fixation stick) and slowly moved the target toward the center of the patient's eyes until the patient reported double vision. For the clinician measurement, the clinician slowly moved the target toward the patient until the patient reported double vision and recorded the NPC distance. The NPC distance was recorded as the average of three trials. Paired-samples t-tests were performed to examine differences in NPC distance between patient and clinician administration. Chi-square analyses were performed to compare the number of cases exceeding clinical cutoffs (>5cm) between the two administration methods. Statistical significance was set at p<.05.

**RESULTS:** There were no significant differences between patient and clinician administered NPC distance measurements (t[102]=-1.66, p=.10). The number of NPC distance measures that exceeded clinical cutoffs (>5cm) were not significantly different between patient (n=28) and clinician administrations (n=31) (χ<sup>2</sup>[1,204]=.22, p=.64). **CONCLUSIONS:** Patients can accurately administer NPC distance despite not having the training and experience of clinicians. All 28 patients that exceeded clinical cutoffs during patient administration also exceeded clinical cutoffs during clinician administration.

**1506** Board #268 May 30 10:30 AM - 12:00 PM  
**The Effect of School Socioeconomic Status and Sport on Adolescent Athletes' Baseline Concussion Assessment**

Paul J. Gubanich, FACSM<sup>1</sup>, Matthew S. Propst<sup>2</sup>, Christy Reed<sup>1</sup>, Tim S. Foster<sup>3</sup>, Kelsey Logan<sup>1</sup>, Adam W. Kiefer<sup>1</sup>. <sup>1</sup>Cincinnati Children's Hospital Medical Center, Cincinnati, OH. <sup>2</sup>CHI St. Joseph Health, College Station, TX. <sup>3</sup>University of Cincinnati, Cincinnati, OH.  
 Email: paul.gubanich@cchmc.org  
 (No relevant relationships reported)

**PURPOSE:** The purpose is to examine the effect of school socioeconomic status (SES) and sport on the baseline performance of adolescent athletes on the King-Devick test (KD), modified Balance Error Scoring System (mBESS), and Post Concussive Symptom Inventory (PCSI).

**METHODS:** A retrospective cohort study was conducted on athletes' baseline concussion assessments completed as part of a concussion surveillance program. Testing included a history and risk factor questionnaire, KD, mBESS, and PCSI. Schools and sports clubs were classified as high SES (private or <50% free/reduced lunches) vs. low SES (public, > 75% free/reduced lunches). Sports were categorized as collision, contact, and non-contact. An ANCOVA was performed for each outcome while controlling for age  
**RESULTS:** Analysis was conducted on 377 athletes (63% M), average age 15.9±1.5 years (range 12.1-19.2). Two schools and 1 club were classified as high SES (n=162); 5 schools (n=215) were classified as low SES. For KD score, only a significant school × sport interaction was observed (p=0.01), with age as a significant co-variate (p=0.01). Only a significant main effect of school was observed for the mBESS (p=0.02), while a significant main effect of school (p=0.001) and school × sport interaction (p=0.02) was observed for PCSI. Age was not significant for either mBESS or PCSI (p>0.47).

**CONCLUSIONS:** This study examines the influence of school SES and sport on baseline KD, mBESS, and PCSI. KD scores were slower in contact and non-contact athletes of high SES schools compared to low SES school athletes. Additionally, low SES school contact and non-contact athletes reported higher baseline PCSI scores

compared to their high SES school counterparts. These findings have implications for how baseline scores are considered as comparisons for concussion surveillance; however, more studies are necessary to examine other confounding factors and the utility of these measures in managing injury recovery.

Baseline Concussion Outcome by School SES and Sport Type					
School	Sport type	n	Mean KD (SD) s	Mean mBESS (SD)	Mean PCSI (SD)
High SES	Collision	29	45.76(8.15)	26.76(2.25)	4.66(6.77)
	Contact	59	50.41(10.29)	26.54(2.84)	4.73(5.93)
	Non-contact	73	48.93(9.49)	26.22(3.15)	4.15(6.94)
Low SES	Collision	125	48.30(10.40)	24.93(3.26)	4.29(7.68)
	Contact	64	44.14(8.02)	25.84(3.25)	7.83(10.52)
	Non-contact	26	44.47(7.79)	26.23(2.52)	10.65(10.87)

**1507 Board #269 May 30 10:30 AM - 12:00 PM**  
**Administering Computerized Neurocognitive Testing Does Not Increase Symptoms Following Sport-Related Concussion**

Katie Stephenson-Brown<sup>1</sup>, Melissa Womble<sup>2</sup>, Philip Schatz<sup>3</sup>, Nathan D'Amico<sup>1</sup>, Brett Gustman<sup>2</sup>, Eric Castor<sup>2</sup>, R.J. Elbin<sup>1</sup>.  
<sup>1</sup>University of Arkansas, Fayetteville, AR. <sup>2</sup>Inova Medical Group, Fairfax, VA. <sup>3</sup>Saint Joseph's University, Philadelphia, PA.  
 (Sponsor: Brendon McDermott, FACSM)  
 (No relevant relationships reported)

Computerized neurocognitive testing (CNT) is an important component for the management of sport-related concussion (SRC). The cognitive demands required to complete CNT may exacerbate SRC symptoms.

**PURPOSE:** To prospectively examine changes in post-concussion symptom reporting after completing CNT. **METHODS:** One hundred forty-five athletes (15.72 ± 1.78 years) with a medically diagnosed SRC completed the Post-Concussion Symptom Scale (PCSS) before and after completing a CNT (e.g., The Immediate Post-Concussion Assessment and Cognitive Testing: ImPACT). Changes in total PCSS symptoms and symptom clusters (somatic, affective, and cognitive-migraine-fatigue) were examined with a series of paired samples *t*-tests. Participants were also assigned to groups based on the time elapsed from injury until their first clinical visit: 0-7, 8-14, and 15-21 days. A series of 3 (time since injury group) X 2 time (pre, post) analysis of variance were performed on symptom totals and clusters. Statistical significance was set at a Bonferroni-corrected *p* < .01.

**RESULTS:** There were no significant differences in total (*t* (145) = -.69, *p* = .49), somatic, (*t* (145) = -1.02, *p* = .31), or cognitive-migraine-fatigue symptoms (*t* (145) = -1.75, *p* = .08) before and after CNT. There was a significant difference for affective symptoms (*t* (145) = 2.51, *p* = .01). Affective symptoms were significantly higher before CNT (*M* = 2.19, *SD* = 3.15) compared to after CNT (*M* = 1.80, *SD* = 2.89). There were no between-subjects or within-subjects main effects for total, somatic, affective, or cognitive-migraine-fatigue symptom clusters (*p* > .05). There were also no significant group x time interactions for total symptoms (*Wilks*  $\lambda$  = .99, *F* [1, 142] = 0.20, *p* = .40,  $\eta^2$  = .01), somatic, (*Wilks*  $\lambda$  = 1.00, *F* [2, 142] = .30, *p* = .74,  $\eta^2$  = .004), affective (*Wilks*  $\lambda$  = .99, *F* [2, 142] = 0.89, *p* = .43,  $\eta^2$  = .01), or cognitive-migraine-fatigue symptom clusters (*Wilks*  $\lambda$  = .99, *F* [2, 141] = 0.41, *p* = .67,  $\eta^2$  = .01). **CONCLUSIONS:** The administration of CNT during recovery from SRC does not increase concussion symptoms. Sports medicine professionals should administer CNT to concussed athletes even when symptomatic, to more accurately identify neurocognitive impairment, which will help determine targeted treatment options.

**1508 Board #270 May 30 10:30 AM - 12:00 PM**  
**No Differences in Tandem Gait Performance between Males and Females Acutely Post-Concussion**

Jessie R. Oldham<sup>1</sup>, David R. Howell<sup>2</sup>, Kelsey N. Bryk<sup>3</sup>, William P. Meehan III<sup>1</sup>, Thomas A. Buckley<sup>3</sup>. <sup>1</sup>Boston Children's Hospital, The Micheli Center, Waltham, MA. <sup>2</sup>Children's Hospital Colorado, University of Colorado School of Medicine, Aurora, CO. <sup>3</sup>University of Delaware, Newark, DE.  
 Email: Jessie.Oldham@childrens.harvard.edu  
 (No relevant relationships reported)

Postural control impairments are common following concussion and traditionally assessed using the Balance Error Scoring System (BESS). Tandem gait (TG) has

successfully identified impairments in postural control acutely post-concussion that were undetected by the BESS; thus, TG may be a more robust postural control assessment following concussion. While sex differences in BESS performance after concussion have been explored, there is no literature regarding sex differences in post-concussion TG. **PURPOSE:** To examine sex differences in TG performance among collegiate student-athletes acutely post-concussion relative to pre-injury performance. **METHODS:** Forty-eight concussed collegiate student-athletes (30 females) and twenty-five healthy controls (13 females) completed TG tests during pre-season and again acutely post-concussion. Participants walked heel-to-toe down a 3-meter line, turned, and returned as quickly as possible, completing four single-task (ST) and dual-task (DT) TG trials. During DT trials, they simultaneously answered mini-mental style questions. The best ST and DT times were recorded. A 2x2 (group\*sex) ANOVA was used to examine TG change between pre-injury and post-injury tests (positive value=slower/worsening; negative value=faster/improving).

**RESULTS:** The change in TG time from pre-injury to post-injury was significantly higher for the concussion group relative to the control group during both ST (Concussion: 1.6±2.6 seconds, Controls: -1.1±0.8 seconds, *p*<0.001) and DT (Concussion: 2.0±3.8 seconds, Controls: -0.9±1.7 seconds, *p*<0.001) TG. There were no significant interactions (ST: *p*=0.17, DT: *p*=0.23) or main effects for sex (ST: *p*=0.63, DT: *p*=0.91).

**CONCLUSIONS:** There were no sex-specific differences in TG performance acutely post-concussion. However, all concussed participants, regardless of sex, performed significantly worse on TG than male and female controls after injury relative to baseline, while controls did not demonstrate such a change. These results suggest that TG can appropriately identify postural control impairments following concussion; however, there do not appear to be differences in performance between males and females.

**1509 Board #271 May 30 10:30 AM - 12:00 PM**  
**Post-Concussion Symptom Factors in Male and Female High School and Collegiate Athletes**

Morgan Anderson, Abigail C. Bretzin, Kyle M. Petit, Jennifer L. Savage, Tracey Covassin. Michigan State University, East Lansing, MI.  
 Email: ande1997@msu.edu  
 (No relevant relationships reported)

Previous research suggests concussed female athletes report higher severity of total symptoms; however, sex differences for symptom factors across recovery are understudied. **PURPOSE:** To examine sex differences in post-concussion symptom factors across concussion recovery (i.e., ≤72 hours, return-to-play, >one-month). **METHODS:** Symptoms were rated from 0 (none) to 6 (severe) on the Post-Concussion Symptom Scale (PCSS), which consists of 22 total symptoms and a total symptom severity score ranging from 0-132. The PCSS was broken into two symptom factors: cognitive-migraine-fatigue (headache, dizziness, fatigue, drowsiness, sensitivity to light/noise, feeling slowed down, foggy, difficulty concentrating/remembering) and affective (sadness, nervousness, feeling more emotional). A 2 sex (male, female)\*2 group (concussed, healthy)\*3 time (≤72 hours, return-to-play, >one-month) repeated measures ANOVA was used to analyze sex differences in symptom factors throughout recovery between concussed and healthy athletes. **RESULTS:** There were 167 (*M*=17.46 years, *SD*=2.2; male=97, female=70; concussed=78, healthy=89) total athletes. There were no significant sex differences between testing sessions at ≤72 hours (*M*=2.03 days, *SD*=0.8, *p*=.42), return-to-play (*M*=16.09 days, *SD*=11.7, *p*=.95), and >one-month (*M*=59.72 days, *SD*=21.4, *p*=.65). There was no significant within-subject interaction for sex\*group\*time for the cognitive-migraine-fatigue or affective symptom factors. There was a significant between-subjects sex\*group interaction for the cognitive-migraine-fatigue symptom factor (*F*<sub>(1,163)</sub> = 5.52, *p* = .02,  $\eta^2$  = .03). Simple main effects analysis revealed concussed females (*M*=7.39, *SE*=0.57) reported significantly higher severity for the cognitive-migraine-fatigue symptom factor than concussed males (*M*=4.83, *SE*=0.48; *p*≤.001), yet no sex differences were observed between healthy athletes (*p*=.82). There was no significant between-subjects sex\*group interaction for the affective post-concussion symptom factor. **CONCLUSIONS:** Concussed females reported greater symptom severity for the cognitive-migraine-fatigue symptom factor compared to concussed males, which may direct targeted concussion management approaches between female and male athletes.

**1510** Board #272 May 30 10:30 AM - 12:00 PM  
**Patient-parent Agreement On The Health And Behavior Inventory After Pediatric Concussion**

Tatiana Patsimas, David R. Howell, Morgan N. Potter, Aaron J. Provance, Michael W. Kirkwood, Julie C. Wilson. *University of Colorado, Denver, CO.*  
 Email: tatiana.patsimas@gmail.com  
 (No relevant relationships reported)

**PURPOSE:** The purpose of our study was to examine patient-parent agreement on measures of concussion symptom frequency after pediatric sport-related concussion, and identify differences in patient-parent agreement between child and adolescent age groups.

**METHODS:** We conducted an analysis of data collected from a prospective registry of patients with concussion in a sports medicine clinic. Patients and their parents completed the Health and Behavior Inventory (HBI) at each clinic visit. Wilcoxon signed rank tests were used to assess for potential differences in symptom frequency ratings. Spearman rho correlations and Fisher's r to z transformation were used to assess linear agreement for total HBI score between parents and children (ages 6-12 yrs), compared to parents and adolescents (ages 13-18 yrs). Multiple regression analyses were used to evaluate the association between parent-reported and patient-reported HBI ratings with return to play (RTP) time and symptom duration.

**RESULTS:** A total of 267 patients (24% children, 28% females, evaluated 8.9±5.2 days post-concussion) were included in the analysis. For total HBI score, the agreement between children and their parents was high (rs=0.88; 95% CI=0.80-0.95). Adolescents also highly agreed with their parents (rs=0.78; 95% CI=0.71-0.85). However, child-parent agreement was significantly higher than adolescent-parent agreement (z=2.21; p=0.03). Additionally, combined child and adolescent patient HBI ratings were significantly associated with symptom resolution time (β=0.296; 95% CI=0.091-0.501; p=0.005) and RTP time (β=0.487; 95% CI = 0.009-0.965; p=0.046), whereas parent HBI ratings were not.

**CONCLUSIONS:** Overall, there was strong agreement between patients and their parents on the HBI, though children demonstrated significantly higher agreement with their parents compared to adolescents. Additionally, patient-reported HBI scores were more predictive of symptom duration and RTP time than parent-reported HBI scores. Clinicians may find this useful when setting expectations regarding concussion symptom duration and RTP timing for patients and their families. Significant reporting discrepancies between patients and their parents may also be a relevant factor for clinicians to consider during acute post-concussion evaluations.

**1511** Board #273 May 30 10:30 AM - 12:00 PM  
**Three-dimensional Multiple Object Tracking's Role In Injury Incidence Reduction In Collegiate Athletics**

Emma Foss, Christina Renodin, Daniel Antonoff, Erin Hartigan, Jasmine Honey, Taylor Langevin, Wallace Marsh, John Rosene. *University of New England, Biddeford, ME.*  
 Email: efoss1@une.edu  
 (No relevant relationships reported)

Three-dimensional multiple object tracking (3D-MOT) has been proposed as a training tool for processing dynamic events such as sports activities, and has been hypothesized to reduce athletic injuries through increased awareness of player movement.

**PURPOSE:** The purpose of this study was to determine if 3D-MOT is an effective intervention to minimize the risk of injury in collegiate ice hockey and lacrosse.

**METHODS:** 78 NCAA Division III ice hockey and lacrosse players volunteered for a season-long investigation. Players were assigned to a 3D-MOT training intervention (3D-MOT; n=38) or a control group (C; n = 40). 3D-MOT training gains were measured by mean speed threshold (m/s) obtained from Core training sessions and were analyzed using paired t-tests. Athletic trainers (ATs) attended school-sanctioned team conditioning sessions, practices, and competitions from which injury data was collected. Repeated measures analysis of variance (RM-ANOVA) were performed to compare total number of injuries over time and between groups (3D MOT and C). Two additional RM-ANOVA were performed to explore if 3D-MOT training decreased the number of injuries over time based on injury mechanism (i.e., contact vs. non-contact).

**RESULTS:** The mean speed threshold significantly increased from the first Core session to the last Core session (p=0.000). The total number of injuries significantly decreased over the course of the season (p=0.002). When comparing the 3D-MOT to C, there was no significant difference in the total number of injuries (p=0.293). For those injured at baseline, the total number of injuries also significantly decreased over time (p=.002) though the 3D-MOT intervention had no effect on the number of injuries in athletes injured at baseline (p=.204). The 3D-MOT intervention did not have an effect on mechanism of injury, however both contact (p=.016) and non-contact injuries (p=.013) significantly decreased over time (length of season). **CONCLUSIONS:** Motion perception training with 3D-MOT did not decrease injury incidence in NCAA Division III men's and women's ice hockey and lacrosse athletes compared to controls. NCAA Division III men's and women's ice hockey and lacrosse athletes experience fewer injuries, both contact and non-contact, as their seasons' progress.

**1512** Board #274 May 30 10:30 AM - 12:00 PM  
**Head Motion Predicts Transient Loss of Consciousness in Human Head Trauma: Insights From Mixed Martial Arts**

Alexandra E. Fogarty<sup>1</sup>, Christian S. Guay<sup>1</sup>, Gabrielle Simoneau<sup>2</sup>, Berdale Colorado<sup>1</sup>, G Ross Segal<sup>3</sup>, Kent Werner<sup>4</sup>, Jeffery M. Ellenbogen<sup>5</sup>. <sup>1</sup>Washington University in St Louis, St Louis, MO. <sup>2</sup>McGill University, Montreal, QC, Canada. <sup>3</sup>Segal and Iyer Orthodontics, Marlton, NJ. <sup>4</sup>Johns Hopkins University School of Medicine, Baltimore, MD. <sup>5</sup>Baltimore County Fire Department, Baltimore, MD.  
 Email: afogarty@wustl.edu  
 (No relevant relationships reported)

Transient loss of consciousness (tLOC) is commonly observed in athletes with concussion. Despite evidence that tLOC has long-term clinical implications, the mechanism by which it occurs is not well characterized in human models. **Purpose:** To investigate the strike patterns that produce concussion with tLOC using professional mixed martial arts (MMA) competitors. **Methods:** An online database was screened for Ultimate Fighting Championship (UFC) fights ending with knockouts (KO). Inclusion criteria for analysis were classification as KO, dated from January 2013 to December 2015. Videos were excluded if a strike leading to tLOC could not be definitively identified and characterized. Demographic information of athletes was compiled into fight profiles. Two blinded, independent reviewers generated impact profiles, which included timing of strike, striking implement, strike location, and head motion. This was performed for all KO strikes (cases) and for a group of non-KO (NKO) strikes (controls). Winner and loser characteristics were compared using 2-tailed t-tests. Multivariate logistic regression analyses were used to compute odds ratios for the strike characteristics associated with tLOC. The Kaplan-Meier estimate was used to describe the temporal distribution of KOs. **Results:** A total of 130 fights were identified for review and 106 fights met criteria for analysis. Analysis of impact profiles revealed that the strongest independent predictor for LOC was axial head rotation (OR, 45.3; 95% CI, 20.8 - 98.6). Other independent risk factors included non-fist striking implements (OR, 11; 95% CI, 4.58 - 26.4), strike location affecting the mandible (OR, 2.84; 95% CI, 1.26 - 6.41) or maxilla (OR, 3.74; 95% CI, 1.32 - 10.6), and strikes resulting in flexion, extension or lateral head flexion (OR, 4.94; 95% CI, 2.09 - 11.7). The Kaplan-Meier survival curve demonstrates a decreasing risk of KO through time. **Conclusion:** Our study is among the first investigations of directly observed human head trauma and the first to directly link axial head rotation as a major contributing variable for whether trauma causes LOC in humans, in line with an extensive literature in animals.

**C-45** Free Communication/Poster - Clinical Populations

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

**1513** Board #275 May 30 10:30 AM - 12:00 PM  
**Agreement Between Segmental Bioimpedance Devices, Air Displacement Plethysmography, and Dual Energy X-Ray Absorptiometry in Obese Adults**

Brett S. Nickerson<sup>1</sup>, Cherilyn N. McLester<sup>2</sup>, John R. McLester, FACSM<sup>2</sup>, Brian M. Kliszczewicz, FACSM<sup>2</sup>. <sup>1</sup>Texas A&M International University, Laredo, TX. <sup>2</sup>Kennesaw State University, Kennesaw, GA.  
 Email: brett.nickerson@tamiu.edu  
 (No relevant relationships reported)

Segmental bioimpedance analysis (BIA) has emerged as a desirable technique for assessing body composition in obese populations when more sophisticated laboratory equipment is not readily available. Nonetheless, research has yet to examine the agreement of various segmental BIA devices, air displacement plethysmography (ADP) and dual energy X-ray absorptiometry (DXA). **PURPOSE:** This study examined the agreement of segmental BIA devices, ADP and DXA for estimating body composition in obese adults. **METHODS:** Fifty obese adults (25 men and 25 women; age = 34.2 ± 11.2 years; BMI = 36.1 ± 5.3 kg/m<sup>2</sup>) had their total body fat percentage (BF%) and fat-free mass (FFM) evaluated with two segmental BIA devices, ADP, and DXA. **RESULTS:** The effect size of the mean differences for all BF% and FFM comparisons (segmental BIA vs. ADP, segmental BIA vs. DXA; ADP vs. DXA) were trivial (Cohen's d <0.20). The standard error of estimate (SEE), total error (TE), and 95% limits of agreement (LOAs) were similar for the segmental BIA devices (SEE < 2.26% and 2.35 kg; TE < 2.58% and 2.66 kg; 95% LOAs < ±4.94% and 4.86 kg) and ADP (SEE = 2.39% and 2.57 kg; TE = 2.34% and 2.56 kg; 95% LOAs = 4.63%

and 5.06 kg) when compared to DXA. Validity statistics were slightly higher, but considered acceptable, when comparing the segmental BIA devices against ADP (SEE < 3.37% and 3.63 kg; TE < 3.44% and 3.79 kg; 95% LOAs < ±5.82% and 7.19 kg). **CONCLUSION:** The main findings from the present study revealed the segmental BIA devices are interchangeable with ADP and DXA when utilized on obese adults. ADP and DXA also had good agreement with each other. These results suggest that clinicians and practitioners can employ segmental BIA devices in obese adults when the ADP or DXA are not available.

**1514** Board #276 May 30 10:30 AM - 12:00 PM  
**The Effects of Swimming Training on Arterial Stiffness, Muscular Strength and Cardiorespiratory Endurance in Postmenopausal Women with Stage 2 Hypertension**  
 Steven Scott<sup>1</sup>, Alexei Wong<sup>2</sup>, Yi-Sub Kwak<sup>3</sup>, Won-Mok Son<sup>4</sup>, Jung-jun Park<sup>4</sup>, Elizabeth Pekas<sup>1</sup>, Song-Young Park<sup>1</sup>. <sup>1</sup>University of Nebraska at Omaha, Omaha, NE. <sup>2</sup>Marymount University, Arlington, VA. <sup>3</sup>Dong-eui University, Busan, Korea, Republic of. <sup>4</sup>Pusan National University, Busan, Korea, Republic of.  
 (No relevant relationships reported)

**Purpose:** Aging is associated with progressive decreases in arterial health and function as well as overall fitness. It is crucial to prevent or reduce the negative effects of aging on vasculature and fitness components by implementing appropriate lifestyle interventions, such as exercise training. We examined the effects of a swimming (SWM) regimen on arterial stiffness (pulse wave velocity, PWV), blood pressure (BP), wave reflection (AIx), muscle strength and aerobic capacity in postmenopausal women with stage 2 hypertension. **Methods:** Using a parallel experimental design, participants were randomly assigned to either a SWM (n=52) or non-exercising control group (n=48) for 20 weeks. Participants in the SWM group trained 3-4 days/week, progressing in duration from 25 to 45 min. Participants' carotid to radial PWV (crPWV), BP, AIx, muscular strength and cardiorespiratory capacity were measured at baseline and after 20 weeks of their assigned intervention. **Results:** There was a significant group x time interaction (P<0.05) for crPWV, AIx, and systolic and diastolic BP, which significantly decreased (P<0.05); and strength and cardiorespiratory capacity, which significantly increased (P<0.05) following SWM compared to no changes in control. **Conclusion:** SWM led to reductions in arterial stiffness, wave reflection and BP while increasing strength and aerobic capacity in postmenopausal women with stage 2 hypertension. SWM may be an effective intervention in the prevention and treatment of age-related vascular complications as well as declines in muscle strength and cardiorespiratory capacity. <!--EndFragment-->

**1515** Board #277 May 30 10:30 AM - 12:00 PM  
**Improvement Of Redox Balance After Isometric Exercise Involving Large Muscle Mass In Hypertensive Adults**  
 Rafael Reis Olher, Thiago Belarmino Ribeiro, Brande Rantner Soares, Ioranny Raquel Souza, Luiz Humberto Rodrigues Souza, Geiziane Leite Rodrigues Melo, Lysleine Alves Deus, Caio Victor Souza, Herbert Gustavo Simões, Rodrigo Vanerson Passos Neves, Thiagos Santos Rosa, Milton Rocha Moraes.  
 Universidade Católica de Brasília, Brasília, Brazil.  
 Email: rfolher@gmail.com  
 (No relevant relationships reported)

Hypertension is one of the cardiovascular diseases responsible for more deaths worldwide. Although isometric exercise (IE) has been showing promising results to treat hypertension, the physiological mechanisms underneath blood pressure (BP) responses are still warranted, being oxidative stress (OS) and nitric oxide (NO), major factors involved in acute and chronic pathophysiology of this disease. **PURPOSE:** The aim of this study was to investigate the OS, NO responses to IE in normotensive (NTG) and hypertensive (HTG) individuals. **METHODS:** After body composition and muscular strength assessment, twenty-four adult men (14 hypertensive and 10 normotensive). Individuals were submitted to 3 sessions of IE in Bench and Leg press exercises. The sessions in each exercise consisted in: i) assessment of maximal voluntary isometric contraction (MVIC); ii) 8 sets x 1' contraction at 30% MVIC with 2' rest pause; iii) control session (CS). Blood samples were collected at rest, immediately after the session and 60-min post-exercise. NO- were obtained through the Griess reaction method. OS parameters (uric acid, TBARS, TEAC, GSH, catalase and SOD) were analyzed using commercial kits. For the statistical analysis, a repeated-measures ANOVA with Bonferroni post-hoc was used. **RESULTS:** A significant increase in plasmatic NO-bioavailability immediately after the IE session was observed only in HTG ( $\Delta = 23.9 \pm 8.45 \mu\text{L}$ ). Regarding OS parameters, TBARS presented a significant reduction after the IE session in both groups in comparison to CS ( $\Delta = -0.94 \pm 0.9$  and  $-0.63 \pm 0.53 \text{ nmol/L}$ ) for HTG and NTG respectively. Catalase increased in both groups against CS ( $\Delta = 48.66 \pm 13.7$  and  $36.92 \pm 19.18 \text{ U} \cdot \text{mL}^{-1}$  for HTG and NTG respectively). Whereas no statistical differences were identified for uric

acid, TEAC, GSH and SOD analysis within- or between-group. **CONCLUSIONS:** In conclusion, 8 minutes of isometric exercise with large muscle mass elicits an elevated pro-oxidant activity, increased antioxidant reaction, leading to a greater NO bioavailability in hypertensive individuals.

**1516** Board #278 May 30 10:30 AM - 12:00 PM  
**Cardiac Rehabilitation Significantly Reduces Body Composition in Men Greater than Women**  
 Amanda R. Bonikowske, Jose R. Medina Inojosa, Maria Irene Barillas-Lara, Yaoshun Dun, Francisco Lopez Jimenez, Thomas P. Olson, FACSM. Mayo Clinic, Rochester, MN. (Sponsor: Thomas P. Olson, FACSM)  
 Email: bonikowske.amanda@mayo.edu  
 (No relevant relationships reported)

**PURPOSE:** To examine body composition (BC) changes by dual energy x-ray absorptiometry (DXA) after cardiac rehabilitation (CR) participation. We hypothesized that CR would improve multiple components of body composition. **METHODS:** The Mayo Clinic CR database was reviewed; 296 had DXA at baseline and after CR completion from January 2014 to August 2018. DXA and relevant clinical metrics (e.g. age, sex, height, weight, hip and waist circumference (WC), and clinical diagnosis) were extracted from the medical record. Referral diagnoses included myocardial infarction (29%), coronary artery disease (4%), percutaneous coronary intervention (23%), coronary artery bypass grafting (14%), heart valve surgery (14%), heart transplant (4%), heart failure (6%), and other (6%). Data are presented as mean±SD and analyzed with ANOVA, chi-square and fisher's exact test when appropriate.

**RESULTS:** There was no difference in age between groups at enrollment. As expected, men weighed more, had more lean mass, were taller, had larger WC, and higher waist to hip ratio (WHR; p<0.05) at baseline. Women had higher body fat % and gynoid fat mass % (p<0.05). After CR, weight did not change significantly in men or women; however, BC changed significantly as presented in the table. Specifically, in men compared to women, CR resulted in greater reductions in fat mass and body fat %, with greater increases in lean mass (p<0.05). Men also demonstrated greater reductions in android fat mass % and WHR (p<0.05). Conversely, women had a significant reduction in gynoid fat mass % but no change in android fat mass % or WHR (p<0.05). Fat mass index was reduced in both groups and significantly between the sexes (p<0.05).

**CONCLUSIONS:** CR participation significantly reduced BC in men and women; however, men demonstrate greater reductions compared to women. Additionally, the distribution of BC improvements appears to differ between sexes suggesting sex specific CR programming may be appropriate.

	Men			Women		
	Before	After	Delta Change	Before	After	Delta Change
Weight (kg)	90.48 ± 18.71	89.82 ± 18.42	(-)0.62 ± 4.96	75.52 ± 17.56	75.29 ± 19.73	(-)0.23 ± 3.29
Waist (cm)	106.23 ± 13.78	104.31 ± 13.98	(-)1.91 ± 5.11 *	95.39 ± 15.81	93.62 ± 15.94	(-)1.76 ± 6.29 *
Hip (cm)	106.53 ± 9.45	105.54 ± 9.42	(-)0.96 ± 4.52 *	107.83 ± 13.52	107.1 ± 13.58	(-)0.73 ± 4.74
Waist/Hip Ratio	0.99 ± 0.07	0.98 ± 0.07	(-)0.0095 ± 0.05 *	0.88 ± 0.08	0.87 ± 0.08	(-)0.012 ± 0.06
Fat mass (Kg)	31.25 ± 11.45	30.07 ± 11.29	(-)1.10 ± 2.47 *	31.71 ± 13.14	30.93 ± 14.20	(-)0.75 ± 2.28 *
Lean mass (Kg)	57.34 ± 8.54	57.74 ± 8.34	0.46 ± 2.24 *	41.85 ± 6.01	41.7 ± 6.29	(-)0.08 ± 2.18
% Fat	34.38 ± 6.97	33.29 ± 6.91	(-)1.06 ± 2.05 *	41.46 ± 9.04	40.91 ± 9.13	(-)0.58 ± 2.28
Fat Mass Index (kg/m <sup>2</sup> )	11.01 ± 2.4	9.79 ± 3.47	(-)1.30 ± 2.28 <sup>†*</sup>	15.37 ± 3.74	11.75 ± 4.91	(-)3.43 ± 3.19 <sup>†*</sup>
% Trunk Fat	40.29 ± 8.98	38.96 ± 8.94	(-)1.31 ± 2.97 *	43.54 ± 11.88	42.93 ± 12.05	(-)0.61 ± 3.19
Android Fat mass %	43.19 ± 10.29	41.93 ± 10.12	(-)1.07 ± 4.51 *	44.13 ± 13.84	43.53 ± 14.03	(-)0.69 ± 4.16
Gynoid Fat Mass %	33.75 ± 6.86	32.46 ± 6.83	(-)1.25 ± 2.23 *	44.7 ± 7.88	43.86 ± 7.93	(-)0.86 ± 2.40 *
Android/gynoid	1.28 ± 0.23	1.29 ± 0.23	0.14 ± 0.12	0.97 ± 0.23	0.97 ± 0.25	0.00026 ± 0.08
Percentile of Fat for age and sex	86.82 ± 22.98	83.67 ± 25.48	(-)3.15 ± 9.48 *	67.72 ± 24.41	66.38 ± 30.44	(-)1.34 ± 9.60

Data presented as mean ± SD. \* P < 0.05 between delta changes between sex. † P < 0.05 between means of before and after among same sex.

**1517 Board #279 May 30 10:30 AM - 12:00 PM**  
**A Novel 4 Pillar® Model Of Exercise Delivery Reduces Cardiovascular Risk Factors In Cardiac Patients**

Yvonne Rumble, Matthew Thompson, Sam Olden, Gavinder Kandola, Ivor Cradock. CP+R, London, United Kingdom.  
 Email: yvonne.rumble@cpandr.co.uk  
 (No relevant relationships reported)

**PURPOSE:** Cardiovascular disease (CVD) accounts for an estimated 31% of deaths worldwide (WHO, 2017). Current strategies to manage CVD include medical therapy and invasive procedures, with cardiac rehabilitation (CR) offered as a secondary treatment. According to the UK National Audit of CR (2017) only 51% of referred patients commence a programme, which lasts a median of 9 weeks. In addition, the current outcomes from CR are underwhelming and research has found it is not yet effective at reducing the risk of MI or revascularization and all-cause mortality (Cochrane review, 2016). The current study investigates the effectiveness of an alternative approach to CR using a novel 4 Pillar model of exercise delivery and nutritional guidance, on reducing key modifiable risk factors in a cardiac population. **METHODS:** 120 patients (4 MI, 24 MI + PCI, 7 MI + CABG, 15 CABG, 48 PCI, 27 Valve Surgery) (109M, 11F), aged 56.5 ± 10.8 years, completed a 12-week cardiac rehabilitation programme at CP+R. This involved twice-weekly supervised resistance sessions reaching overload, twice-weekly aerobic training within a prescribed heart rate zone, on-going step-count monitoring and nutritional guidance. The programme was led by a clinical exercise specialist and overseen by a clinical nurse. All patients underwent pre and post physiological and psychological measures including systolic (SBP) and diastolic (DBP) blood pressure, body mass (BM) body fat percentage (BF%), cardio-respiratory fitness (predicted VO<sub>2</sub>peak), hospital anxiety and depression (HAD) and exercise confidence (Ex Con). **RESULTS:** 95% of patients completed the full 12 weeks CR programme. There were significant reductions in SBP 8.6 ± 12.6 mmHg, DBP 6.3 ± 9.0 mmHg, BM 2.3 ± 3.2 kg and BF% 1.2 ± 2.3 %. A significant increase in predicted VO<sub>2</sub>peak 5.5 ± 7.4 ml/kg/min and significant improvements in HAD 16.6 ± 56.1 % and Ex Con 17.0 ± 16.4 % (all P < 0.01). **CONCLUSIONS:** This novel exercise and nutrition programme incorporating a 4 Pillar model significantly reduced SBP, DBP, BM, BF and increased predicted VO<sub>2</sub>peak in cardiac patients. This could provide a blueprint for an achievable and effective application of lifestyle intervention following primary care that should be routinely offered to individuals to reduce further risk and improve quality of life.

**1518 Board #280 May 30 10:30 AM - 12:00 PM**  
**The Inorganic Nitrate For eXercise In Heart Failure (INIX-HF) Trial: Rationale, Design, And Preliminary Data**

Andrew R. Coggan, FACSM<sup>1</sup>, Derrick Gray<sup>1</sup>, Susan B. Racette<sup>2</sup>, W. Todd Cade<sup>2</sup>, Dakkota Thies<sup>2</sup>, Kenneth B. Schechtman<sup>2</sup>, Linda R. Peterson<sup>2</sup>. <sup>1</sup>Indiana University Purdue University Indianapolis, Indianapolis, IN. <sup>2</sup>Washington University in St. Louis, St. Louis, MO.  
 Email: acoggan@iupui.edu  
 (No relevant relationships reported)

Peak oxygen uptake (VO<sub>2</sub>peak) and muscle contractile function are both impaired in patients with heart failure with reduced ejection fraction (HFrEF), with these deficits significantly contributing to the diminished quality of life and possibly even early mortality of such individuals. In previous pilot studies, however, we have reported that these deleterious changes can be ameliorated by acute ingestion of nitrate (NO<sub>3</sub><sup>-</sup>), which *in vivo* can be converted to nitric oxide (NO) via the enterosalivary NO<sub>3</sub><sup>-</sup> → nitrite (NO<sub>2</sub><sup>-</sup>) → NO pathway.

**PURPOSE** Based on these studies, the INIX-HF trial is a proposed multi-center (i.e., 8 site), randomized control trial of the effects of acute (i.e., single dose) and chronic (i.e., 2 wk) dietary NO<sub>3</sub><sup>-</sup> supplementation (in the form of KNO<sub>3</sub>) on VO<sub>2</sub>peak and muscle contractility in patients with HFrEF. We are presently performing the work that is necessary and sufficient to set up this trial, including determining the optimal dose of KNO<sub>3</sub> to utilize.

**METHODS** Using a double-blind, crossover design, six patients with HFrEF (5 men, 1 woman; age = 49±4 y; EF = 32±3%) were studied 2-3 h after acute ingestion of either 10 or 20 mmol KNO<sub>3</sub>. On each occasion, VO<sub>2</sub>peak was measured during an incremental treadmill exercise test (modified Naughton protocol) and muscle function was determined using isokinetic dynamometry.

**RESULTS** The increase in plasma NO<sub>3</sub><sup>-</sup> was greater following ingestion of 20 vs. 10 mmol KNO<sub>3</sub> (Δ = 430±51 vs. 218±19 μmol/L; P=0.002). However, plasma NO<sub>3</sub><sup>-</sup> increased to a similar degree in both trials (Δ = 0.219±0.078 vs. 0.169±0.044 μmol/L; P=0.67). Presumably as a result, VO<sub>2</sub>peak did not differ between treatments (i.e., 18.0±1.5 vs. 17.7±1.3 mL min<sup>-1</sup> kg<sup>-1</sup>; P=0.74). There was also no difference in maximal knee extensor power (4.52±0.56 vs. 4.25±0.59 W/kg; P=0.69) across trials. 27% of subjects experienced moderate-to-severe nausea and/or vomited after ingesting the higher dose KNO<sub>3</sub>, vs. only 9% after the lower dose.

**CONCLUSION** There was no difference in the efficacy of 10 vs. 20 mmol KNO<sub>3</sub> in influencing VO<sub>2</sub>peak or muscle power in patients with HFrEF. The higher dose, however, was associated with a greater frequency of gastrointestinal distress. Based on these preliminary data, it appears that 10 mmol KNO<sub>3</sub> is the preferred dose for a larger, multicenter trial.

Supported by award R34HL138253 from the NHLBI

**1519 Board #281 May 30 10:30 AM - 12:00 PM**  
**Body Mass Index and Exercise Performance in Patients with Single Ventricle Fontan Circulation**

Sydney Bouressa, Michael Danduran. Marquette University, Milwaukee, WI.  
 Email: sydney.bouressa@marquette.edu  
 (No relevant relationships reported)

Single ventricle physiology is the most devastating of the congenital heart diseases affecting nearly 5000 children annually. Staged surgical palliation that concludes with the Fontan surgery results in elimination of the pulmonary pump, increased venous pressures, and a decreased exercise tolerance. Body mass index (BMI) is associated with exercise performance in the healthy populations but its utility as a correlate to exercise performance in the Fontan population has not been explored. **PURPOSE:** Assess the utility of BMI as a predictor of exercise performance in Fontan patients. **METHODS:** A review of Fontan patients below 20 years of age who performed exercise testing at the Children's Hospital of Wisconsin was performed (n=397). Age, gender, BMI, as well as exercise time (EXTM), VO<sub>2</sub> and HR were assessed. Maximal efforts were verified by a respiratory quotient (RQ) greater than 1.05. Mean and standard deviation were obtained for BMI at each age category. Correlations between BMI and EXTM were determined. **RESULTS:** Fontan patient's BMIs fall on average near the 50<sup>th</sup> percentile, consistent with normal growth across early lifespan. BMI did not predict EXTM in this patient population. Sub-analysis of patients that fell below the 5<sup>th</sup> or above the 85<sup>th</sup> percentile resulted in no prediction of EXTM. **CONCLUSION:** The determinants of exercise limitations of patients having undergone Fontan palliation are multi-factorial and complex. Our findings suggest that BMI may not be a sensitive marker in patients with complex congenital heart disease. The inability of BMI as a singular measure may not account for the diminished muscle size or function that may result from chronic states of hypoxia or altered cardiovascular physiology resulting in decreased EXTM. These results warrant further investigation into potential peripheral factors of exercise limitations not yet identified in this population of patients.

Age (yrs)	Gender	N	BMI (SD)	BMI Range	EXTM min (SD)	Correlation
4-6	M	12	15.1 (1.4)	13.6-18.3	9.4 (1.6)	-0.26
	F	11	15.4 (1.0)	14.2-16.7	8.6 (1.1)	-0.10
7-8	M	24	16.1 (1.6)	14.1-20.5	10.8 (2.2)	0.11
	F	26	15.8 (1.6)	13.2-23.8	10.1 (1.9)	-0.02
9-10	M	37	17.8 (4.2)	13.6-28.5	10.9 (2.2)	-0.34
	F	14	17.0 (2.8)	13.2-23.8	10.4 (1.2)	0.10
11-12	M	49	18.3 (3.9)	13.5-32.9	11.4 (1.8)	-0.35
	F	26	17.4 (3.0)	13.8-26.1	9.9 (1.9)	0.05
13-14	M	34	19.1 (3.8)	14.6-35.5	11.7 (1.8)	-0.23
	F	26	21.0 (3.3)	14.0-27.4	9.8 (2.2)	0.03
15-16	M	36	21.1 (5.8)	15.7-39.6	10.3 (2.5)	-0.26
	F	26	21.2 (4.3)	13.4-28.6	9.0 (2.3)	-0.27
17-18	M	37	21.6 (4.5)	15.9-38.3	10.8 (2.2)	-0.56
	F	14	24.3 (6.3)	15.3-34.7	9.0 (2.4)	-0.50
19-20	M	17	23.4 (3.6)	17.1-28.9	10.7 (1.3)	-0.08
	F	8	25.9 (5.1)	20.0-34.6	9.4 (1.8)	-0.56

**1520** Board #282 May 30 10:30 AM - 12:00 PM  
**Desmin is Improved in the Gastrocnemius of Patients with Peripheral Artery Disease after Revascularization Interventions**

Panagiotis Koutakis<sup>1</sup>, Ahmed Ismael<sup>1</sup>, Evlampia Papoutsis<sup>1</sup>, Jeremiah Kidd<sup>1</sup>, Robert S. Smith<sup>2</sup>, Robert Brumberg<sup>3</sup>, Jeffrey S. Kirk<sup>4</sup>, William T. Bohannon<sup>2</sup>. <sup>1</sup>Florida State University, Tallahassee, FL. <sup>2</sup>Baylor Scott and White, Temple, TX. <sup>3</sup>Vascular Surgery Associates, Tallahassee, FL. <sup>4</sup>Capital Regional Medical Center, Tallahassee, FL. (Sponsor: Lynn Pantan, FACSM)  
 Email: pkoutakis@fsu.edu

(No relevant relationships reported)

Patients with peripheral artery disease (PAD) develop a myopathy in their ischemic limbs which is characterized by myofiber degeneration, mitochondrial dysfunction and impaired leg function. Degenerated myofibers have cytoskeletal abnormalities the best described of which is a disorganized accumulation of desmin filaments.

**Purpose:** We hypothesized that the levels and organization of desmin in the myofibers of the gastrocnemius of PAD patients improve after revascularization and correlate with increases in mitochondrial respiration and calf muscle strength. **Methods:** Gastrocnemius biopsies were collected from 32 PAD patients (61.6 ± 5.2 yrs, 31.0 ± 9.0 kg/m<sup>2</sup>) before and six months after revascularization. Accumulation and organization of desmin protein in myofibers were determined by quantitative fluorescence microscopy and desmin gene transcripts were quantified by rtPCR of RNA in biopsy homogenates. The effects of revascularization on these parameters and their association with ischemic window, mitochondrial function determined by respirometry, and calf muscle strength determined by isokinetic testing with the Biodex system were evaluated. Data were analyzed in SPSS 21 using paired-t test and Pearson correlation with a level of significance at p<0.05. **Results:** Revascularization reduced the abnormal accumulation of disorganized desmin protein and gene transcripts in the PAD gastrocnemius. The ischemic window ( $\Delta$ =529 mm Hg x min; p<0.05), myofiber morphology ( $\Delta$ =657  $\mu$ m<sup>2</sup>; p<0.05), mitochondrial respiration ( $\Delta$  ETC I=12.3 ± 22 and ETC II=21.6 ± 33 O<sub>2</sub> · min<sup>-1</sup> · unit<sup>-1</sup> · CS activity<sup>-1</sup>; p<0.05) and calf muscle strength ( $\Delta$ =8.33 ± 19 N\*<sup>2</sup>m) were significantly improved after revascularization. After revascularization, the decreased desmin expression was associated with a more structured appearance of the protein, suggesting a return to the normally filamentous structure. These changes in desmin correlated with improved mitochondrial function (r=0.406; p<0.05) and increased calf muscle strength (r=0.313; p<0.05). **Conclusions:** Revascularization operations improve the levels and organization of the desmin filaments in the gastrocnemius of patients with PAD and these changes correlate with improved mitochondrial function and calf muscle strength.

**1521** Board #283 May 30 10:30 AM - 12:00 PM  
**Metabolomic Profiling of Amino Acid Metabolism in Peripheral Artery Disease Patients**

Ahmed Ismael<sup>1</sup>, Marco E. Franco<sup>2</sup>, Ramon Lavado<sup>2</sup>, Panagiotis Koutakis<sup>1</sup>. <sup>1</sup>Florida State University, Tallahassee, FL. <sup>2</sup>Baylor University, Waco, TX. (Sponsor: Lynn Pantan, FACSM)  
 Email: ai18@my.fsu.edu

(No relevant relationships reported)

The spectrum of symptoms of peripheral artery disease (PAD) is classified according to the Fontaine classification. Patients presenting with intermittent claudication are classified in Stage II, and in the latest stages of PAD referred to as critical limb ischemia (CLI), patients exhibit rest pain with or without ulcers and gangrene. Although systemic risk factors for PAD have been established, an omics approach may represent an innovative method to comprehensively investigate the molecular basis of PAD pathogenesis. **Purpose:** To determine the metabolomics profile of amino

acid metabolism of patients with PAD and identify changes as the disease progresses. **METHODS:** Blood samples were acquired from 24 Stage II PAD patients (PAD-II: 62.1±6.9yrs), 24 CLI patients (CLI: 68.2±9.9yrs), and 26 healthy controls (HC; 63.2±7.4yrs). For targeted metabolomic analysis to identify and quantify amino acid metabolite concentrations, serum was extracted, and samples were measured using the AbsoluteIDQ p400 kit, and an Orbitrap mass spectrometer coupled to an UltiMate 3000 Rapid Separation Quaternary high performance liquid chromatography (HPLC) system. To examine differences between groups, one-way ANOVA was carried out, followed by Tukey's test for post-hoc analysis. **RESULTS:** Relative to PAD-II and HC, CLI showed significantly lower content of alanine (HC: 296.5 ± 109.2  $\mu$ M, PAD-II: 361.2 ± 143.0  $\mu$ M, CLI: 247.4 ± 84.4  $\mu$ M; p=0.004) arginine (HC: 106.8 ± 32.5  $\mu$ M, PAD-II: 114.7 ± 20.3  $\mu$ M, CLI: 94.2 ± 25.5  $\mu$ M; p=0.033), glutamine (HC: 569.7 ± 82.8  $\mu$ M, PAD-II: 568.3 ± 93.2  $\mu$ M, CLI: 505.3 ± 118.9  $\mu$ M; p=0.043), histidine (HC: 75.7 ± 10.8  $\mu$ M, PAD-II: 77.2 ± 12.6  $\mu$ M, CLI: 54.6 ± 16.4  $\mu$ M; p<0.001), ornithine (HC: 68.5 ± 15.7  $\mu$ M, PAD-II: 61.3 ± 17.0  $\mu$ M, CLI: 54.6 ± 26.1  $\mu$ M; p=0.065), proline (HC: 202.3 ± 54.2  $\mu$ M, PAD-II: 220.3 ± 63.7  $\mu$ M, CLI: 169.3 ± 54.5  $\mu$ M; p=0.011), tryptophan (HC: 50.9 ± 13.9  $\mu$ M, PAD-II: 53.8 ± 17.9  $\mu$ M, CLI: 32.7 ± 10.9  $\mu$ M; p<0.001), and tyrosine (HC: 62.7 ± 15.6  $\mu$ M, PAD-II: 58.3 ± 18.2  $\mu$ M, CLI: 47.2 ± 14.8  $\mu$ M; p=0.004). **CONCLUSION:** The metabolic fingerprint of amino acid metabolites of CLI is considerably different from PAD-II and HC. Perturbations in amino acid metabolism may contribute to CLI pathology and may serve as a diagnostic/prognostic tool to alter the management of CLI.

**C-46** Free Communication/Poster - Obesity

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

**1522** Board #284 May 30 10:30 AM - 12:00 PM  
**Exercise Mitigates The Loss In Muscle Mass And Functionality In Obese Women Undergoing Bariatric Surgery**

Saulo Gil, Wagner Silva Dantas, Igor Hisashi Murai, Carlos Merege Filho, Marco Aurelio Santo, Roberto de Cleve, Rosa Maria Rodrigues Pereira, Samuel Katsuyuki Shinjo, John P. Kirwan, Bruno Gualano, Hamilton Roschel. *University of São Paulo, São Paulo, Brazil.*  
 Email: saulosgil@hotmail.com  
 (No relevant relationships reported)

**INTRODUCTION:** Bariatric surgery effectively reduces weight and some comorbidities in obese patients; however, surgery incurs in severe muscle waste and functionality impairments, warranting the investigation of therapeutic strategies to mitigate these outcomes. **PURPOSE:** To examine the effects of exercise training on vastus lateralis fiber cross-sectional area (fCSA), strength and functionality in women undergoing bariatric surgery. **METHODS:** Sixty-two obese women were randomly allocated to receive either bariatric surgery (RYGB: BMI=47±8) or bariatric surgery plus exercise training (RYGB+ET: BMI=49±7). Patients were assessed at baseline (PRE), three (POST3), and nine months (POST9) after surgery for fCSA, lower- and upper-limb 1RM, and timed-up-and-go (TUG) and timed-stands (TST) test. The 6-month exercise intervention started at POST3 for RYGB+ET, while RYGB followed standard care. **RESULTS:** Type I and II fCSA was decreased in both RYGB (-21 and -27%) and RYGB+ET (-22 and -27%) at POST3 (all p<0.0001). RYGB+ET increased types I and II fCSA from POST3 to POST9 (23%, p=0.0053 and 32%, p=0.0055), whereas no changes were observed in RYGB (4% and 1%, respectively; both p>0.05). Importantly, type I and II fCSA were significantly greater in RYGB+ET than in RYGB at POST9 (both p=0.0001). Lower- (RYGB=-32% and RYGB+ET=-24%, both p<0.0001) and upper-limb 1RM (RYGB=-26% and RYGB+ET=-29%, both p<0.0001) were reduced at POST3. Exercise increased lower- and upper-limb strength (49%, p<0.0001 and 11%, p=0.0024, respectively). In contrast, no differences were observed in RYGB (1% and 4%, respectively; both p>0.05). Additionally, lower-limb 1RM was significantly greater in RYGB+ET than in RYGB at POST9 (p<0.0001). No effects of surgery were observed in either TUG or TST (all p>0.05). RYGB+ET increased TUG and TST scores from POST3 to POST9 (11%, p<0.0001 and 26%, p<0.0001, respectively), while no significant differences were observed in RYGB (2% and 3%, respectively, both p>0.05). TST were significantly greater in RYGB+ET than in RYGB at POST9 (p<0.0001). **CONCLUSIONS:** Our data suggest that a 6-month exercise training program is effective in counteracting the loss of muscle mass, strength and functionality that occur after bariatric surgery. Clinicaltrials.gov: NCT02441361

1523 Board #285 May 30 10:30 AM - 12:00 PM

**The Role of Physical Activity on Abdominal Fat Patterning in Pre and Post-Menopausal Women**

Emily W. Flanagan, Arlette C. Perry, FACSM, Wesley N. Smith.  
*University of Miami, Coral Gables, FL.*  
 Email: e.white6@umiami.edu  
 (No relevant relationships reported)

Changes in the hormonal milieu with menopause are associated with increases in both total body fat and abdominal fat storage (AFS), both of which are related to an adverse metabolic profile and increased cardiovascular disease risk. Physical activity (PA) is a common intervention to ameliorate adipose fat accumulation during all life-stages.

**PURPOSE:** To examine differences in the protective effect of physical activity on total adiposity and fat patterning in pre and post-menopausal women.

**METHODS:** A total of 1018 women (pre-menopausal 425; post-menopausal 593) participated in the study. Each patient completed anthropometric measurements and a physical activity survey using the HealthSnap platform, which encompasses a streamlined health evaluation with lifestyle recommendations. Patients were stratified by age to predict menopausal status (pre-menopausal <35 yrs; post-menopausal >45 yrs). BMI was computed as kg/m<sup>2</sup> and AFS was determined using a waist-to-hip ratio above 0.85. PA was defined as MET-minutes equivalent to >75 minutes of vigorous activity, or >150 minutes of moderate activity, per week.

**RESULTS:** As expected, in both groups of pre and post-menopausal women, a significant association was observed between PA and BMI (RR=1.8, CI: 1.24-2.70 and RR = 2.18, CI: 1.67-2.80; p<0.001, respectively). In contrast, PA was only associated with AFS patterning in post-menopausal (RR=1.45, CI: 1.24-1.70; p<0.001) but not pre-menopausal women (RR= 1.034, CI: 0.83-1.30; p=0.74).

**CONCLUSIONS:** PA is protective against BMI in both pre and post-menopausal women. However, PA appears to be protective against the development of AFS in post-menopausal women, but not pre-menopausal women. To our knowledge, this is the first study to show a dichotomous relationship between PA and an AFS patterns between two life stages in women. These findings suggest that exercise is an effective therapeutic intervention to prevent or reduce abdominal fat deposition and its associated health consequences. These adverse health risks associated with endocrine changes in post-menopausal women may be ameliorated by meeting weekly PA recommendations.

1524 Board #286 May 30 10:30 AM - 12:00 PM

**Obesity Further Impairs Neuromuscular and Functional Performance in Older Women**

Ryan M. Miller, Eduardo D.S. Freitas, Aaron D. Heishman, Japneet Kaur, Brady S. Brown, Michael G. Bembem, FACSM.  
*University of Oklahoma, Norman, OK.* (Sponsor: Michael G Bembem, FACSM)  
 (No relevant relationships reported)

**INTRODUCTION:** Age-related changes in body composition consists of reductions in total body lean body mass as well as a concomitant increase in total body fat through the 8<sup>th</sup> decade of life. Accompanied with these alterations in body composition is the gradual reduction in muscular strength. Obesity has been suggested to further impair neuromuscular performance; however, previous data often employs the body mass index (BMI) approach to classify obesity, whereas waist circumference (WC) may be a better indicator considering the redistribution of adiposity and spinal compression associated with natural aging. **PURPOSE:** The purpose of this study was to examine the differences in grip strength (HGS), jump power (JPOW), bench press one-repetition maximum (BP1RM), timed up and to (TUG) speed, and Berg Balance testing (BBT), in women between the ages of 50 to 70 years classified as having normal WC (≤89cm) or elevated WC (>90cm). Women with normal WC were considered non-obese and those with elevated WC were classified as obese. **METHODS:** Forty-one older women (non-obese: n = 21, obese: n = 19) completed two visits which consisted of visit 1 including consenting, questionnaires, and familiarization trials and visit 2 including body composition analysis via dual-energy X-ray absorptiometry (DXA) and performed BP1RM, VJ, JPOW, HGS, TUG, and BBT. Independent samples t-tests were used to determine mean differences between non-obese and obese women and Pearson's correlation coefficients examined the relationships between WC and performance measures. **RESULTS:** According to the physical activity scale for the elderly questionnaire, 38/41 women met the recommended amount of physical activity when stratified by age and sex. With the exception of the BBT (p=0.35), women classified as non-obese performed significantly better for the BP1RM (p=0.04, ES: 0.25), VJ (p<0.01, ES: 0.71), JPOW (p=0.02, ES: 0.54), HGS (p<0.001, ES: 1.3), and TUG (p<0.001, ES: 0.94). Additionally, WC was inversely, but significantly correlated with HGS (r = -0.51, p=0.01) and TUG (r = -0.48, p=0.01) values. **CONCLUSION:** These data suggest that neuromuscular and functional measures may be further reduced when accompanied with obesity in older women. Remarkably, these differences were still observed with no differences in physical activity.

1525 Board #287 May 30 10:30 AM - 12:00 PM

**Limiting Factors In Cycling And Knee Extension Exercise In Obese Subjects**

Filippo Vaccari<sup>1</sup>, Mirco Floreani<sup>1</sup>, Alessandro Sartorio<sup>2</sup>, Stefano Lazzar<sup>1</sup>. <sup>1</sup>Udine University, Udine, Italy. <sup>2</sup>Istituto Auxologico Italiano, Verbania, Italy.  
 Email: filippo.vaccari@live.com  
 (No relevant relationships reported)

In whole body exercise like cycling, maximal oxygen uptake is mainly limited by cardiac output rather than the oxygen extraction and utilization capacity of the muscle<sup>1</sup>. When the exercise is performed with small muscle mass (like in single leg knee extension exercise), the muscle oxygen uptake should be not limited by central circulation, but from peripheral factors like peak muscle perfusion, oxygen diffusion or mitochondrial respiratory capacity<sup>2</sup>. Obese patients (OB) compared with normal weight people (CTRL) have similar peak oxygen consumption (V'O<sub>2</sub> Peak), lower V'O<sub>2</sub> Peak for 1 Kg of fat free mass and lower peak work rate in Cycling Exercise<sup>3</sup>. On the other hands Obese show greater isometric force and hypertrophy<sup>3</sup>. **PURPOSE:** In the present study, we investigated if maximal oxygen uptake is mainly limited by cardiac output rather than the capacity to oxygen extraction and utilization of the muscle in OB and CTRL subjects, during maximal incremental test on Cycle Ergometer (CE) and on single leg Knee Extension (KE) ergometer. **METHODS:** 15 OB (age 25±7 y; BMI 43±7 kg/m<sup>2</sup>) and 13 CTRL subjects (age 27±7 y; BMI 22±3 kg/m<sup>2</sup>) participated in this study. V'O<sub>2</sub> and Cardiac Output (CO) were measured during CE and KE. Maximal voluntary contraction (MVCs) of knee extensor muscle were performed before and immediately after the two incremental tests. **RESULTS:** Peak V'O<sub>2</sub> (mL min<sup>-1</sup>) and CO (mL min<sup>-1</sup>) were significantly higher (p<0.05) in CE than KE with no differences between OB and CTRL (V'O<sub>2</sub> CE: OB 2.68±0.68, CTRL 3.04±0.65; V'O<sub>2</sub> KE: OB 1.36±0.51, CTRL 1.15±0.26) (CO CE: OB 20.81±5.42, CTRL 20.61±4.04; CO KE: OB 15.97±5.89, CTRL 12.00±2.45). Maximal work rate (W) was lower in OB than CTRL (191±38 vs 226±39, p<0.05) in CE but similar between two groups in KE (62±13 vs 61±14, p>0.05) The MVC reduction after CE was lower in OB compared with CTRL (14±13 vs 26%±16%, p<0.05), while in KE was the same (32±11 vs 32%±18%). **CONCLUSIONS:** The limiting factor during KE should reside in the muscle for both groups, instead the performance during CE might be limited due to central mechanisms. This is particularly true for OB where cardio respiratory system might have played a role in determining the cessation of CE as it can be evinced by a lower MVC reduction at exhaustion compared to the one produced after KE. Supported by Municipalities of Gemona del Friuli (Udine, Italy)

1526 Board #288 May 30 10:30 AM - 12:00 PM

**12-week of Tai Chi Training Reduces Visceral Fat in Centrally Obese Older Adults**

Angus, P. Yu<sup>1</sup>, Doris S. Yu<sup>2</sup>, Stanley S. Hui, FACSM<sup>2</sup>, Jean Woo<sup>2</sup>, Parco M. Siu, FACSM<sup>1</sup>. <sup>1</sup>The University of Hong Kong, Hong Kong, Hong Kong. <sup>2</sup>The Chinese University of Hong Kong, Hong Kong, Hong Kong. (Sponsor: Dr. Parco M. Siu, FACSM)  
 Email: aphyu@connect.hku.hk  
 (No relevant relationships reported)

Excess visceral fat is associated with metabolic abnormality and increased susceptibility to diabetes and cardiovascular diseases. It is known that visceral fat is reduced with strenuous physical exercise. However, older adults (age≥50) may prefer to manage their visceral fat with alternate exercise modalities. **PURPOSE:** To examine the effectiveness of Tai Chi, a popular mind-body exercise among older adults, in the reduction of visceral fat in centrally obese older adults. **METHODS:** This randomized controlled trial was conducted from March to August, 2018. In this three-arm, single-blinded randomized controlled trial, 102 Chinese adults aged ≥50 years with central obesity (male with waist circumference (WC) ≥ 90 cm / female ≥ 80 cm) were randomly assigned to Control (n= 33; received no intervention), Fitness (n= 35; received 12-week conventional exercise intervention) or Tai Chi groups (n= 34; received 12-week Tai Chi intervention). The primary outcome was the determination of visceral fat mass by dual-energy x-ray absorptiometry at 12-week post-randomization, while the secondary endpoints were the risk factors of metabolic syndrome (i.e. WC, blood pressure, fasting blood glucose, high-density lipoprotein-cholesterol and triglyceride). Data were analyzed by Generalized linear model with baseline as covariate. Pairwise comparison was done by closed test procedure. **RESULTS:** Visceral fat was reduced by 1.6% and 4.1% in the Tai Chi and Fitness groups respectively whereas the control group manifested a 3.8% increase. A main effect of intervention was observed in visceral fat (P<0.001). The pairwise comparison shown that both the Tai Chi (P=0.001) and Fitness (P=0.022) groups exhibited lower visceral fat content compared with their control counterpart. A main effect of intervention was observed in waist circumference (P<0.013) and triglyceride (P<0.046). Pairwise comparisons showed that the waist circumference (P=0.011) and triglyceride level (P=0.043) were reduced significantly in response to Tai Chi intervention.

**CONCLUSIONS:** These data suggest that Tai Chi training reduces visceral fat, waist circumference and blood triglyceride.

Supported by Health and Medical Research Fund 12131841

**1527** Board #289 May 30 10:30 AM - 12:00 PM

### Functional Evaluation and VO<sub>2</sub>-kinetics in Obese Patients Before and After Sleeve Gastrectomy

Daniel Neunhaeuserer<sup>1</sup>, Sara Ortolan<sup>1</sup>, Alessandro Patti<sup>1</sup>, Andrea Gasperetti<sup>1</sup>, Francesco Savalla<sup>1</sup>, Francesca Battista<sup>1</sup>, Stefano Gobbo<sup>1</sup>, Silvia Bettini<sup>2</sup>, Anna Belligoli<sup>2</sup>, Andrea Ermolao<sup>1</sup>.

<sup>1</sup>*Sport and Exercise Medicine Division, Padova, Italy.* <sup>2</sup>*Internal Medicine 3, Padova, Italy.*

Email: daniel.neunhaeuserer@unipd.it

(No relevant relationships reported)

Sleeve gastrectomy (SG) has become an important therapeutic option for patients with severe obesity, showing a positive impact on patients' comorbidities. Even though poor cardiorespiratory function is a powerful predictor of mortality, functional evaluation has been given little attention after SG.

#### PURPOSE

To investigate the effects of SG on functional capacity six months after surgery, with specific analysis of peripheral oxidative muscle metabolism by determination of VO<sub>2</sub>-kinetics.

#### METHODS

In this longitudinal observational study 36 patients (age 44±11 years, 78% females) with severe obesity (BMI 43.95±5.67 kg/m<sup>2</sup>) were evaluated one month before (pre-SG) and six months after SG (post-SG). A maximal cardiopulmonary exercise test was performed on treadmill with an initial 5 min constant, moderate load exercise and a subsequent incremental Bruce protocol. VO<sub>2</sub>-kinetics during constant load exercise were analyzed by mono-exponential function. Furthermore, muscle strength was evaluated by isometric handgrip strength test. Patients' physical activity level was assessed by the Global Physical Activity Questionnaire (GPAQ).

#### RESULTS

As expected, a significant weight loss (-31.14±9.45 kg, p<0.001) and a reduction of waist circumference (-15.35 cm, p<0.001) were observed post-SG, associated with improved exercise time (14.48±2.5 vs 16.90±2.15 min; p<0.001) and capacity (8.38±2.5 vs 10.66±2.08 METs; p<0.001). While the VO<sub>2</sub>peak/kg was significantly increased, a reduction of the absolute VO<sub>2</sub>peak and Oxygen Uptake Efficiency Slope (OUES) were shown after surgery (all p<0.001). Furthermore, the time-constant Tau (τ) of the fundamental phase of VO<sub>2</sub>-kinetics significantly worsened post-SG (37.71±12.20, vs 43.75±11.35 s; p<0.02). However, muscle strength remained unchanged in these patients (handgrip: 29.87±11.73 vs 28.91±10.83 kg; p=0.1), showing also an increased level of weekly physical activity post-SG (GPAQ, p<0.01).

#### CONCLUSIONS

Even though patients after SG improved functional capacity due to a significant weight loss, absolute aerobic capacity and VO<sub>2</sub>-kinetics significantly worsened despite increased physical activity. The study findings thus suggest an impaired peripheral oxidative muscle metabolism post-SG without affecting patients' muscle strength.

**1528** Board #290 May 30 10:30 AM - 12:00 PM

### Athletic Obesity and Long-Term Health

Justin B. Ethington, *Utah Valley University, Orem, UT.*

Email: justin.ethington@hotmail.com

(No relevant relationships reported)

**PURPOSE:** Obesity in athletes is closely correlated with many comorbidities such as hypertension, dyslipidemia, osteoporosis, diabetes mellitus, left ventricular hypertrophy, and lower self-esteem; all of which can lead to decreased quality of life both during an athlete's career and after. It is the objective of this systematic review to compare the long and short-term health risks associated with athletes who are clinically overweight or obese.

**METHODS:** Studies were obtained using online databases such as PubMed, Google Scholar, and Scopus. Search terms included obese, obesity, athletes, body composition, health risk, anthropometry, adult, American Football, rugby, professional, athletes, BMI, female, women, overweight, BF%, body image, sumo wrestling, unhealthy, left ventricular hypertrophy, health, retired, and NFL. To be included in this review, articles needed to meet a list quality assessment.

**RESULTS:** Active collegiate and professional level athletes, regardless of their BMI, are shown to have healthier BF% than those of comparable BMI. These findings are consistent with linemen, rugby players, and lightweight sumo wrestlers. However, when comparing football players and non-athletes of comparable BMI it was concluded that linemen had an even greater risk for developing CVD and metabolic syndrome (metsyn) than non-athletes. Little information could be found on the effects of obesity among female athletes. Retired Athletes who were obese due to the nature of their professional sport and maintained obesity status were more likely to have

sustained cognitive impairment during their career and cardiovascular diseases (CVD). Furthermore, a significant increase in mortality due to CVD has been directly linked to athletes who retire from a career in professional football.

**CONCLUSIONS:** In conclusion, athletes that compete at a high level generally have a healthier body fat percentage (BF%) and cholesterol vitals than comparable non-athletic populations. However, due to their excessive amount of muscle mass, these athletes are susceptible to high BP and other cardiovascular risks putting them at greater risk for LVH. This is consistent with observations that athletes who maintain high BMI after their career will develop and sustain cardiovascular-related diseases and other severe health risks.

**1529** Board #291 May 30 10:30 AM - 12:00 PM

### Mechanical Assistance During Unloaded Pedaling Improves the Dynamic Range of the Metabolic Response in Obesity

Tolulope Popoola<sup>1</sup>, William Stringer<sup>1</sup>, Tomohiko Kisaka<sup>2</sup>, Kathy Sietsema<sup>1</sup>. <sup>1</sup>*Los Angeles Biomedical Institute (LABIOMED) at Harbor-UCLA Medical Center, Torrance, CA.* <sup>2</sup>*Hiroshima University, Hiroshima, Japan.* (Sponsor: Harry Rossiter, PhD, FACS M)

Email: teepopoola@yahoo.com

*Reported Relationships: T. Popoola: Industry contracted research; MITSUBISHI ELECTRIC ENGINEERING Co.,LTD.*

**PURPOSE:** Obese individuals have a greater oxygen uptake (VO<sub>2</sub>) than lean individuals for a given work rate during cycling exercise due to higher resting metabolic rate and metabolic cost from lifting heavier legs against gravity. This can result in the majority of the total increase in VO<sub>2</sub> occurring early in the exercise test, resulting in short test duration and obscuring the gas exchange details. We hypothesized that mechanical assistance of pedaling early in exercise could reduce the initial increase in VO<sub>2</sub> of obese subjects, and increase the VO<sub>2</sub> range.

**METHODS:** 20 obese (O, BMI 40.2 ± 6.1 kg/m<sup>2</sup>) and 10 lean otherwise normal subjects (L, BMI 24.9 ± 2.2) were tested. Subjects performed 2 symptom-limited ramp incremental tests on a cycle ergometer capable of providing variable degrees of mechanical assistance to pedaling (Ergo-strength, Mitsubishi Electrical Engineering, Osaka, Japan). Ventilation and pulmonary gas exchange were measured breath by breath (Vyair, Yorba Linda, California). During warm up, in random order, the subjects performed either unmodified cycling (UM) or mechanical assistance (MC) to pedaling. After warm up, each subject performed a progressively increasing test to exhaustion.

**RESULTS:** The MC protocol resulted in a lower initial VO<sub>2</sub> compared to UM in 19 of 20 O subjects and 8 of 10 L subjects, with average differences of 165 +/- 125 ml/min (p < 0.00001) and 101 ml/min +/- 94 (p < 0.008) for O and L, respectively, by paired T-tests. Peak VO<sub>2</sub> did not differ systematically within subjects by protocols (p=NS).

All Values L/min except DVO2/DWR: ml/min/W	VO <sub>2</sub> atRest	Warm Up UM	Warm Up MC	DVO2/DWR UM	DVO2/DWR MC	Peak VO <sub>2</sub> UM	Peak VO <sub>2</sub> MC
Obese	0.352±0.07	0.706±0.20	0.541±0.17	10.3±1.4	11.2±1.1	2.006±0.56	1.974±0.56
Lean	0.290±0.05	0.501±0.01	0.400±0.08	9.3±1.7	9.64±1.5	2.897±0.92	2.267±0.66

**CONCLUSIONS:** Mechanical assisted cycling during the initial phase of an incremental exercise test was effective in modulating the initial increase in VO<sub>2</sub> with unloaded cycling, and increases the VO<sub>2</sub> testing range in obese and normal weight subjects. This may be a significant proportion of the entire response in a patient with exercise limitation, and therefore useful in exercise testing and training. Funding: MITSUBISHI ELECTRIC ENGINEERING Co.,LTD.

**C-47 Free Communication/Poster - Pulmonary/Respiratory**

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

**1530 Board #292 May 30 10:30 AM - 12:00 PM  
Using Rhythmic Auditory Stimulation to Increase Cadence in Individuals with Chronic Obstructive Pulmonary Disease**

Alison Hernandez<sup>1</sup>, Eileen Collins<sup>2</sup>, David X. Marquez, FACSM<sup>2</sup>, Alana Steffen<sup>2</sup>, Cynthia Fritsch<sup>2</sup>, Laurretta T. Quinn<sup>2</sup>, Ulf Bronas<sup>2</sup>, <sup>1</sup>Northwestern University, Chicago, IL. <sup>2</sup>University of Illinois at Chicago, Chicago, IL.  
Email: alison.hernandez@northwestern.edu  
(No relevant relationships reported)

Rhythmic Auditory Stimulation (RAS) uses the physiologic effects of auditory rhythm to facilitate movements that are inherently rhythmic, such as walking. There is a strong sensorimotor connection between the brain and the motor system while walking to rhythmic cues that occurs without cognitive learning efforts.

**PURPOSE:** To determine if cadence and Six-Minute Walk Distance (6MWD) are increased while walking to RAS-tempo enhanced music as compared to walking to music-without tempo enhancement (MC) or no-music (NM) in individuals with Chronic Obstructive Pulmonary Disease (COPD). **METHODS:** Three 6-Minute Walk Tests (6MWT) were completed in random order under three conditions (RAS, MC, NM). Tempo for the MC walk was matched to the patient's usual cadence, which was determined by a one-minute manual step count. Cadence was measured manually for 60-seconds between minutes 1-2, 3-4, and 5-6 for all 6MWT conditions. The tempo of the music for the RAS walk was increased 5-10 beats per minute higher than usual cadence. **RESULTS:** Twenty-five older adults (age=71±5yr) with moderate to severe COPD (47±15.0% FEV<sub>1</sub> % predicted), with 56±27 years of smoking were enrolled. The mean usual cadence was 103±8 steps/min in one minute. When comparing RAS to NM, cadence was consistently significant at all minute intervals 1-2 (110vs105), 3-4 (110vs107), and 5-6 (110vs107) respectively. When comparing cadence of NM to MC, and RAS to MC no consistent significant increases were found. Participants matched their cadence to the elevated tempo of the RAS music during the entire 6MWT (110 ± 12 steps). Individuals walked 12m further during the 6MWT with RAS (463 ± 72 m) when compared to NM (451 ± 81 m); t (24) =-2.63, p=.015) or MC (451 ± 80 m); t (24) =-2.26, p=.033). **CONCLUSIONS:** Best method for prescribing cadence through music tempo in individuals with COPD has not been established. Individuals walked further and were able to match and sustain elevated cadence during the RAS walking condition. This observation may support the premise that beat perception mechanisms can be neurologically entrained. RAS music may be a useful tool in pulmonary rehabilitation to increase walking distance in individuals with COPD. Supported by RR&D, Veterans Administration

**1531 Board #293 May 30 10:30 AM - 12:00 PM  
Ventilatory Efficiency Among Patients With Pulmonary Hypertension With Varying Levels Of Adaptation To Exercise Training**

Zoe Morris<sup>1</sup>, Lisa Chin<sup>2</sup>, Leighton Chan<sup>2</sup>, Randall Keyser, FACSM<sup>1</sup>. <sup>1</sup>George Mason University, Fairfax, VA. <sup>2</sup>National Institutes of Health, Bethesda, MD.  
(No relevant relationships reported)

The 6-minute walk test (6MWT) is universally accepted as a measure of functional capacity in patients with pulmonary hypertension (PH). While aerobic exercise training (AET) has generally been shown to improve exercise tolerance and 6MWT distance in patients with PH, some patients have been observed to adapt differently to AET, with minimal or even negative changes in 6MWT distance being reported. Differences in patient characteristics and peak ventilatory efficiency to AET have not been characterized and compared in these subset of patients. **Purpose:** To determine differences in ventilatory efficiency, defined as peak ventilatory equivalents for O<sub>2</sub> uptake (VE/VO<sub>2</sub>), peak ventilatory equivalents for CO<sub>2</sub> output (VE/VCO<sub>2</sub>), end-tidal CO<sub>2</sub> (PETCO<sub>2</sub>) and tidal volume (TV), in patients with high (HI, >42 meters), low (LI, 0-42 meters) and negative (NEG, <0 meters) change in 6MWT distance after AET. **Methods:** Subjects were 25 females (age 54±11 years; BMI 31±7 kg/m<sup>2</sup>) enrolled in the NIH Exercise Therapy for Advanced Lung Disease Trial. Participants completed 24-30 supervised treadmill walking exercise sessions, over 10 consecutive weeks, at a training intensity of 70% to 80% of heart rate reserve. The thrice-weekly sessions were 30-45 minutes in duration. A cardiopulmonary exercise test and 6MWT was completed before and after the 10-weeks of training. Ten of the 25 subjects were classified as HI (range = 47-143 meters), 11 were classified as LI (range = 4 - 37 meters) and 4 were classified as NEG (range = -17-53 meters). **Results:** After AET, peak values in VE/VO<sub>2</sub>

(p=0.02), VE/VCO<sub>2</sub> (p=0.002), PETCO<sub>2</sub> (p=0.016) and TV (p=0.016) were improved for the HI versus NEG group. Peak values for VE/VO<sub>2</sub> (p=0.003) and TV (p=0.041) were improved for the LI versus NEG group. **Conclusion:** Previous studies suggest that reduced ventilatory efficiency (VE/VCO<sub>2</sub>) is associated with a poor prognostic outcome in patients with PH. To our knowledge this is the first study to look at changes in ventilatory efficiency after AET, specifically in HI, LI and NEG subsets. Findings from this study suggest that reduced ventilatory efficiency may also contribute to reduced functional capacity in patients with PH, contributing to the etiological basis for the association between 6MWD and mortality in these patients. Funding NIH IRP [1 Z01 CL060068-05 CC].

**1532 Board #294 May 30 10:30 AM - 12:00 PM  
Is The EVH Test Best For Diagnosing Exercise Induced Bronchoconstriction In Swimmers?**

Michael G. Leahy, Caitlin M. Geary, Michael S. Koehle, Donald C. McKenzie, James Brotherhood, Carli M. Peters, Andrew W. Sheel, FACSM. University of British Columbia, Vancouver, BC, Canada. (Sponsor: Dr. Andrew William Sheel, FACSM)  
Email: mick.leahy@ubc.ca  
(No relevant relationships reported)

Competitive swimmers have high rates of exercise induced bronchoconstriction (EIB), which may be associated with repeated exposure to chlorinated pool water. The eucapnic voluntary hyperpnea (EVH) test is often used in a laboratory setting to provoke a reduction in lung function associated with EIB. However, swimmers experience EIB symptoms in warm, humid and chlorinated environments. The relationship between EVH testing environment and the development of EIB from swim exercise is unclear.

**PURPOSE:** To compare the provoking effects of inspired air and high-intensity exercise in inducing EIB in swimmers to laboratory-based EVH methods. **METHODS:** 15 collegiate swimmers (n=5 male, n=10 female; 21±2 years) completed three days of testing in random order. On day one, subjects performed an EVH test in a laboratory (EVH-L). On a separate day, swimmers performed a modified EVH test, while breathing chlorinated pool air (EVH-Cl). On a third day subjects completed a swimming challenge, performing consecutive 200 and 400 m freestyle efforts at 85 % of their season's best time (Average achieved 200 and 400 m time; 2:18.52±7.79 and 4:55.22±20.38, respectively) and age predicted heart rate maximum. Lung function was measured at baseline, as well as 3, 5, 10, 15, and 20 minutes following EVH testing and swim exercise. **RESULTS:** Greatest achieved fall index of forced expired volume in one second (FEV<sub>1</sub>) was significantly different between all three methods (p<0.05). EVH-L elicited a -9.7±6.4 % fall compared to the EVH-Cl test, -6.6±9.2 % (p>0.05) and swim effort, -3.0±7.5 % (p<0.05). A greater Pearson's correlation in FEV<sub>1</sub> fall index between EVH-L vs. EVH-Cl (r=0.78, p<0.05) was seen compared to EVH-L vs. Swimming (r=0.20, p>0.05) and EVH-Cl vs. Swimming (r=0.50, p>0.05). A greater reduction in forced expired flow between 25 and 75 % lung volume (FEF<sub>25-75</sub>) was induced by the EVH-L (-16.6±8.7 %) compared to the EVH-Cl (-8.2±14.9 %) (p>0.05) and swimming test (-1.3±15.6 %) (p<0.05).

**CONCLUSION:** The EVH-L elicits a greater bronchoconstrictive response, compared to EVH-Cl and swimming. There is little relationship in reduction of lung function between the EVH-L test and swimming.

Funding: Natural Sciences and Engineering Research Council of Canada

**1533 Board #295 May 30 10:30 AM - 12:00 PM  
Red Blood Cell Deformability is an Independent Predictor of Exertional Dyspnea in Deployed Veterans**

Duncan S. Ndirangu, Michael R. Condon, Jacquelyn C. Klein-Adams, Thomas Alexander, Steven D. Greer, Michael J. Falvo. Department of Veterans Affairs New Jersey Health Care System, East Orange, NJ.  
Email: Duncan.ndirangu@va.gov  
(No relevant relationships reported)

**PURPOSE:**

Respiratory symptoms on exertion that are disproportionate to cardiopulmonary function represent a challenging clinical scenario that has been increasing in frequency among Iraq and Afghanistan veterans following their deployment. Among their exposures were burning trash, dust, sand, and air pollution. We hypothesized that impairment in oxygen delivery, due to impaired red blood cell (RBC) deformability, may contribute to reports of dyspnea in this population.

**METHODS:**

We recruited 18 symptomatic Iraq and Afghanistan veterans (34.1±7.0 yrs; 2 female) and 13 asymptomatic controls (n = 13; 34.1±8.9 yrs; 3 female) to participate in this study. All participants completed spirometry and maximal cardiopulmonary exercise testing. Blood samples were obtained before and immediately post-exercise for the determination of RBC deformability, calculated as cell deformation at infinite stress (EI<sub>MAX</sub>), by laser diffraction analysis using an ektacytometer. Dyspnea was assessed at

peak exercise via the Borg breathlessness scale. We examined the association between  $EI_{MAX}$  (rest and peak exercise) and peak dyspnea, adjusting for age, body mass index, smoking and airway obstruction ( $FEV_1/FVC$ ).

#### RESULTS:

Demographics were similar between groups, but spirometry was reduced in veterans (veterans vs. controls;  $FEV_1$ :  $95.2 \pm 18.3$  vs.  $114.3 \pm 14.7\%$  predicted;  $FVC$ :  $101.0 \pm 13.6$  vs.  $116.0 \pm 13.3\%$  predicted;  $p < 0.01$ , Hedges'  $g = 1.11 - 1.17$ ). Peak exercise capacity was similar ( $VO_2/kg$ :  $34.9 \pm 8.9$  vs.  $36.1 \pm 10.5$  ml·kg<sup>-1</sup>·min<sup>-1</sup>), but veterans endorsed greater dyspnea ( $5.6 \pm 1.8$  vs.  $3.6 \pm 1.0$  Borg units;  $p = 0.001$ ,  $g = 1.32$ ).  $EI_{MAX}$  was similar at rest ( $0.59 \pm 0.04$  vs.  $0.57 \pm 0.02$ ;  $p = 0.08$ ,  $g = 0.67$ ), but not at peak exercise ( $0.59 \pm 0.04$  vs.  $0.56 \pm 0.03$ ,  $p = 0.01$ ,  $g = 0.83$ ). In our adjusted model, larger  $EI_{MAX}$  at rest ( $\beta = 22.8$ , 95% CI 4.7, 40.9,  $p = 0.016$ ) and immediately post-exercise ( $\beta = 19.2$ , 95% CI 3.1, 35.3,  $p = 0.016$ ) were associated with greater dyspnea at peak exercise.

#### CONCLUSION:

In our sample, increased RBC deformability measured at rest and immediately post-exercise was independently associated with exertional dyspnea. Future studies are necessary to confirm these findings and investigate mechanisms of altered RBC rheology in the contexts of dyspnea.

**Funding:** VA RR&D (1121RX001079; MJF)

### 1534 Board #296 May 30 10:30 AM - 12:00 PM Respiratory Resistance And Reactance (FOT) Classifications In Chronic Obstructive Pulmonary Disease And Healthy Control Patients.

Jesse Schwartz, Courtney Wheatley, Bruce Johnson. *Mayo Clinic, Scottsdale, AZ.*

(No relevant relationships reported)

Forced oscillation technique (FOT) is a method of measuring lung obstruction of central airways (resistance, Rrs) and elastic properties/distal airway ventilation (reactance, Xrs), which is different from spirometry since it is performed during tidal breathing, utilizing various sound frequencies (5, 11, and 19 Hz) to separate out regions of the lungs and isolates breathing cycles (inspiration and expiration). **PURPOSE:** To evaluate FOT metrics of lung mechanics and obstruction within a chronic obstructive pulmonary disease (COPD) population based upon severity (mild [MLD], moderate [MOD], and severe [SEV]). **METHODS:** Seventeen COPD, and fourteen healthy (H) patients (age:  $69.5 \pm 5.8$  vs.  $49.3 \pm 17.6$  yr.\*; height:  $169.9 \pm 11.3$  vs.  $163.7 \pm 18.1$  cm; weight:  $77.8 \pm 18.8$  vs.  $83.3 \pm 32.4$  kg, COPD vs. H respectively, \* $p < 0.05$ ) completed spirometry and FOT measurements. COPD participants completed the St. George Respiratory Questionnaire (SGRQ) and severity was classified based on GOLD spirometry (MLD, MOD, and SEV). **RESULTS:** In those with MOD&SEV COPD, total Rrs and Xrs at all frequencies, except expiratory  $R_{11}$ , were significantly different ( $p < 0.05$ ) from H, but only  $R_{19}$  was different for MLD participants.  $R_5$ :  $3.9 \pm 1.1$  v  $3.1 \pm 1.3$ ,  $5.9 \pm 2.5$ \*cmH<sub>2</sub>O/L/s;  $X_5$ :  $-1.1 \pm 0.9$ ,  $-1.4 \pm 0.6$ ,  $-4.8 \pm 3.2$ \*cmH<sub>2</sub>O/L/s;  $R_{19}$ :  $0.3 \pm 0.07$ ,  $2.4 \pm 0.9$ \*,  $3.3 \pm 1.0$ \*cmH<sub>2</sub>O/L/s;  $X_{19}$ :  $0.4 \pm 0.03$ ,  $-0.2 \pm 0.7$ ,  $-1.1 \pm 1.0$ \*cmH<sub>2</sub>O/L/s, for H, MLD, and MOD&SEV groups respectively, \* $p < 0.05$  vs. H. No significant difference ( $p > 0.05$ ) between COPD severities were shown for Rrs or Xrs at 5, 11, or 19Hz. SGRQ scores were not different based on spirometric severity (M:  $44.6 \pm 18.6$ ; MOD:  $42.9 \pm 15.2$ ; S:  $43.8 \pm 11.8$ ). **CONCLUSION:** FOT metrics made distinctions between COPD MOD&SEV and H, as well as MLD and H for mixed respiratory tract obstruction. However, no distinctions between COPD severities could be made. Obstruction increased with severity highlighting that more heterogeneous total airway obstruction (frequency dependent) is observed with mild severity patients, followed by more homogeneous obstruction as severity increased. Elastic properties and efficiency of ventilation decreased (became more negative) with increased COPD severity as airflow to and from distal airways become more limited due to hyperinflation from loss of alveolar support and elastic recoil.

### 1535 Board #297 May 30 10:30 AM - 12:00 PM Asthma and EIB Testing Among Collegiate Athletes in Indoor Winter Sports

Matthew J. Garver<sup>1</sup>, Dustin W. Davis<sup>1</sup>, Molly A. Jennings<sup>1</sup>, Taylor K. Dinyer<sup>2</sup>, Alex Rickard<sup>1</sup>, Steve Burns<sup>1</sup>, Brian J. Hughes<sup>1</sup>, Dave M. Burnett<sup>3</sup>. <sup>1</sup>University of Central Missouri, Warrensburg, MO. <sup>2</sup>University of Kentucky, Lexington, KY. <sup>3</sup>University of Kansas Medical Center, Kansas City, KS.

(Sponsor: Dr. Michael Godard, FACSM)

Email: garver@ucmo.edu

(No relevant relationships reported)

Pulmonary conditions, such as asthma and exercise-induced bronchoconstriction (EIB), influence airway diameter, and these conditions may be impacted by seasonal patterns. Systematic, team-wide screening among collegiate athletes is infrequent, and evidence shows a range of prevalence rates. **PURPOSE:** The goal of the current study was to investigate prevalence of asthma, undiagnosed asthma, and EIB in collegiate athletes practicing and performing in indoor arenas for winter sports. **METHODS:** Data collection occurred between mid- and late-fall. The testing protocol began with

baseline spirometry; athletes expired maximally and were encouraged to achieve a 6-second plateau. Values were taken in duplicate. Subjects failing to achieve a forced expiratory volume in one second ( $FEV_1$ ) at or over 70% of a predicted value were noted and removed. Athletes followed with performance of a bout of exercise intensifying to 80-90% of predicted maximal heart rate. Confirmation of appropriate exercise intensity was verified with maximal ventilation values ( $35 * FEV_1 * 0.5$  and  $35 * FEV_1 * 0.6$ ). Athletes continued at target heart rate for 4 minutes. Athletes repeated maximal spirometry efforts post-exercise at 2, 5, 10, 15, and 20 minutes. Values were reviewed by a registered respiratory therapist, and a drop in  $FEV_1 > 10\%$  from baseline was considered positive for EIB. **RESULTS:** Sixty athletes (wrestling or basketball, males=48, females=12) volunteered for testing. Four athletes confirmed previous diagnosis of asthma. Among the 56 tested, 54 obtained a minimum of 70% of predicted  $FEV_1$  at pre-test (2 wrestlers were noted and removed). Among the 54 undergoing the exercise protocol, 11 (of 54=20.4%) tested positive for EIB as they failed to maintain 90% of their pre-exercise  $FEV_1$  (mean drop  $14.2 \pm 2.3\%$ ) at one of the post-exercise time points. In 3 subjects, one from each sport, results were not conclusive. **CONCLUSIONS:** Evidence of reduced pulmonary function was present in athletes across the sports spectrum. Over 20% of the athletes exemplified undiagnosed asthma or underlying EIB, which may have been exacerbated by seasonal patterns. Awareness and systematic testing of these pulmonary conditions in collegiate athletes would support health and potentially effect performance outcomes.

### 1536 Board #298 May 30 10:30 AM - 12:00 PM Echogenicity Is Related to Skeletal Muscle Strength in Patients with Acute Respiratory Failure

Michael J. Berry, FACSM<sup>1</sup>, Daniel C. Files<sup>1</sup>, Claudia L. Campos<sup>1</sup>, Rita N. Bakhru<sup>1</sup>, Brittany M. Skaggs<sup>1</sup>, Peter E. Morris<sup>2</sup>. <sup>1</sup>Wake Forest University, Winston-Salem, NC. <sup>2</sup>University of Kentucky, Lexington, KY.

Email: berry@wfu.edu

Reported Relationships: **M.J. Berry:** Industry contracted research; Isagenix, LLC.

Patients with acute respiratory failure (ARF) show changes in skeletal muscle structure and strength. **PURPOSE:** The purpose of this study was to examine the relationship between muscle thickness (MT), echogenicity, and strength in patients with ARF. **METHODS:** Thirteen (6 females/7 males) patients with ARF participated in the study. Knee extensor (KE) strength was measured via a handheld dynamometer and quadriceps images were obtained via ultrasonography at hospital discharge. The ultrasound images were used to obtain MT and both mean and standard deviation echogenicity of the rectus femoris, vastus lateralis (VL), and vastus medialis. Partial correlations, controlling for age BMI and fluid intake, were used to describe the relationships among KE strength and echogenicity and MT. **RESULTS:** KE strength and vastus lateralis standard deviation echogenicity were significantly correlated when controlling for age, BMI and fluid intake ( $r = .69$ ,  $P = .029$ ). Mean  $\pm$  standard deviation knee extensor strength and vastus lateralis standard deviation echogenicity were  $19.1 \pm 8.0$  kg and  $19.8 \pm 5.4$  units. No other correlations between strength and ultrasound measures were found to be significant. **CONCLUSION:** These results show skeletal muscle echogenicity to be significantly correlated with skeletal muscle strength in patients with ARF. As such, it may be useful in identifying muscle weakness in these patients when they are unable or unwilling to perform voluntary strength testing.

### 1537 Board #299 May 30 10:30 AM - 12:00 PM Participation In Norseman Extreme Triathlon; The Effect On Lung Function And Oxygen Saturation

Trine Stensrud<sup>1</sup>, Maria Mathiassen<sup>2</sup>, Jørgen Melau<sup>3</sup>, Hege N. Østgård<sup>1</sup>, Jonny Hisdal<sup>4</sup>, Julie Stang<sup>1</sup>. <sup>1</sup>Norwegian School of Sport Sciences, Oslo, Norway. <sup>2</sup>Telemark Hospital Trust, Skien, Norway. <sup>3</sup>Vestfold Hospital Trust., Tønsberg, Norway. <sup>4</sup>Oslo University Hospital, HF, Oslo, Norway.

Email: trine.stensrud@nih.no

(No relevant relationships reported)

**PURPOSE:** Primary: To examine changes in lung function, forced expiratory volume in one second ( $FEV_1$ ) and forced vital capacity (FVC), and oxygen saturation ( $SpO_2$ ) from before to after participation in Norseman extreme triathlon, consisting of 3.8 km open water swim, 180 km cycling and 42 km running. Secondary: To assess possible relationships between the physiological variables and respiratory symptoms and training volume. **METHODS:** In a quasi-experimental non-controlled study, 57 recreational triathletes (45 males and 12 females) aged 40.3 (9.0) years (mean (SD)) measured lung function by maximal expiratory flow volume loops ( $FEV_1$  and FVC) and  $SpO_2$  by pulse oximetry the day before the race, 8-10 minutes after finishing the race and the day after the race. Weekly training volume and respiratory symptoms were recorded with a modified AQUA-questionnaire at baseline. Anova for repeated measures was used to test for differences in lung function and  $SpO_2$  and statistical significance was accepted at 0.05 level. The study was approved by the Regional Ethical Committee.

**RESULTS:** Twenty-six participants (46%) developed exercise-induced bronchoconstriction (EIB) defined as  $\geq 10\%$  reduction in FEV<sub>1</sub> from baseline immediately after the race and 16 participants (28%) had still EIB the day after the race. FVC and FEV<sub>1</sub> were significantly reduced immediately after the race (mean: 8.9% and 11.8% respectively) and the day after the race (mean: 6.2% and 7.5% respectively). Thirty-five participants (61%) developed mild to moderate exercise induced arterial hypoxemia (EIAH) defined as  $\geq 4\%$  reduction in SpO<sub>2</sub> from baseline. Further, oxygen saturation was significantly reduced immediately after the race (mean: 4.6%) and the day after the race (mean: 2.4%), respectively. There were no significant correlation between changes in lung function and SpO<sub>2</sub>, respiratory symptoms or training volume ( $p > 0.05$ ). **CONCLUSIONS:** Our results demonstrated that 46% of the participants developed EIB and 61% developed EIAH after Norseman extreme triathlon. The reduction in lung function may be due to fatigue in the respiratory muscles. Further investigation is needed to confirm our results as well as examine the mechanisms in age group triathletes.

#### C-48 Exercise is Medicine®/Poster - EIM - Cancer, Diabetes, Metabolic Syndrome, Obesity

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

1538 Board #300 May 30 10:30 AM - 12:00 PM

#### Resistance-training Induced Regional Body Composition Changes In Females With Obesity Vs. Normal Weight Obesity

Bharath S. Selvaraj<sup>1</sup>, Cory Mahan<sup>1</sup>, Shelby Kloiber<sup>2</sup>, Amy Givan<sup>1</sup>, Mackenzie Clemments<sup>1</sup>, Dominic Sanguinette<sup>1</sup>, Eneko Larumbe-Zabala<sup>3</sup>, Maria Fernandez-del-Valle<sup>1</sup>. <sup>1</sup>Southern Illinois University at Edwardsville, Edwardsville, IL. <sup>2</sup>Texas Tech University, Lubbock, TX. <sup>3</sup>Texas Tech University Health Science Center, Lubbock, TX.  
Email: bselvar@siue.edu

(No relevant relationships reported)

Title: Resistance-training induced regional body composition changes in females with obesity vs. normal weight obesity

Selvaraj, BS, Mahan, C., Kloiber, S., Givan, A., Clemments, M., Sanguinette, D., Larumbe-Zabala, E., Fernandez-del-Valle M.

**Purpose:** The aim of this study was to compare the effects of resistance training on regional body composition and fat loss, including upper and lower limbs and trunk, in females with obesity and normal weight obesity (NWO).

**Methods:** A total of 12 young females with obesity (BMI: 34.1±3.3; percentage body fat [%BF]: 49.2±2.9) and 15 with NWO (BMI: 22.2±1.8; %BF: 35.1±4.5) were randomized into control (obesity n=6, NWO n=8) and resistance training (obesity n=6, NWO n=7). Dual-energy X-ray absorptiometry (DXA) and a maximal strength test were performed before and after a 3-week intervention. Percent change (%Δ) of left and right trunk, arms, legs (LTfat, RTfat, LAfat, RAfat, LLfat and RLfat, respectively) and body fat were recorded. Training consisted of 3 sessions/week for 3 weeks, and 3 sets of 10 repetitions including 7 exercises that targeted major muscle groups. Participants were trained at 80% of their 1-repetition maximum.

**Results:** Non-parametric tests showed a statistically significant difference in %ΔLTfat (-1.05±3.99%,  $p=0.032$ ) and a trend in %ΔBF (-1.73±1.93%,  $P=0.056$ ) in the resistance training obesity group when compared to control. No statistically significant changes were found in NWO group.

**Conclusion:** Resistance training has shown to induce significant changes in the obesity group by reducing LTfat content. However, no changes were detected in the NWO group. Future research should include larger sample size to facilitate the detection of regional body composition changes and to help understand the differential impact of resistance training in women with obesity and NWO.

1539 Board #301 May 30 10:30 AM - 12:00 PM  
**Selective Effectiveness Of 10wk-exercise Protocols On Mets Reduction**

Roberto C. Burini, FACSM<sup>1</sup>, Mariana S. Nakagaki<sup>2</sup>, Hugo T. Kano<sup>1</sup>. <sup>1</sup>São Paulo State University (UNESP), Botucatu, Brazil. <sup>2</sup>Londrina State University, Londrina, Brazil.  
Email: burini@fmb.unesp.br

(No relevant relationships reported)

MetS is recognized as a pervasive condition whose abnormalities result from a mismatch between contemporary environment and our ancient tailored genome. Hence, diet and physical exercise are considered the pillars in the implementation of effective strategies against MetS.

**PURPOSE:** The responses of MetS subjects to different types of physical exercises was investigated in a dynamic cohort study ("Move for Health" program) based on spontaneous demand for healthy lifestyle with supervised exercises and dietary counseling.

**METHODS:** Demographic, socio-economic and physical activity was recorded from IPAQ (version 8) and, dietary quality (HEI) and food intake, from a 24h questionnaire recall. Anthropometry and fast-blood analysis were used for MetS diagnosis (NCEP-ATP III). After clinical selection and baseline assessments they were spontaneously assigned to structured protocols involving supervised exercises of strength (Pac, n=43) isolated or combined with endurance (walking) exercises (PMi, n=146), hydro-gymnastics (PHy, n=50) and treadmill high-intensity exercises (PHit, n=63), applied during 10 weeks. Nutritional counseling was conducted weekly. Protocols were compared statistically using SAS vs 9.3 for  $p=0.05$ .

**RESULTS:** Sample of 55.5 ± 108 yrs old (n=302), predominantly female (88%), presented adequate physical activity (91%), cardio-respiratory fitness (63%) and strength (78%), referring themselves as in good health (67.8%). At baseline, groups were similar in anthropometry, fitness and MetS (averaging 48.7%). Altered components of MetS ranked from waist circumference (72.9%) to triglycerides (37.9%). After 10-wk of exercises, increased aerobic capacity was found in all groups and, strength only in Pac and PMi. MetS reduction averaged 16.9%, mainly and significantly in PHy (25.4%) and PMi (12.7%). Among the MetS components, a major decreasing to exercise protocols was found in hyperglycemia (20.6%) and hypertension (15.9%).

**CONCLUSIONS:** The reduction of MetS occurred in different types of physical exercises with higher responsiveness in PHy and PMi having hyperglycemia and hypertension as its most responsive components. Support CNPq and CAPES.

1540 Board #302 May 30 10:30 AM - 12:00 PM

#### Reason To Exercise In Diabetic Populations: Use Of Rapid-acting Insulin Predicts Falls In At-risk Patients

Saejel G. Mohan<sup>1</sup>, Tina Bhateja<sup>1</sup>, Kathy L. Leslie<sup>1</sup>, J. Mark VanNess<sup>1</sup>, Jonathan M. Saxe<sup>2</sup>, Lewis E. Jacobson<sup>2</sup>, Courtney D. Jensen<sup>1</sup>. <sup>1</sup>University of the Pacific, Stockton, CA. <sup>2</sup>St. Vincent Hospital, Indianapolis, IN.

(No relevant relationships reported)

Diabetes is present in 9.4% of American adults. Insulin is used in Type 1 and Type 2 cases, but without lifestyle change, it can hasten the progression of the disease. Limited data supports an association between diabetes and fall risk in older adults, with greater risk found among insulin-treated patients. Little is known about different insulin classes.

**PURPOSE:** To evaluate the effect of insulin classes on incidence of falls in older adults.

**METHODS:** We conducted retrospective and prospective analyses of 615 hospital patients age  $\geq 65$  years who sustained a fall in 2015. Data was extracted from their first fall-related admission that year, including demographic reports, health history, injury characteristics, relevant diagnoses, and home medications. We exported the number of previous falls since 2010 and used logistic and Poisson regressions to test the effect of insulin on the odds of experiencing falls and the total number experienced. We then tracked patients forward until August 2016 and tested the effect of insulin on return visits for new fall-related admissions.

**RESULTS:** Patients were 80.0±9.1 years old, 6.2% used long-acting insulin, 0.5% used intermediate insulin, and 4.2% used rapid-acting insulin. They were admitted 1.9±1.3 times previously and had 0.5±0.9 return visits. There was no relationship with intermediate insulin and the number of previous ( $P=0.223$ ) or future ( $P=0.383$ ) falls. Long-acting insulin associated with modest increases in the number of previous ( $P=0.053$ ) and return ( $P=0.050$ ) falls. Rapid-acting insulin significantly predicted both. Controlling for weather, age, balance, and cognitive condition, patients using rapid-acting insulin had a 4.2-fold increase in the odds of sustaining multiple previous falls ( $P=0.002$ ; 95% CI of odds ratio=1.68-10.54), a 37.2% increase in the number of previous visits ( $P=0.012$ ; 95% CI of IRR: 1.07-1.76), a 2.4-fold increase in the odds of readmission ( $P=0.033$ ; 95% CI of odds ratio: 1.07-5.50), and a 64.3% increase in the number of return visits ( $P=0.026$ ; 95% CI of IRR: 1.06-2.54).

**CONCLUSIONS:** Diabetics taking rapid-acting insulin express an elevated risk of falls. Exercise may serve two functions in this population: it can mitigate the acute and chronic effects of diabetes via non-insulin dependent glucose uptake, and it can protect against fall risk.

**1541** Board #303 May 30 10:30 AM - 12:00 PM  
**The Effects of Traditional Chinese Exercise on Sugar Metabolism And Physical Fitness**

Mian Jia<sup>1</sup>, Jing Li<sup>2</sup>, Zhengzhen Wang, FACSM<sup>3</sup>, Tongtong Gao<sup>2</sup>.  
<sup>1</sup>World Federation of Chinese Medicine Societies, Beijing, China. <sup>2</sup>Dongzhimen Hospital of Beijing University of Chinese Medicine, Beijing, China. <sup>3</sup>Beijing Sport University, Beijing, China.  
 Email: cathie0501084@163.com  
 (No relevant relationships reported)

**Purpose:** Exercise therapy of traditional Chinese medicine (TCM) has a long history in treating diabetes. Few evidence to date have shown its effects on the glucose metabolism and muscle fitness. We evaluated the effects of TCM exercise therapy and sedentary lifestyle on sugar metabolism and physical fitness in both female individuals with prediabetes and type II diabetes mellitus (T2DM).

**Methods:** Thirty-three diabetic subjects and 33 prediabetic subjects were randomly divided into the exercise therapy group (diabetic: ED, prediabetic: EP) or sedentary group (diabetic: CD, prediabetic: CP) as a 2:1 ratio. ED and EP groups were given the same traditional exercise for moderate intensity, 50min, 3 times a week. Hemoglobin a1c (HbA1c), fasting insulin, oral glucose tolerance test (OGTT), peak oxygen uptake ( $VO_{2peak}$ ), grip strength, back strength, and sit-ups (muscle endurance) were taken at the pro and post of 12-week-exercise. Responses were compared between prediabetes and diabetes.

**Results:** Compared with CP and CD group, HbA1c decreased by 0.156 mmol/L ( $P < 0.05$ ) and 0.45 mmol/L ( $P < 0.01$ ) with EP and ED, respectively. Fasting insulin decreased by 4.61 cycles U/mL in EP group, and 13 of them returned to normal blood glucose, both fasting and postprandial ones, according to the OGTT test. The  $VO_{2peak}$ , muscle strength and endurance of the diabetic groups were significantly lower than those of the prediabetic groups ( $P < 0.001$ ).  $VO_{2peak}$  of the exercise groups increased significantly (EP: +6.55%, ED: +33.43%,  $P < 0.001$ ). Muscle fitness improvements were significant ( $P < 0.05$ ) on the grip strength (ED: +1.75kg, CD: -0.44kg), back strength (ED: +8.47kg, CD: -0.27kg), and sit-ups (ED: 3.50 more, CD: 0.18 less) in diabetic groups but not obvious in prediabetic groups.

**Conclusions:** The  $VO_{2peak}$  and muscle fitness of diabetic patients were significantly lower than that of prediabetes. TCM exercise therapy can improve sugar metabolism and physical fitness, which is safe and effective. The same traditional exercise is better for diabetes than prediabetes.

Supported by: JDZX2015136 and GASC2014B007.

**1542** Board #304 May 30 10:30 AM - 12:00 PM  
**Combined Metformin and Exercise Treatment Improves Glucose Control and Insulin Sensitivity in Type-2 Diabetes Patients.**

Juan F. Ortega, Miguel Ramirez-Jimenez, Felix Morales-Palomo, Ricardo Mora-Rodriguez. *University of Castilla-La Mancha, Toledo, Spain.*  
 Email: juanfernando.ortega@uclm.es  
 (No relevant relationships reported)

**BACKGROUND:** The antidiabetic medicine, Metformin, and exercise are cornerstones in the treatment of type-2 diabetes. However, there is conflicting evidence about the benefits of combining both interventions. **PURPOSE:** To compare free-living ambulatory glycemic control and insulin sensitivity among the separated and combined effects of metformin and exercise.

**METHODS:** Twelve middle-aged ( $55.5 \pm 1.4$  years) adults, diagnosed with type-2 diabetes and obesity ( $BMI 32.0 \pm 1.2$  kg/m<sup>2</sup>) undergoing pharmacological treatment with metformin (>3 yrs.) participated in the study. All participants underwent 4 trials in a randomized order: i) taking their habitual doses of metformin (MET), ii) after 48-hours of metformin withdrawal, which was replaced by two (43 min) daily bouts of high-intensity interval training (EX), iii) combining medicine and exercise (MET+EX), and iv) a Control trial withdrawing from metformin (48-hours) and exercise (CONT). Ambulatory glycemic control was inferred from interstitial fluid glucose concentration (IFG), which was frequently monitored during 72 h (FreeStyle Libre, Abbott, USA) in each experimental condition. In addition, after an overnight fasting, a blood sample was collected 24 h after each experimental condition for the assessment of glucose and insulin concentration and subsequent calculation of insulin sensitivity (i.e., HOMA-IR). **RESULTS:** During the 72 hours of IFG monitoring an average of 109 + 11 readings per trial were obtained (i.e., 1.5 readings per hour). IFG in EX ( $7.3 \pm 1.9$  mmol/L) was similar than CON ( $7.3 \pm 1.9$  mmol/L;  $P=0.604$ ). However, in MET ( $6.9 \pm 1.6$  mmol/L) and MET+EX ( $6.6 \pm 1.3$  mmol/L) IFG was significantly lower than CONT ( $P < 0.001$  and  $P=0.05$ , respectively). IFG peaks (i.e., IFG > 11.1 mmol/L) were more frequent in CONT than in the rest of the trials. However, IFG peaks frequency was lower in MET+EX than in MET ( $P=0.025$ ) and EX ( $P=0.030$ ). Finally, insulin resistance (i.e., HOMA-IR) was lower than CONT in MET+EX ( $P=0.031$ ) and in MET ( $P=0.001$ ) but not in EX alone. **CONCLUSIONS:** The combination of metformin and exercise reduces the occurrence of IFG peaks thus improving glucose control in

a sample of type-2 diabetic individuals in a free-living situation. Monitoring of IFG seems adequate to track the effects of both, exercise and pharmacological treatment (metformin).

**1543** Board #305 May 30 10:30 AM - 12:00 PM  
**A Review Of Intervention Of Baduanjin For Diabetes And Complications**

Shuxin Wu, Xiaohui Yang, Lu Sun, Hongfeng Sun, Shuli Cheng.  
*Dongfang Hospital Affiliated to Beijing University of Chinese Medicine, Beijing, China.*  
 Email: 15120039753@163.com  
 (No relevant relationships reported)

**PURPOSE:** The traditional Chinese guidance technique--fitness qigong · Baduanjin exercise, which means the eight-section brocade exercise in English, has the functions of body building. It is widely used in diabetic patients as exercise therapy, we systematically reviewed the history and role of Baduanjin exercise applied to diabetes and its complications.

**METHODS:** The source and historical evolution of Baduanjin exercise were systematically analyzed based on ancient Chinese literature. Health benefits of Baduanjin exercise intervention in diabetes and its complications were summarized based on clinical research literature.

**RESULTS:** (1) The development of Baduanjin exercise went through five periods:

① The guidance technique in ancient times about 2000 BC was its origin; ② The Northern Song Dynasty from 960 to 1127 AD was the formation period of movements; ③ It became popular in the Southern Song Dynasty from 1127 to 1279 AD and was first recorded in the book "Yijianzhi". And it became mature from the Southern Song Dynasty to Yuan Dynasty of 1280; ④ It was widely spread and promoted in the Ming and Qing Dynasties from 1368 to 1912; ⑤ After the foundation of the People's Republic of China in modern times, a lot of books in regard to Baduanjin exercise were published. The fitness qigong management center of General Administration of Sport of China organized the compilation and creation of the exercise, which was named "fitness qigong · Baduanjin exercise". The nationwide fitness program was carried out actively and the exercise was promoted around the world. (2) After practicing Baduanjin exercise for 3-6 months, FBG and HbA1C can be significantly reduced. BP, TG and blood lipid levels such as LDL-C, HDL-C can be adjusted. The SNCV and MNCV can be enhanced. Psychological index scores such as HAMD, SDS, SAS, DSQ and so on of diabetes patients with depression or anxiety can be improved. **CONCLUSIONS:** The development of Baduanjin exercise went through five stages. As an exercise therapy, it can improve glucose and lipid metabolism and diabetic neuropathy. The level of mental health can be enhanced. Therefore, it deserves to be widely promoted and co-developed internationally to gain more benefits. Fund support: The Technology Research Project of the fitness qigong center of General Administration of Sport of China (QG2017038)

**1544** Board #306 May 30 10:30 AM - 12:00 PM  
**Relationships Between Exercise Level, Beliefs About Exercise, And Exercise Promotion Among Cardiologists And Oncologists**

Heather Leach<sup>1</sup>, Kelli LeBreton<sup>1</sup>, Barry Braun, FACSM<sup>1</sup>, Steven Schuster<sup>2</sup>, Patrick Green<sup>2</sup>. <sup>1</sup>Colorado State University, Fort Collins, CO. <sup>2</sup>University of Colorado Health, Aurora, CO.  
 (Sponsor: Barry Braun, FACSM)  
 Email: heather.leach@colostate.edu  
 (No relevant relationships reported)

**PURPOSE:** This study examined the relationships between cardiologists' and oncologists' exercise levels, beliefs about exercise for their patients, and frequency of discussing or recommending exercise.

**METHODS:** A survey was distributed to oncologists and cardiologists via Qualtrics. Questions and responses were: (1) "I believe exercise is safe for most of my patients, most of patients are capable of exercise, exercise is effective for improving my patients' well-being, and exercise can reduce likelihood of disease recurrence, or increase chances of survival in my patients (strongly disagree to strongly agree), (2) "How often do you discuss exercise with your patients?" (none/few, some, most/all visits), (3) "What percent of patients have you recommended should exercise in the past month?" (none/few, some, most/all), and (4) "How do you provide information about exercise?" (referral as a yes/no option). Self-reported exercise was categorized at meeting exercise guidelines or not. Fisher's Exact (FE) tests with Cramer's V were used to compare the proportion of responses in each category between questions. **RESULTS:** Out of 154 surveys distributed, 58 (n=25 cardiologists, n=33 oncologists) were returned (37.7% response rate). Respondents were  $M=45.7 \pm 11.3$  years old and 63.6% male. Those who agreed (vs. neutral/disagreed) with "...exercise can reduce likelihood of disease recurrence or increase survival..." were more likely to refer patients to an exercise program ( $FE=5.588$ ,  $p=.040$ ,  $V=.324$ ). Cardiologists who agreed with the same statement were more likely to discuss exercise at most/all patient

visits ( $FE=9.351$ ,  $p=.027$ ,  $V=.514$ ). More than half (58.6%) reported meeting exercise guidelines, and there were no differences in beliefs about exercise for patients between those meeting vs. not meeting guidelines.

**CONCLUSION:** Cardiologists and oncologists who believe exercise can reduce the likelihood of disease recurrence or improve survival for their patients, may be more likely to discuss exercise or refer patients to an exercise program. Beliefs about exercise did not differ by exercise level. These findings suggest that cardiologists' and oncologists' beliefs about the benefits of exercise for improving disease outcomes may be a viable path to increase exercise promotion.

**1545** Board #307 May 30 10:30 AM - 12:00 PM

**Effects of Exercise on Sexual Function in Men with Advanced Prostate Cancer.**

Ciaran Fairman<sup>1</sup>, Dennis R. Taaffe, FACSM<sup>1</sup>, Robert U. Newton<sup>1</sup>, Suzanne Chambers<sup>1</sup>, Nigel Spry<sup>2</sup>, David Joseph<sup>3</sup>, Daniel A. Galvão, FACSM<sup>1</sup>. <sup>1</sup>Edith Cowan University, West Perth, Australia. <sup>2</sup>Genesis Cancer Care, West Perth, Australia. (Sponsor: Daniel Galvão, FACSM)  
Email: c.fairman@ecu.edu.au

(No relevant relationships reported)

Normal 0 false false EN-US JA X-NONE /\* Style Definitions \*/ table.MsoNormalTable {mso-style-name:"Table Normal"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshadow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:12.0pt; font-family:"Calibri", sans-serif; mso-ascii-font-family:Calibri; mso-ascii-theme-font:minor-latin; mso-hansi-font-family:Calibri; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi;} **PURPOSE:** To report the effects of a 12-week modular multimodal exercise program (M3EP) comprising of resistance, aerobic and flexibility training on sexual health and function in men with advanced prostate cancer. **METHODS:** Prostate cancer patients (70.0 ± 8.4 yr; body mass index 28.7 ± 4.0 kg·m<sup>-2</sup>) with bone metastases (rib/thoracic spine, 66.7%; lumbar spine, 43.9%; pelvis, 75.4%; femur, 40.4%; humerus, 24.6%; other sites, 70.2%) were randomly assigned to a supervised exercise program (3 days/week) comprising resistance, aerobic and flexibility exercises (EX; n=28) or usual care (UC; n= 29) for 12-weeks. Outcome measures of sexual health and function (International Index of Erectile Function (IIEF), the Expanded Prostate Cancer Index Composite (EPIC) and the EORTC-PR25 were assessed at baseline and 12-weeks. **RESULTS:** After adjusting for baseline values, there were no differences between groups for any of the measures of sexual function and activity,  $p>0.05$ . Additionally, there were no differences between groups for urinary and bowel function as assessed by the EORTC-PR25 ( $p>0.05$ ). **CONCLUSIONS:** A M3EP program does not improve indices of sexual health and function in men with advanced prostate cancer. <!--EndFragment-->

**1546** Board #308 May 30 10:30 AM - 12:00 PM

**Baduanjin's Impact on Quality of Life and Sleep Quality in Breast Cancer Survivors Receiving: An Intervention Study**

XIAOHUI HOU. GUANGZHOU SPORT UNIVERSITY, GUANGZHOU, China.  
Email: lilyhxx@163.com

(No relevant relationships reported)

**Purpose**

To investigate the impact of Baduanjin, a traditional Chinese exercise intervention, on quality of life and sleep quality in breast cancer survivors receiving aromatase inhibitors.

**Patients and Methods**

A 3-month intervention study was conducted in 68 breast cancer survivors who were receiving treatment with aromatase inhibitors (AIs). All patients were instructed to participate in 12 weeks of Baduanjin exercise training, which involved three 90-minute sessions per week. Group 1 attended ≥2 sessions per week (n=33), while group 2 attended <2 sessions per week (n=35). Questionnaires measuring quality of life (QOL) and sleep quality were completed at baseline and 3 months after the intervention. Quality of life was assessed using the European Organization for Research and Treatment of Cancer Quality-of-Life Questionnaire Core 30 (EORTC QLQ- C30). Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI).

**Results**

The indexes of quality of life, which included functional scores, general health and symptom relief, significantly improved in group 1 ( $P<0.05$ ) and had a larger effect size compared to group 2 ( $P$  value for group difference < 0.05). Compared with group 2, group 1 had a higher score on the functional scales ( $P<0.05$ ), while the functional scale scores for group 2 worsened. The overall PSQI score in group 1 decreased by 4.85 points (47.92%) ( $P<0.01$ ) and was lower than that of group 2 ( $P$  for group difference < 0.05).

**Conclusion**

A 12-week Baduanjin exercise training program led to improvements in the quality of life and sleep quality of breast cancer patients receiving AIs.

**1547** Board #309 May 30 10:30 AM - 12:00 PM

**Evaluating The Translation Of Dutch Exercise Oncology Trials Into Clinical Practice Using The RE-AIM Framework**

Laurien M. Buffart<sup>1</sup>, Anne M. May<sup>2</sup>, Rosalie Huijsmans<sup>1</sup>, Neil K. Aaronson<sup>3</sup>, Martijn M. Stuiver<sup>4</sup>. <sup>1</sup>Amsterdam UMC, Amsterdam, Netherlands. <sup>2</sup>UMC Utrecht, Utrecht, Netherlands. <sup>3</sup>Netherlands Cancer Institute, Amsterdam, Netherlands. <sup>4</sup>Netherlands Cancer Institute and Amsterdam University of Allied Sciences, Amsterdam, Netherlands.  
Email: l.buffart@vumc.nl

(No relevant relationships reported)

**PURPOSE:** Implementation of exercise programs for cancer patients is challenging. This study evaluated the potential for implementation of exercise programs from Dutch exercise oncology trials.

**METHODS:** Three randomized controlled trials (PACES, REACT, PACT), examining effects of exercise during or following chemotherapy treatment with curative intent, were evaluated using the 5 dimensions of the RE-AIM framework: Reach, Effectiveness, Adoption, Implementation, and Maintenance.

**RESULTS:** *Reach:* Participation rates were 37-45%. Compared to non-participants, participants were higher educated, less fatigued or distressed, and had higher scores on behavioral variables. *Effectiveness:* No serious exercise-related adverse events occurred. Significant benefits of exercise were found for physical fitness, fatigue, and quality of life. A significant benefit on chemotherapy completion was found in one study but not in another. *Adoption:* To enable twice weekly exercise session attendance close to patients' homes, local physiotherapists (PTs) were educated about exercise supervision for cancer patients. Generally, the PTs felt sufficiently capable to deliver exercise programs, but less capable to support behavioral change. *Implementation:* 61-89% of participants had high attendance at the supervised sessions. Education, additional radiotherapy, BMI, fatigue and self-efficacy predicted adherence in some studies. Basic insurance does not cover the program, but some additional coverage policies do. Some evidence for cost-effectiveness of the programs was found.

*Maintenance:* Exercise-induced gains in physical fitness and quality of life post cancer treatment, and benefits from exercise during chemotherapy on physical activity and function maintained, whereas maintenance of fatigue benefits were inconsistent across studies. Sustainability of program delivery is ensured by incorporation of the exercise protocols in post-graduate oncology education for PTs. A quality control system has been implemented via Onconet.

**CONCLUSIONS:** The exercise programs have high potential for successful implementation in clinical oncology practice, but reach and adherence should be monitored, and lack of reimbursement is currently a barrier. Future studies should focus on improving maintenance of benefits.

**1548** Board #310 May 30 10:30 AM - 12:00 PM

**Effects of Different Volumes of Combined Training in Breast Cancer Survivors: A Pilot Study**

Stephanie Pinto<sup>1</sup>, Elisa Portella<sup>1</sup>, Cristine Alberton<sup>1</sup>, Rochele Pinheiro<sup>1</sup>, Gabriela David<sup>1</sup>, Pedro Lopez<sup>2</sup>, Maria Laura Brizio<sup>1</sup>, Gustavo Schaan<sup>1</sup>, Daniel Umpierre<sup>2</sup>. <sup>1</sup>Federal University of Pelotas, Pelotas, Brazil. <sup>2</sup>Federal University of Rio Grande do Sul, Porto Alegre, Brazil.  
Email: tetisantana@yahoo.com.br

(No relevant relationships reported)

**PURPOSE:** We aimed to assess the effects of different volumes of eight-week combined training on neuromuscular, cardiorespiratory, fatigue and quality of life parameters in breast cancer patients in stages I-III who have finished treatment, such as surgery, chemotherapy and radiotherapy. **METHODS:** Ten women (57.1 ± 9.6 years) were placed into either a group based on a single set (SS) protocol or a group following multiple sets (MS) protocol for prescribed resistance exercises. The eight-week combined training included resistance and aerobic exercise within the same training sessions, which were performed twice a week. Resistance exercises were performed with sets of maximal repetitions and along the training the number of repetitions decreased. The intensity of aerobic exercise was based on the anaerobic threshold, monitored by relative heart rate (first weeks) or velocity of the anaerobic and aerobic thresholds (last weeks). Before and after the intervention, the following variables were evaluated: maximal dynamic and isometric strength of knee extensors, maximal isometric electromyography (EMG) activity of vastus lateralis, muscle thickness of quadriceps, peak oxygen uptake, fatigue and quality of life. The training-related effects were assessed using a Generalized Estimating Equations and Bonferroni post-hoc test ( $\alpha=0.05$ ). **RESULTS:** The maximal dynamic strength of knee extensors (SS: 32.10 ± 45.70 vs. MS: 23.33 ± 13.59%,  $p<0.001$ ), muscle thickness of quadriceps (SS: 14.60 ± 4.64 vs. MS: 25.50 ± 19.30%,  $p=0.001$ ), peak oxygen uptake (SS: 8.67

$\pm 8.76$  vs. MS:  $12.07 \pm 12.04\%$ ,  $p < 0.001$ ) and quality of life (SS:  $2.71 \pm 6.91$  vs. MS:  $5.75 \pm 7.97\%$ ,  $p = 0.039$ ) increased after training, with comparable changes for both groups. For maximal isometric strength of knee extensors and EMG activity of vastus lateralis there were no significant changes in both groups after training. For cancer-related fatigue, only the MS group showed decreases ( $16.24 \pm 135.32\%$ ). We highlight these results are preliminary. **CONCLUSIONS:** In this pilot study, a short period of combined training, independent of the volume of resistance training, promoted key benefits for functional variables and quality of life in sedentary breast cancer survivors.

**1549** Board #311 May 30 10:30 AM - 12:00 PM  
**Feasibility Of Exercise Prehabilitation During Neo-adjuvant Chemotherapy In Oesophago-gastric Cancer Surgery**

Janine Zylstra<sup>1</sup>, Andrew R. Davies<sup>1</sup>, Jim Pate<sup>2</sup>, Gemma Tham<sup>1</sup>, Nick Maisey<sup>1</sup>, Cara R. Baker<sup>1</sup>, Mark Kelly<sup>1</sup>, James Gossage<sup>1</sup>, Mike Browning<sup>3</sup>, Greg Whyte<sup>4</sup>. <sup>1</sup>Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom. <sup>2</sup>Centre for Health and Human Performance, London, United Kingdom. <sup>3</sup>Maidstone and Tunbridge Wells NHS Trust, London, United Kingdom. <sup>4</sup>Liverpool John Moore's University, London, United Kingdom. Email: janine.zylstra@gstt.nhs.uk  
 (No relevant relationships reported)

**PURPOSE:**

To determine the feasibility and potential benefits of patients diagnosed with operable gastro-oesophageal cancer undertaking a structured-exercise cancer prehabilitation program (prehab) during neo-adjuvant chemotherapy (NAC) versus patients on a standard care pathway.

**METHODS:**

Patients were enrolled in a prospective, cohort-controlled trial. Prehab was based on World Health Organisation (WHO) 'recommended levels of physical activity for adults over the age of 18'.

Cardiopulmonary exercise tests (CPEX) were performed at 4 time-points: 1. Baseline/pre-NAC. 2. Post-NAC. 3. Before surgery. 4. After surgery. Participants wore wearable tracker devices.

CPEX variables analysed included anaerobic threshold (AT) and peak oxygen uptake (VO<sub>2</sub>peak).

Clinical and pathological data variables were recorded.

**RESULTS:**

At time of writing, 25 male and female patients, aged 25 - 78 years, had participated in the study; 22 had undergone surgery. Mean baseline AT in the prehab group was  $17.57 \pm 3.35$ SD (range 10.77 - 20.94; n=10) ml/kg/minute, compared to  $15.19 \pm 3.57$ SD (range 11.10 - 22.90; n=12) ml/kg/minute in the control group.

Mean baseline VO<sub>2</sub>peak achieved was  $27.55 \pm 5.63$ SD (range 15.18 - 36.83) ml/kg/minute and  $23.39 \pm 4.06$ SD (range 18.75 - 29.94) ml/kg/minute, respectively.

Mean values of AT and VO<sub>2</sub>peak between the groups pre-surgery were of little scientific value. However,  $\Delta$ VO<sub>2</sub>peak in individual patients showed a trend towards improvement in the prehab cohort. Post-surgery values decreased markedly in both groups:

Mean AT prehab decreased to  $13.46 \pm 2.29$ SD (range 10.54 - 15.91) ml/kg/minute versus  $13.10 \pm 2.60$ SD (range 10 - 18.4) ml/kg/minute in control group.

Mean VO<sub>2</sub>peak reduced to  $20.33 \pm 4.94$  (range 14.01 - 26.81) ml/kg/minute compared to  $19.56 \pm 2.74$ SD (range 18.00 - 24.76) ml/kg/minute respectively.

**CONCLUSIONS:** Cancer prehabilitation during NAC is feasible. Recovery of peak oxygen uptake shows an improvement trend in patients undergoing prehab during and after NAC. Post-surgery mean AT and VO<sub>2</sub> values confirm physiological stress in patients undergoing high-risk, intra-thoracic and intra-abdominal oesophagectomy.

**1550** Board #312 May 30 10:30 AM - 12:00 PM  
**Moving Cancer Care Ontario's Exercise Guidelines Into Oncology Practice: Using The Theoretical Domains Framework To Validate A Questionnaire**

Sarah Neil-Sztramko<sup>1</sup>, Michelle Nadler<sup>2</sup>. <sup>1</sup>McMaster University, Hamilton, ON, Canada. <sup>2</sup>University of Toronto, Toronto, ON, Canada. Email: neilszts@mcmaster.ca  
 (No relevant relationships reported)

**PURPOSE:** The purpose of this study was to validate a questionnaire used to identify barriers and facilitators to use of exercise guidelines in oncology care.

**METHODS:** A questionnaire was designed to explore knowledge, beliefs, practices, barriers and facilitators to discussion of exercise guidelines in oncology patients. It was optimized for face and content validity through pilot testing, and administered to oncology care providers at a regional tertiary cancer. To offer more strategic and precise data collection, and to inform the development of interventions with a higher likelihood of applicability and success, we validated the questionnaire based on the

updated 14-item Theoretical Domains Framework (TDF). The TDF is a knowledge translation (KT) framework used to identify potential targets for health professional behavior change related to evidence-based practice. Cronbach's alpha was calculated to assess internal consistency between items within each domain of the TDF. **RESULTS:** Existing items were mapped successfully within the eight TDF domains deemed to be relevant to exercise discussion in oncology care. Internal consistency was generally high across domains, with all domains  $> 0.7$ , with the exception of intentions, and beliefs about consequences. Four questions were removed, which increased the internal consistency within domains.

**CONCLUSIONS:** Many KT frameworks emphasize context in developing and assessing the effectiveness of implementation strategies. Our questionnaire, based on a commonly used KT framework, has the potential to assist other researchers to collect valuable contextual data prior to the design phase of an intervention to promote exercise discussion in cancer practice. The consideration of these formative data in the development of KT interventions that have a greater likelihood of success in closing the gap between the known benefits of exercise in people with cancer and coverage in care planning.

**1551** Board #313 May 30 10:30 AM - 12:00 PM  
**Exercise in Patients Newly Diagnosed with Multiple Myeloma - a Randomized Controlled Feasibility Study**

Rikke F. Larsen<sup>1</sup>, Mary Jarden<sup>2</sup>, Lisbeth R. Minet<sup>3</sup>, Ulf C. Frølund<sup>1</sup>, Niels Abildgaard<sup>3</sup>. <sup>1</sup>Zealand University Hospital, Roskilde, Denmark. <sup>2</sup>University Hospital of Copenhagen, Copenhagen, Denmark. <sup>3</sup>Odense University Hospital, Odense, Denmark. Email: rfl@regionsjaelland.dk  
 (No relevant relationships reported)

Exercise is considered a feasible, safe and beneficial complementary treatment for patients with hematological cancer. However, there is a lack of knowledge regarding exercise interventions (EI) in patients with newly diagnosed multiple myeloma (MM). Our ongoing randomized controlled trial (RCT) examines the effect of an EI in newly diagnosed patients with MM, irrespective of age and treatment regimen, on muscle strength, physical function and physical activity. **PURPOSE:** To report an interim analysis of feasibility and safety of the early initiated exercise intervention.

**METHODS:** A two-center RCT with blinded outcome assessors. Baseline tests are carried out three days after starting anti-myeloma treatment, followed by randomization to control group (CG) or intervention group (IG). The EI is a 10-week supervised and home-based exercise program comprising aerobic and strengthening exercises and physical activity. Feasibility outcome measures are study eligibility, acceptance and drop-out rates. Further, intervention adherence, tolerability and safety by registration of adverse events (AE) are assessed. IG is compared to CG by k-sample test for medians and by Fisher's exact test for categorical variables. **RESULTS:** Of 49 patients screened, 80% were eligible for inclusion, 77% accepted participation. Median age 69 years, range (38-90), 77% were men. No difference between CG and IG in age ( $p = 0.713$ ) and gender ( $p = 0.666$ ). From IG, five patients dropped out (29%) prior to start of intervention due to no surplus energy (n=3), treatment near by home town (n=1) or because of sudden impairment (n=1). Adherence was high; 99% of the supervised ES were completed and 89% of the home-based ES were completed. Tolerability was high; only two patients had to discontinue one supervised ES, each due to non-serious AE (pain and dyspnea/dizziness). No serious AE (e.g. pathological fractures) were reported. **CONCLUSION:** Early initiated exercise in patients with MM, regardless of age and treatment regimen, is feasible, tolerable and safe and may be important in preventing physical decline during treatment for MM. **SUPPORTED BY:** Zealand University Hospital; Region Zealand; Region of Southern Denmark; REHPA, The Danish Knowledge Centre for Rehabilitation and Palliative Care; Amgen; The Association of Danish Physiotherapists.

**1552** Board #314 May 30 10:30 AM - 12:00 PM  
**Effects Of Exercise And Yoga On Sleep Problems In Women With Breast Cancer: A Meta-analysis**

Charlotte Kreutz, Martina E. Schmidt, Karen Steindorf. DKFZ, Heidelberg, Germany. (Sponsor: Jürgen Scheerhag, FACSM) Email: charlotte.kreutz@nct-heidelberg.de  
 (No relevant relationships reported)

Sleep problems are one of the top five long-term health issues in breast cancer patients. However, the optimal treatment still needs to be defined. Exercise and yoga are promising approaches. **Purpose:** To conduct a meta-analysis evaluating the effects of physical exercise and yoga interventions on self-reported and objective sleep problems in breast cancer patients during or post-cancer treatment. **Methods:** PubMed, Web of Science and Cochrane library databases were systematically searched for randomized controlled trials with any type of exercise or yoga intervention in women with breast cancer. Outcomes were self-reported or objective measurements of sleep. Standardized mean differences (SMDs) using random-effects models were calculated. **Results:** The meta-analysis included 22 trials with 2091 participants. Sleep was assessed in

17 studies with the Pittsburgh Sleep Quality Index (PSQI). Only 6 studies included objective sleep assessments (ActiGraph). Physical exercise interventions included aerobic exercise, resistance exercise or a combination of both. Most interventions were supervised. Yoga interventions comprised various yoga protocols. Also 3 studies with Tai-Chi or Qigong were included in the yoga group for the meta-analysis. Both, physical exercise interventions (SMD -0.32; 95% CI -0.54 to -0.10) and yoga interventions (SMD -0.27; 95% CI -0.44 to -0.09), resulted in improvements of sleep problems. There was no significant difference between the effects of physical exercise and yoga. Subgroup analyses revealed no clear difference between interventions conducted during cancer therapy versus post therapy. Considering the PSQI subscores, exercise resulted in improvements of sleep quality (SMD -0.28; 95% CI -0.44 to -0.11) and of sleep disturbances (SMD -0.26; 95% CI -0.45 to -0.06). Regarding the objective sleep measurements, no significant effects were found, however, the number of studies was very limited. **Conclusions:** Physical exercise as well as yoga, Tai-Chi or Qigong might reduce sleep problems and improve subjective sleep quality in breast cancer patients, both during and after cancer treatment. Effect sizes were small to moderate. Future studies should clarify which type of intervention might be most effective depending on individual patients' and treatment characteristics.

**1553** Board #315 May 30 10:30 AM - 12:00 PM

**Preventive Action Of Cardiorespiratory Fitness On Health Outcomes In Childhood Acute Lymphoblastic Leukemia Survivors**

Maxime Caru<sup>1</sup>, Valérie Lemay<sup>1</sup>, Mariia Samoilenko<sup>1</sup>, Simon Drouin<sup>1</sup>, Nathalie Alos<sup>1</sup>, Geneviève Lefebvre<sup>2</sup>, Emile Levy<sup>1</sup>, Sarah Lippé<sup>1</sup>, Valérie Marcil<sup>1</sup>, Serge Sultan<sup>1</sup>, Laurence Bertout<sup>1</sup>, Maja Krajinovic<sup>1</sup>, Caroline Laverdiere<sup>1</sup>, Marie-Josée Raboisson<sup>1</sup>, Daniel Sinnett<sup>1</sup>, Gregor Andelfinger<sup>1</sup>, Daniel Sinnett<sup>1</sup>, Daniel Cornier<sup>1</sup>. <sup>1</sup>Sainte-Justine University Hospital, Montreal, QC, Canada. <sup>2</sup>University of Quebec in Montreal, Montreal, QC, Canada.

Email: maxime.caru@umontreal.ca

(No relevant relationships reported)

**PURPOSE:** Most childhood acute lymphoblastic leukemia (ALL) survivors develop chronic treatment-related adverse effects several years after the end of therapy. A regular practice of physical activity and a good cardiorespiratory fitness have the potential to reduce the risk of chronic diseases and to improve quality of life. It is currently unknown whether a good cardiorespiratory fitness or the regular practice of physical activity is enough to induce a preventive action on late adverse effects. The first aim of this study was to evaluate the association between a good cardiorespiratory fitness and major long-term health outcomes. The second aim of this study was to assess the association between the respect of physical activity guidelines and major long-term health outcomes.

**METHODS:** 247 ALL survivors underwent a cardiopulmonary exercise test. They also completed a physical activity questionnaire and a battery of clinical exams. We calculated the odds ratio to obtain the preventive fraction in order to evaluate the effects of cardiorespiratory fitness and physical activity levels on health outcomes (i.e. obesity, metabolic health, cardiac health, cognitive health and mood, bone health) **RESULTS:** Despite their young age, 88% of the survivors presented at least one adverse health outcome, and 46% presented 3 or more adverse health outcomes. Their cardiorespiratory fitness had a median VO2 peak reaching 84% of predicted value, which was lower than expected. In the analyses regarding cardiorespiratory fitness, statistically significant preventive fractions were observed for obesity (30%), low HDL-cholesterol (21%) and depression (26%). In the physical activity level analyses, statistically significant preventive fractions were observed for obesity (55%), depression (81%) and low bone mineral density (60%).

**CONCLUSIONS:** Our results indicated that a good cardiorespiratory fitness and physical activity level induced a preventive action for most health outcomes studied and was associated with a lower late adverse effects prevalence in ALL survivors. Clinicians and researchers have an important role to play in the reduction of late adverse effects in ALL survivors. This study provides additional evidence regarding the benefits of physical activity for cancer survivors

**C-49 Basic Science World Congress/Poster - Circadian and Sleep Behavior in Adolescents**

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

**1554** Board #316 May 30 10:30 AM - 12:00 PM  
**Descriptive Analysis of Objectively Measured Physical Activity and Sleep Activity in Adolescents: a Preliminary Analysis.**

Sarah N. Brown, Sarah E. Domoff, Aubrey L. Borgen, Ryan Foley, Rachael K. Nelson. *Central Michigan University, Mount Pleasant, MI.*

(No relevant relationships reported)

Although growing evidence suggests a link between physical activity (PA) behavior and sleep quality in adolescents, a causal relationship between these two variables has yet to be elucidated. Methodological differences in data collection (subjective vs. objective) has been highlighted as a limiting factor in data interpretation. In fact, the majority of the literature includes subjective or subjective combined with objective data, with only two studies comparing objective measures of both PA and sleep in adolescents within the same analysis. **PURPOSE:** To objectively examine PA behavior and sleep activity in adolescents using accelerometers. **METHODS:** 7 males and 3 females, age: 10±1 yrs., BMI: 20±5 were recruited for this study. PA and sleep were monitored by Actigraph wGT3x accelerometers worn on participants' non-dominant wrist to assess sedentary (SED), light-intensity (LPA), and moderate-to-vigorous activity (MVPA), as well as sleep activity including: total sleep time (TST), wake after sleep onset (WO), and average wake length (WL). Time spent awake and sedentary (aSED) was calculated as  $aSED = SED - TST$ . Participants were instructed to wear the accelerometer for 7 consecutive days only removing it while swimming, bathing, or playing contact sports. Our analysis only included data from participants who wore the accelerometer continuously for ≥4 days. **RESULTS:** On average participants accumulated 435±15 min/day of sleep equal to 7.3±0.3 hours per night. Participants also accumulated 473±24 min/day of MVPA, 371±29 min/day aSED, and 141±8 min/day LPA. There was not a significant difference between TST and MVPA per day (p=0.22). Participants spent the majority of their day sleeping (33% time/day) or engaged in MVPA (31%) followed by aSED (26%), and the fewest proportion of their day engaged in LPA (10%; p<0.01). We observed a negative association between LPA and TST (p=0.01). However, we observed a positive association between LPA and WO (p=0.03) and WL (p=0.03). No other significant associations were observed between PA and sleep variables. **CONCLUSION:** Outcomes of this analysis suggest that adolescents accumulate less than the recommended 8-10 hours of sleep per night and parameters of sleep disturbance may be linked to engaging in higher amounts of light-intensity physical activity.

**1555** Board #317 May 30 10:30 AM - 12:00 PM  
**24-hour Movement Behaviors, Body Composition And Cognitive Performance In Adolescents**

Erin K. Howie, Marilou D. Shreve, Connie Lamm, Matthew S. Ganio, FACSM. *University of Arkansas, Fayetteville, AR.*  
Email: ekhowie@uark.edu

(No relevant relationships reported)

**PURPOSE:** The purpose of this pilot study was to examine associations between 24-hour movement behaviors (sleep, physical activity, and sedentary time), body composition, and executive functions in adolescents with and without obesity. **METHODS:** Adolescents between the ages of 12 and 18 years (n=30, n=14 girls, mean age=14.9 years) wore accelerometers on the hip for 24-hours to measure total night sleep time, minutes of moderate-to-vigorous physical activity (MVPA), and percentage of waking wear in sedentary activity. Body composition including lean mass, fat mass and bone mineral density was measured using dual-energy x-ray absorptiometry. Cognitive performance, particularly attention and inhibitory control, was tested using the Go/NoGo task. **RESULTS:** Mean sleep time was 487.2 (SD 80.0) minutes per night, median minutes of moderate-to-vigorous physical activity were 16 (10.2, 25.3 25<sup>th</sup> to 75<sup>th</sup> percentiles) minutes per day, and 68.5% (SD 6.95) of waking time was spent in sedentary activity. There were no differences in sleep or sedentary time in adolescents with and without obesity, however, adolescents with obesity participated in less MVPA compared to those without obesity (median 13.4 vs 23.3 minutes per day respectively, p=.024). In linear regression models with all three behaviours as independent variables adjusted for total body mass, sex, and age, total sleep time (minutes/day), but not sleep efficiency, was positively associated with total body percent fat (0.05, 95%CI: 0.002, 0.11, p=.043) and negatively associated with total lean mass (-37.8 grams, 95%CI: -71.7, -4.0, p=.030). Using negative binomial regression adjusted for age and sex, there were no associations of any of the movement

behaviors with accuracy (errors of omission or commission) or reaction times. Body fat percentage (IRR 1.06, 95%CI: 1.01, 1.12),  $p=.026$ ) and total lean mass (kg) (IRR 0.89, 95%CI, 0.80, 0.97,  $p=.013$ ) were associated with omission errors of inattention. **CONCLUSION:** In this sample of adolescents, total sleep time was associated with body fat and lean mass. Body composition was associated with inattention. Novel interventions that integrate sleep strategies to improve health and cognitive performance in adolescents should be explored.

**1556** Board #318 May 30 10:30 AM - 12:00 PM  
**What Affects the Sleep of Youth? Results from the 2017 Youth Risk Behavior Surveillance Survey**

Hai Yan, *University of Illinois at Urbana Champaign, Champaign, IL.* (Sponsor: Weimo Zhu, FACSM)  
 Email: haiyan2@illinois.edu  
 (No relevant relationships reported)

**Background/Purpose:** Sleep plays a critical role in metabolism, memory, learning, and other vital functions. Sleep deprivation is associated with an increased risk of developing diabetes, cardiovascular disease, and many other complications. However, evidence has shown that youth are sleeping less than before. Understanding what influences sleep time is extremely important in designing interventions to help to improve the sleep time and sleep quality of youth. The aim of this study was to examine the influencing factors of sleep for youth age from 12 to 18 yr.

**Methods:** The data were derived from the 2017 Youth Risk Behavior Surveillance System (YRBSS) and a total of 14,765 youth responded to the survey. Descriptive analysis was used to explore the sleep patterns and Pearson's Chi-squared test was applied to examine the gender and race/ethnicity difference. Logistic regression was implemented to explore the impact of health-related behaviors such as physical activity (PA), playing video games (GAME), smoking (SMOKE), and drinking alcohol (DRINK) on sleep time.

**Result:** Only 23.88% female and 25.78% male reported having 8 or more hours of sleep on an average school night. Significant disparities exist among demographic subgroups of youth defined by gender ( $\chi^2 = 5.70$ ,  $p = 0.02$ ) and race ( $\chi^2 = 30.13$ ,  $p = 0.00$ ). Results of logistic regression were displayed in the table below:

Factor		Odds Ratio	SE	$p$
Age		0.79	0.02	0.00
Gender	Male	1.08	0.06	0.14
Race	Black	0.94	0.08	0.72
	White	1.14	0.07	0.03
	Asian	0.62	0.08	0.00
	Pacific Islander	0.58	0.20	0.11
	Native American	0.69	0.22	0.24
Obesity	Non-obese	1.22	0.10	0.01
PA		1.04	0.01	0.00
GAME		0.91	0.01	0.00
SMOKE		1.07	0.03	0.02
DRINK		0.83	0.03	0.00

Comparing with Hispanic youth, White youth tended to have longer sleep time ( $p = 0.03$ ) while Asian youth had significantly less sleep time ( $p = 0.00$ ). Youth who were non-obese and physically active were more likely to have 8-hour sleep, while those who played video games and consumed alcohol tended to sleep less.

**Conclusion:** About 75% of the youth did not meet the 8-hour sleep needs and promote physical activity and reduce alcohol consumption may help to increase the sleep time of youth.