

**C-15 Thematic Poster - Advancing Physical Activity Assessment Methods - Part II**

Thursday, June 2, 2016, 8:00 AM - 10:00 AM  
 Room: 103

1261 **Chair:** Deborah Salvo. *University of Texas, Austin, TX.*  
 (No relationships reported)

1262 **Board #1** June 2, 8:00 AM - 10:00 AM  
**Validation Of The Cybex Arc Trainer Estimation Of Energy Expenditure**  
 Greg J. Petrucci, Amanda Hickey, Albert Mendoza, Patty S. Freedson, FACSM. *UMass Amherst, Amherst, MA.* (Sponsor: Dr. Patty S. Freedson, FACSM)  
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**Reported Relationships:** G.J. Petrucci: Salary; Cybex International.

**PURPOSE:** Elliptical machine exercise has grown in popularity in the fitness community. Despite the popularity of the Cybex Arc Trainer, (AT) which utilizes a unique arc motion unlike other elliptical machines, little is known about the validity of the AT console display of energy expenditure (EE). **PURPOSE:** The purpose of this study was to examine the accuracy of the AT estimation of EE during a 30-minute moderate intensity workout.

**METHODS:** Thirteen participants (5 normal-weight, 8 overweight) were fitted with the Oxycon Mobile (OXY), a portable indirect calorimeter system. Resting heart rate was used to calculate heart rate reserve, (HRR) an individual characterization of workout intensity. To maintain a moderate intensity throughout the 30-minute bout, participants were instructed to change the resistance level to yield a rating of perceived exertion of 12-13, while maintaining stride rate at  $114 \pm 5$  strides per min. Criterion EE measured via the OXY was compared to EE values on the AT console display at the end of the workout. Linear mixed effects models and correlations were used to examine differences in EE between the AT and OXY and the relationship between EE OXY and EE AT.

**RESULTS:** The AT significantly overestimated EE compared to the OXY (NW: 12.4%; OW: 18.0%). Correlations between OXY and AT EE ranged from  $r = 0.96$  to  $0.97$  for NW and OW groups, respectively. No differences were observed in % HRR between groups.

**CONCLUSIONS:** Although correlations between OXY and AT EE were high, AT consistently overestimated EE. Additionally, the EE overestimation was larger for the overweight group. These results indicate that the AT EE display is inaccurate. Therefore, users do not receive correct EE feedback. This will affect user ability to achieve desired EE goals, and over-time this discrepancy may have a substantial impact on weight-loss management. Fitness professionals should consider these results when prescribing AT exercise in physical activity interventions.

1263 **Board #2** June 2, 8:00 AM - 10:00 AM  
**Accuracy Of A Smartphone-based "App" For The Assesment Of Sedentary And More Active Behaviors**  
 Meynard John L. Toledo<sup>1</sup>, Eric Hekler<sup>1</sup>, Kevin Hollingshead<sup>1</sup>, Dana R. Epstein<sup>2</sup>, Barbara A. Ainsworth, FACSM<sup>1</sup>, Matthew P. Buman<sup>1</sup>. <sup>1</sup>Arizona State University, Phoenix, AZ. <sup>2</sup>Phoenix Veterans Health Care System, Phoenix, AZ.  
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 (No relationships reported)

Mobile devices provide a convenient platform for log-based assessments of sedentary and physical activity (PA) behaviors. **PURPOSE:** This study aimed to evaluate the accuracy of a smartphone-based "app" designed to assess context-specific forms of sitting, light-intensity PA (LPA), and moderate-vigorous PA (MVPA). **METHODS:** Adults (N=23 [323 observations]; 49.0±8.9 years; 85% men; 73% Caucasian; BMI=35.0±8.3kg/m<sup>2</sup>) reported their sitting, LPA, and MVPA over the course of an 11-week behavioral intervention. During three separate 7d time period, participants simultaneously wore the ActivPAL3c™ accelerometry/inclinometer as a criterion measure. Intraclass correlation (ICC [95% CI]) and bias estimates (mean difference [d] and absolute percent error [APE = difference/direct observation x 100]) were used to compare app-based reported behaviors to measure sedentary time (lying/seated position), LPA (standing or stepping < 3 metabolic equivalents [METs]), and MVPA (stepping ≥ 3METs). **RESULTS:** Sitting time accuracy was moderate (ICC=0.50 [0.37, 0.60]) with under-reporting (d = -127 [-612.41, -356.73] minutes/day; APE = -8.61 [-155.73, 140.51]). LPA and MVPA time accuracy was also moderate (ICC=0.64 [0.55, .72] and 0.55 [0.32, 0.71], respectively) with over-reporting (d = 293.00 [-39.06, 625.06] minutes/day; APE = 31.87 [-138.28, 202.02]) and (d = 19.46 [-133.20, 172.12] minutes/day; APE=83.93 [-387.21, -555.07]). **CONCLUSION:** The smartphone-based log targeting sedentary and more active behaviors underreported sedentary time and overreported LPA and MVPA with only moderate accuracy relative

to an objective monitor. This tool may still be useful as a self-monitoring tool in the context of a behavioral intervention as well as a tool to capture context-specific forms of sedentary, LPA, and MVPA behaviors. Given the wide variations in accuracy, future research may explain some reasons for under- or over-reporting of behaviors.

1264 **Board #3** June 2, 8:00 AM - 10:00 AM  
**Validity of Self-Reported Pedometer Steps Per Day in College Students**  
 Brittany Overstreet, Scott E. Crouter, FACSM, George A. Butler, Cary M. Springer, David R. Bassett, Jr, FACSM. *University of Tennessee, Knoxville, TN.* (Sponsor: Dr. David Bassett, FACSM)  
 (No relationships reported)

**PURPOSE:** To examine the validity of self-reported pedometer steps/day, before and after participants are given a daily step goal.

**METHODS:** Forty-seven participants (21±1 years of age; mean±SD) were provided a pedometer and a log sheet, but were not informed of the pedometer's data-storing capabilities. During week 1, participants maintained normal daily activities. During weeks 2 and 3, they were given a goal to accumulate 3,000 steps/day above their average step count for week 1. Twenty-six individuals completed all three weeks of the study. A 2x3 repeated measures ANOVA (recording method x time) was used to examine differences between self-reported and pedometer recorded average steps/day. Bland-Altman plots were used to assess the mean bias and limits of agreement between self-reported and pedometer-recorded average steps/day.

**RESULTS:** The average self-reported and pedometer-recorded steps/day for the entire study were (mean±SD) 9,264±3,555 steps/day and 8,971±3,590 steps/day, respectively. No main effects were seen for recording method or time, and the method x time interaction was not significant (p>0.05). Bland-Altman plots indicated that the mean biases were 216 (week 1), -506 (week 2), and -590 (week 3) steps/day; however, the 95% prediction intervals were large.

**CONCLUSIONS:** At the group level, steps/day were similar between both recording methods. However, at the individual level, large differences between self-reported and pedometer-recorded steps/day were observed. This suggests that surveillance studies of population-level steps/day could use either method, but caution is warranted when using self-reported pedometer data in walking interventions.

1265 **Board #4** June 2, 8:00 AM - 10:00 AM  
**Energy Expenditure And Step Count Accuracy Of The Actigraph wGT3X-BT During Walking And Running**  
 Marquell J. Johnson, Jillian Turek, Chelsea Dornfeld, Jennifer Drews, Nicole Hansen. *University of Wisconsin - Eau Claire, Eau Claire, WI.* (Sponsor: Stewart Trost, FACSM)  
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 (No relationships reported)

**PURPOSE:** To examine the energy expenditure (EE) estimation and step count accuracy of the latest ActiGraph wGT3X-BT (AG) accelerometer during walking and running. The study also examined the impact of monitor placement at the hip and wrist on these measures. **METHODS:** Twenty-nine participants (mean age 21.69±1.63) participated in the study. Participants wore an AG monitor placed at the hip and wrist simultaneously during self-paced walking and treadmill (TM). Participants walked around a 200-meter track at self-selected pace for 15 consecutive minutes and ran on a TM at 2.24 m · s<sup>-1</sup> for 15 consecutive minutes. EE (Kcal) was determined via portable indirect calorimetry and steps taken during walking and running were determined by the StepWatch 3 Step Activity Monitor (SAM). The Freedson Combination (1998) EE algorithm was used for AG at both placements. One-way repeated measures ANOVAs were used to determine differences between EE and step count estimates from AG monitors placed at the hip and wrist compared to indirect calorimetry and SAM determined steps. **RESULTS:** During self-paced walking, EE estimation from the hip placement was significantly different than indirect calorimetry (95.09±30.07 & 68.57±14.86, respectively) (p < .001) and step count estimation from the wrist placement was significantly different from SAM (1228±331 & 1722±195, respectively) (p < .001). During TM at 2.24 m · s<sup>-1</sup>, EE estimation (73.11±27.29 & 143.96±33.17, respectively) and step count estimation (1194±133 & 2308±179, respectively) from the wrist placement was significantly different than indirect calorimetry and SAM (both p < .001). **CONCLUSIONS:** AG monitor placement impacts EE estimation utilizing the Freedson Combination (1998) algorithm during walking and TM at 2.24 m · s<sup>-1</sup>. Preferred placement during walking is the wrist and preferred placement during TM at 2.24 m · s<sup>-1</sup> is the hip. The AG placement at the hip provides valid estimates of step counts during self-paced walking (1779±164 vs 1723±195 SAM) and TM at 2.24 m · s<sup>-1</sup> (2319±330 vs 2308±179 SAM) when compared to SAM determined steps.

THURSDAY, JUNE 2, 2016

1266 Board #5 June 2, 8:00 AM - 10:00 AM  
**Convergent Validity of Ecological Momentary Assessment to Assess Free-Living Sedentary Behavior and Physical Activity**

Kelley Pettee Gabriel, FACSM<sup>1</sup>, Gregory Knell<sup>1</sup>, Michael Businelle<sup>2</sup>, Kerem Shuval<sup>3</sup>, Daria Kendzor<sup>2</sup>. <sup>1</sup>University of Texas School of Public Health, Austin, TX. <sup>2</sup>University of Oklahoma Health Sciences Center, Oklahoma City, OK. <sup>3</sup>American Cancer Society, Atlanta, GA.  
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 (No relationships reported)

Self-report measures of physical activity (PA) can result in respondent over-reporting. Accelerometers provide direct estimates of movement but lack context. Ecological momentary assessment (EMA) may elicit PA estimates that are less prone to bias than traditional self-report measures, while providing context. **PURPOSE:** To examine the convergent validity of EMA-assessed PA compared to an accelerometer.

**METHODS:** In 2014, the Pathways between Socioeconomic Status and Behavioral Cancer Risk Factors (PATHS) Study enrolled 238 free-living adults from Dallas, TX. Participants completed surveys of PA behaviors [International Physical Activity Questionnaire (IPAQ) and Behavioral Risk Factor Surveillance System (BRFSS)], and wore an accelerometer on their waist while concurrently completing daily EMAs for 7 days. Weekly summary estimates included: sedentary time, moderate-, vigorous-, and moderate- to vigorous intensity physical activity (MVPA). Spearman correlation coefficients and Lin's concordance correlation coefficients (LCC) were used to examine the linear association and agreement for EMA and self-report measures compared to accelerometry.

**RESULTS:** Participants were aged 43.3 (±13.1) years and predominantly Black (51.7%), overweight/obese (74.8%), and low income (52.4%). Based on accelerometer data, participants spent an average of 3,400.8 (±864.0) minutes per week sedentary; median (25th, 75th percentile) levels of MVPA was 121.5 (66.0, 225.0) minutes per week. The linear associations of EMA and self-reports with accelerometer estimates were statistically significant for sedentary time (EMA:  $\rho=0.16$  [ $p=0.03$ ]), moderate intensity PA (EMA:  $\rho=0.29$  [ $p<0.01$ ]); BRFSS:  $\rho=0.17$  [ $p=0.02$ ]; IPAQ:  $\rho=0.24$  [ $p<0.01$ ]) and MVPA (EMA:  $\rho=0.31$  [ $p<0.01$ ]; BRFSS:  $\rho=0.17$  [ $p=0.02$ ]; IPAQ:  $\rho=0.20$  [ $p<0.01$ ]). Only EMA estimates were statistically significant compared to accelerometer for agreement (moderate intensity PA: LCC=0.30 [95%CI: 0.18, 0.43]; vigorous intensity PA: LCC=0.06 [95%CI: 0.03, 0.10]; MVPA: LCC=0.28 [95%CI: 0.16, 0.41]).

**CONCLUSIONS:** EMA showed better correlation and agreement to accelerometer estimates than traditional self-report methods. These findings suggest that EMA may be a practical alternative to assess PA in free-living settings. Funded by MRSRG-10-104-01-CPHPS (to DK)

1267 Board #6 June 2, 8:00 AM - 10:00 AM  
**Feasibility And Acceptability Of Tracking Adolescent Physical Activity And Sedentary Behavior Using A Mobile Application**

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During adolescence, sedentary time tends to increase while physical activity (PA) declines. Previous self-report measures of adolescent's activities can be prone to recall bias and are limited by their inability to detect activities that occur simultaneously. Real-time measurements (Experienced Sampling Method, ESM), may address these limitations by assessing activities as they are taking place.

**PURPOSE:** The primary purpose of this study was to examine the feasibility and acceptability for adolescents to track their after-school PA and sedentary time through a mobile application (app) using ESM. The secondary purpose was to describe adolescents' after-school behaviors.

**METHODS:** Participants completed surveys on type and amount of time spent in sedentary behaviors and PA during the previous 30 minutes using an app on their mobile device. The surveys occurred randomly, six times, from 3-7pm, for three days (18 surveys total). Participants also completed a 15-minute follow-up interview over the phone to assess ease and likeability of using the app on 5-pt scales (1= very easy, 5= very hard; 1= disliked a lot, 5= liked a lot).

**RESULTS:** A total of 12 adolescents, 11-15 years old, completed the study. The number of surveys answered among participants ranged from 2 to 17 over the three-day period, and the average number of surveys taken per day was 3.2 (53% daily completion rate). Common reasons for not answering surveys were sports practices, traveling without WiFi access, or simply forgetting. Participants indicated the app was very easy to use (mean=1.4), and that they liked using the app (mean=3.8). No participants said they disliked using the app. Adolescents most frequently reported

engaging in "mobile device use" (31.7%), "reading, writing, drawing, or doing homework" (31.7%), and "other activities" (30.1%). While it was not the most frequently reported activity, adolescents spent the greatest amount of time doing "other activities" (6.9 hours).

**CONCLUSIONS:** While the mobile app appears to be appealing and easy to use among adolescents, the feasibility was low. Some of the reasons for low feasibility are addressable (forgetting) while others are not (sports practices). The ESM methodology may need to be modified in order to improve feasibility and to account for these periods of unavailability in adolescents.

1268 Board #7 June 2, 8:00 AM - 10:00 AM  
**Validity of Popular Smartphone Apps at Measuring Steps at Different Intensities**

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 (No relationships reported)

Smartphones have become common in industrialized societies and can be used as an effective means to increase physical activity without the need to purchase additional equipment. Smartphone apps are relatively cheap and allow users to track activity levels and receive personalized feedback with little effort. **PURPOSE:** To determine the validity of popular smartphone apps at measuring steps at different intensities compared to observed step counts. **METHODS:** Ten participants (age=25.2 yrs±3.4; BMI=23.8±4.2) participated in all trials. Following informed consent, participants were fitted with a smartphone enclosed in a smartphone armband worn on the upper right arm. The smartphone was programmed with 5 popular smartphone apps which measured steps. Participants were asked to walk 500 steps at 2 and 3 mph, and to jog 500 steps at 5 mph on a calibrated treadmill. Steps were counted by a researcher using a hand tally device and compared to the steps recorded by each of the apps. Step counts from each app were compared to observed and pedometer counts with a 2 factor (intensity x app) repeated measures ANOVA using SPSS Statistical Analysis Software v22. **RESULTS:** Significant differences were observed between intensities and apps ( $p<0.01$ ). For pairwise comparisons for intensity, mean number of steps recorded at 2mph (296.5±22.7) was significantly different than steps recorded at 3mph (468.1±7.6;  $p<0.01$ ) and 5mph (486.2±3.7;  $p<0.01$ ). For pairwise comparisons between apps, 3 apps recorded significantly different step values compared to observed counts (322.0±20.8, 370.6±18.9, 388.8±18.0;  $p<0.01$ ) while the pedometer, and 2 other apps were not different from observed steps (461.0±10.8, 388.8±29.0, 487.3±10.1;  $p>0.05$ ). One app was accurate for 2mph (steps=501.9±26.7), while the other apps were off by several hundred steps. A different app was accurate at 3mph (steps=499.7±6.8) with other apps off by 20-100 steps, while at the 5mph speed, 4 out of the 5 apps were within 20 steps from observed counts. **CONCLUSION:** As intensity increases, apps are more accurate at recording steps, but at lower intensities such as those occurring during daily physical activity, smartphone applications may have significant error when reporting steps and associated distance and calories.

1269 Board #8 June 2, 8:00 AM - 10:00 AM  
**Validating The Latest Commercial Physical Activity Monitors: Which Monitor Should You Use?**

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 (No relationships reported)

**PURPOSE:** Completing 10,000 steps per day is recommended by the World Health Organisation, the US Centre for Disease Control and the Australian National Heart Foundation. Physical activity monitors (PAM) are popular and have become increasingly available, marketed for their ability to count steps. However, limited data is available on the newer monitors (Fitbits/Jawbone) in comparison to the Actigraph, a validated research-based accelerometer, or a visual step counts, at multiple speeds and placement sites. This study aimed to compare these newer PAMs to the Actigraph and a visual count 1) across different speeds; and 2) at different placement sites in a lab based treadmill test. **METHODS:** Participants wore an Actigraph wGT3X-BT and Fitbit One around the waist and each wrist, as well as a Fitbit Flex, Fitbit Charge HR and Jawbone UP24 on each wrist while performing 5 x 3 minute bouts on a treadmill at multiple speeds (5.0, 6.5, 8.0, 10.0 and 12.0km/h). A video of their lower limbs was recorded for a visual count (criterion measure) to be completed in duplicate. Paired sample t-tests to test for any significant differences and Spearman's correlations for associations, between the device and visual count were completed. **RESULTS:** 31 participants (61% male) aged 24.3±5.2yrs ranging in BMI (18.6kg/m<sup>2</sup> to 29.9kg/m<sup>2</sup>) were recruited. Across all speeds the Actigraph (waist) and Fitbit One (waist) were accurate when compared to visual counts ( $p<0.001$ ), with the Fitbit One (waist) being the most accurate PAM at slower speeds (5.0, 6.5km/h). All PAMs worn around the wrist became more accurate at the faster speeds with the strongest

associations at 8.0km/h=Fitbit Charge ( $r=0.87, p<0.01$ ); 10.0km/h=Fitbit One ( $r=0.91, p<0.01$ ) and 12.0km/h=Jawbone ( $r=0.90, p<0.01$ ). Most PAMS, excluding the Fitbit One significantly undercounted at 5.0 and 6.5km/h ( $p>0.05$ ). At the higher speeds (10.0, 12.0kph) there were no significant differences ( $p<0.05$ ) between step counts for all devices. **CONCLUSION:** The step count accuracy of PAMS was affected by speed and placement site. The Fitbit One (waist) was the most accurate PAM across all speeds. Other PAMS worn on the wrist were accurate at the faster speeds only. Future studies should look at the effect of body mass index and outdoor free living environments on the accuracy of these newer PAMS.

**C-16 Thematic Poster - Behavioral and Psychological Aspects of Sport and Performance**

Thursday, June 2, 2016, 8:00 AM - 10:00 AM  
Room: 104

1270 **Chair:** Dominic Micklewright, FACSM. *University of Essex, Colchester, United Kingdom.*  
(No relationships reported)

1271 Board #1 June 2, 8:00 AM - 10:00 AM  
**Feedback Restricted to a Single Source of Preferred Performance Information Improves Cycling Time Trial Pacing and Performance**  
Manhal Boya, Dominic Micklewright, FACSM. *University of Essex, Colchester, United Kingdom.* (Sponsor: Dominic Micklewright, FACSM)  
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(No relationships reported)

**PURPOSE:** Cycle computers provide cyclists with a cacophony of information upon which pacing decisions are made. This study sought to establish what type of feedback cyclists preferred, and whether preferred feedback is isolation improved time trial pacing and performance.

**METHODS:** Fourteen experienced cyclists performed four 5 km self-paced cycling time-trials with different combinations of feedback. The first time trial ( $TT_{FAM}$ ) was performed for familiarization purposes and participants were provided with power, speed, elapsed distance, cadence, elapsed time and heart rate feedback. The same method was used during the second time trial ( $TT_{ALL}$ ), but participants wore a calibrated SMI iVedwX head-mounted monocular eye-tracking device that measured the time spent looking at each type of feedback. The eye-tracking data was used to identify the most looked at information by each participant during the time trial (primary information). Participants performed two further randomly counterbalanced time trials in which either just primary feedback was presented ( $TT_{PRIME}$ ), or all feedback except primary information was presented ( $TT_{ALL-PRIME}$ ). Time-trial performance was measured as average speed and pace was every 500 m.

**RESULTS:** Compared to  $TT_{ALL}$ , participants cycled faster during  $TT_{PRIME}$  ( $38.1\pm2.1$  vs.  $37.7\pm2.1$  km/hr<sup>1</sup>,  $t_{13}=-2.1, P=0.026$ ) and slower during  $TT_{ALL-PRIME}$  ( $37.2\pm2.0$  vs.  $37.7\pm2.1$  km/hr<sup>1</sup>,  $t_{13}=3.7, P=0.0015$ ). A trial-by-segment interaction was found ( $F_{18,234}=2.9, P<0.001$ ) indicating a different pacing pattern between trials. Post-hoc paired comparisons revealed that, compared to  $TT_{ALL-PRIME}$ , participants were faster during the last km during  $TT_{ALL}$  ( $37.8\pm2.2$  vs.  $38.8\pm2.5$  km/hr<sup>1</sup>,  $t_{13}=2.3, P=0.018$ ) and  $TT_{PRIME}$  ( $37.8\pm2.2$  vs.  $39.2\pm2.1$  km/hr<sup>1</sup>,  $t_{13}=2.5, P=0.014$ ).

**CONCLUSIONS:** Limiting the feedback cyclists received during a time trial to one piece of preferred information results in a faster overall performance. Cyclists who were deprived of their preferred feedback always performed slower during the last 20% of the time trial. Restricting the feedback during a time-trial to a cyclists preferred information improves pacing and performance. This may be because the presence of other non-preferred feedback has a distracting effect on cyclists.

1272 Board #2 June 2, 8:00 AM - 10:00 AM  
**Qualitative Study Of Middle- And Long-distance Runners' Explanations And Behaviors Associated To Perceived Health Problems**  
Toomas Timpka, Sara Jelvegård. *Linköping University, Linköping, Sweden.*  
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(No relationships reported)

**PURPOSE:** About two out of three elite runners sustain at least one injury period every season; the vast majority of the injuries are non-traumatic with gradual onset. Risk indicators for running-related injuries include both physical factors, such as training load and previous injury, as well as psychological factors, e.g. using

maladaptive negative thinking as coping behavior. The purpose of this study was to explore elite runners' interpretations of perceived symptoms on injury and illness and how these become transformed into behavior.

**METHODS:** A qualitative research design was used based on semi-structured interviews and thematic data analysis. The study population consisted of Swedish middle- and long distance runners on the national top 15 list. Eight male and six female athletes aged 20 to 36 years participated.

**RESULTS:** A wide span of health problems were reported, the majority associated with sports overuse. Perceptions interpreted as illness and injury with a sudden onset led mostly to immediate action and changes in the training and competition programs ("activity pacing"). In comparison, perceptions interpreted as injuries with gradual onset led to varied reactions. These reactions were characterized by indifference with regard to symptom implications and the consequences of maladaptive short-term behaviors, consistent with an "overactivity" behavioral pattern. The latter pattern was consistent with a psychological adaptation to stimuli that were presented progressively to the athlete.

**CONCLUSIONS:** Phenomena that elite runners take into account when interpreting whether perceived pain or other bodily sensations are health problems requiring changes in their training and competition program have been identified. The results can be used as a basis for future research, and point at the importance of developing instruments and self-reporting systems adapted to athletes' perceptions and reasoning about injuries and pain.

1273 Board #3 June 2, 8:00 AM - 10:00 AM  
**Overtaking Behavior in Elite 1500m Short Track Speed Skating Competitions**  
Florentina J. Hettinga, Marco Konings, Marissa Al, Romy de Jong. *University of Essex, School of Biological Sciences, Center of Sport and Exercise Science, Colchester, United Kingdom.* (Sponsor: Carl Foster, FACSM)  
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(No relationships reported)

**PURPOSE:** Pacing can be seen as the outcome of a continuous decision-making process partly dependent on the perception of action possibilities in the environment. In this respect, the decision to overtake an opponent is crucial in short track speed skating and deserves more attention. Therefore, the purpose of the present study was to analyze when and how often males and females overtake their opponents in elite 1500m short track speed skating competitions.

**METHODS:** Lap times and intermediate positions of 1500m races (13,5 laps) were collected from short track speed skating World Cups, European and World Championships over the seasons '11/12 until '14/15 (Men: N= 443 races; Women: N= 565 races). Overtaking behavior was analyzed for every lap by evaluating how often (mean number of overtakings) as well as when (where athletes were positioned relative to their predecessor, expressed as time difference with their predecessor). Sex comparisons were made using an independent t-test ( $P<0.05$ ).

**RESULTS:** Female short track speed skaters demonstrated a higher number of overtakings in the 1st lap (men:  $0.3\pm0.2$  overtakings, women:  $0.4\pm0.2$  overtakings;  $p<0.01$ ), but lower in the 5th (men:  $0.2\pm0.1$  overtakings, women:  $0.1\pm0.2$  overtakings;  $p=0.02$ ) and final lap (men:  $0.2\pm0.2$  overtakings, women:  $0.1\pm0.2$  overtakings;  $p=0.02$ ). In addition, female athletes were positioned closer behind their predecessor in the 1st lap (men:  $0.15\pm0.07$  sec, women:  $0.13\pm0.07$  sec;  $p<0.01$ ), while their male counterparts were positioned closer behind their predecessor in the 8th (men:  $0.10\pm0.06$  sec, women:  $0.11\pm0.07$  sec;  $p<0.04$ ), 9th (men:  $0.10\pm0.05$  sec, women:  $0.11\pm0.06$  sec;  $p<0.03$ ), 13th (men:  $0.18\pm0.19$  sec, women:  $0.24\pm0.29$  sec;  $p<0.01$ ) and 14th lap (men:  $0.29\pm0.62$  sec, women:  $0.39\pm0.41$  sec;  $p=0.01$ ).

**CONCLUSION:** Female short track speed skaters overtook their opponents more often than males in the initial lap of a 1500m race, possibly related to the closer positioning behind their opponent in this race stage. In contrast, male skaters overtook their opponents more often in the last lap of the race, being positioned more closely behind their predecessors in the final stages of the race. This supports the idea that the perception of the action possibilities to overtake an opponent is related to how close athletes are positioned behind their predecessor.

1274 Board #4 June 2, 8:00 AM - 10:00 AM  
**Attitudes of Exercise Science Majors towards Adaptive Recreation and Adaptive Athletes**  
Matthew D. Cunningham, Mitchell L. Cordova, FACSM, Eric Shamus, Chad Caldwell, Renee M. Jeffreys-Heil. *Florida Gulf Coast University, Fort Myers, FL.* (Sponsor: Mitchell L. Cordova, FACSM)  
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(No relationships reported)

**Purpose:** This study summarizes the impact of exposure to Adaptive Recreation Day (ARD) on the attitudes of exercise science students towards adaptive sports and athletes. Methods: In October 2015, Florida Gulf Coast University held its second

annual ARD. This event represented a collaboration among the Exercise is Medicine® On Campus team, Campus Recreation, the Department of Rehabilitation Sciences, Office of Service Learning, and four off-campus community partners. Over the course of the day, individuals participated in five different adaptive activities. Activities ranged from adaptive paddle boarding to adaptive softball. Each activity required the participant to experience adaptations made to the sport. Students also assisted participants with disabilities during the events. Results: Approximately 300 total individuals participated in the event with 100 students engaged specifically in the Service Learning Project. Students in the Exercise Science Program (N=32) submitted a reflective response after the ARD. Qualitative analysis using the following key words identified changes in attitudes: strengthened, respect, impact, appreciate, humbling, learn, and inspiring. Overall, all Exercise Science students reported positive influences on their perspective and attitude towards adaptive sports and athletes. Conclusions: Findings indicate that participation in adaptive recreation activities positively influences student's perception and attitude towards adaptive sports and athletes. Events such as ARD can help to enhance and broaden exercise science students' educational experiences and as such should be added into student learning whenever possible. Future research should investigate the impact of these types of learning activities on American College of Sports Medicine knowledge skills and abilities (KSA) for individuals with a bachelor's level education.

1275 Board #5 June 2, 8:00 AM - 10:00 AM  
**Taking Care Of Our Mental Health: The Self-care Habits Of Applied Sport Psychologists.**

Hannah M. McCormack, Tadhg E. MacIntyre, Deirdre O'Shea, Mark Campbell. *University of Limerick, Limerick, Ireland.* (Sponsor: Giles Warrington, FACSM)  
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Sport psychologists frequently provide psychological support to athletes and performers with regards to managing their stress levels and well-being. Research has rarely examined the self-regulation of sport psychologists own stress and well-being. This is an issue of central concern, given the multiple roles that sports psychologists often perform, and the negative impact that managing the stress and well-being of others can have on their own personal mental health, for example: burnout, compassion fatigue, difficulties with self-esteem, anxiety and depression.

**PURPOSE:** To investigate the utilization of therapeutic lifestyle changes in the self-regulation of the mental health of applied sport psychologists.

**METHODS:** Thirty participants from five nations (USA, UK, Ireland, Australia and New Zealand) completed an online survey regarding Walsh's (2011) therapeutic lifestyle changes (e.g., exercise) and the frequency in which they engaged in them. Semi-structured interviews with participants provided a more in depth exploration of these self-care habits as a strategy for recovery from work and how these strategies differed during times of high stress. All participants were accredited sport psychologists and have worked with high performance athletes; over 60% have attended international sport at the world level with 40% having attended the Olympic Games. Two participants were unaffiliated with an academic institution, with most combining their work in academia with applied consulting.

**RESULTS:** Daily fostering of relationships was engaged in by 72% of participants and 50% of respondents engaged in exercise 3-5 days per week, with a further 29% engaging in exercise daily. Thematic analysis revealed that 16% of participants sacrificed time with family during times of high stress. Over 50% of participants omitted exercise when workload increased, thus having a negative effect on their well-being. Habits were reinstated once workload decreased, and in some cases were used as the catalyst of recovery (e.g., relationships).

**CONCLUSIONS:** The self-care practice of professionals is potentially fragile. During times of high stress, when recovery is most pertinent is when these habits are least frequently engaged in. Tentative recommendations are made regarding practitioner well-being and self-care.

1276 Board #6 June 2, 8:00 AM - 10:00 AM  
**Does Previous Injury Influence Parental Risk Perception In Junior Sport?**

Rebecca Braham<sup>1</sup>, Leanne Lester<sup>1</sup>, Renee Teal<sup>1</sup>, Jessica Richards<sup>2</sup>. <sup>1</sup>University of Western Australia, Perth, Western Australia, Australia. <sup>2</sup>Kidsafe Western Australia, Perth, Western Australia, Australia.  
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 (No relationships reported)

**PURPOSE:** to determine the impact of previous injuries, not requiring hospitalization, on parental perceptions of future injury risk. **METHODS:** 715 parents from 3 of the top 5 junior winter team sports by participation number (Australian Football n=516, Soccer n = 144, Field Hockey n = 55) in Western Australia completed the online, multi dimensional survey. **RESULTS:** The proportion of children experiencing an injury not requiring hospitalization was similar between Australian Football (43.8%) and

Field Hockey (44.4%) and lowest in soccer (34.5%). Children playing soccer report significantly less injuries not requiring hospitalization (mean 0.8, sd=1.1) compared to children playing Australian Football (mean 1.2, sd=1.8) and field hockey (mean 1.1, sd=1.3) (F=3.413, p=0.034). Compared to parents whose child has not had an injury, there is a significant increase in the perceived risk of serious injury during game play and a significant decrease in perceived overall susceptibility to serious injury among parents whose child has had a previous injury not requiring hospitalization. Previous concussion (p=0.017), fracture (p=0.037), sprain (p=0.028) and strain (p=0.016) predicted lower susceptibility to serious injury scores, whereas bruises (p=0.035) and sprains (p=0.010) predicted higher risk of injury scores. **CONCLUSION:** Although parents perceive a risk of injury during sporting games and competition, this risk is decreased after a player sustains a more serious injury that does not require hospitalization (eg. Concussion). This perhaps indicates a more protective perception perceived following an injury due to more risk protective behaviours practiced.

1277 Board #7 June 2, 8:00 AM - 10:00 AM  
**Neuropsychological Measures: Associations With Sex, Contact Level, And Concussion History**

Melissa A. Fraser, Stephen W. Marshall, Jason P. Mihalik, Kevin M. Guskiewicz, FACSM. *University of North Carolina- Chapel Hill, Chapel Hill, NC.* (Sponsor: Kevin Guskiewicz, FACSM)  
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 (No relationships reported)

Increased aggression, impulsivity, anxiety, and depression, have been associated with traumatic brain injury. However, limited data exist between these measures, sport, sex, and sport-related concussion (SRC) history in high school athletes. **PURPOSE:** Determine the association of depression, anxiety, aggression, and impulsivity with sport, sex, and concussion history in high school athletes.

**METHODS:** Preseason concussion history and neuropsychological measures were collected at one high school during 2013-2014 and 2014-2015 and at three high schools during fall 2015. Sports were categorized into no-contact (cross country, swimming, tennis, track), low-contact (baseball, basketball, diving, softball, volleyball), and high-contact sports (field hockey, football, lacrosse, soccer, wrestling). SRC history was analyzed as a dichotomous variable (any vs. none). One-way analysis of variance was used for all analyses.

**RESULTS:** Preseason data were collected from 755 athletes (n=441 males, 314 females; age = 15.5 ± 1.2 years) who averaged 5.8 ± 3.4 years of sport participation. Males reported significantly more aggression (F<sub>1,734</sub>=39.45, p < 0.01) and impulsivity (F<sub>1,726</sub> = 21.48, p < 0.01) than females. Females reported significantly more anxiety (F<sub>1,713</sub> = 41.93, p < 0.01) and depression (F<sub>1,711</sub> = 9.81, p < 0.01) than males. Compared to no and low-contact sports, high contact sports reported significantly more impulsivity (F<sub>2,726</sub> = 5.33, p < 0.01) and significantly less anxiety (F<sub>2,713</sub> = 8.43, p < 0.01) and depression (F<sub>2,722</sub> = 4.12, p = 0.02). Concussion history ranged from 0-6 with 77.1% reporting no prior concussion. Athletes with a SRC history reported significantly more aggression (F<sub>1,670</sub> = 3.75, = 0.05) and depression (F<sub>1,647</sub> = 4.01, p = 0.05) compared to those with no history of SRC.

**CONCLUSIONS:** In univariate analyses, sex, contact level, and SRC history were associated with preseason neuropsychological differences in high school athletes. The causal relationship of these measures will require further research.

1278 Board #8 June 2, 8:00 AM - 10:00 AM  
**Placebo And Nocebo Effects Of A Purported Ergogenic Aid On Repeat Sprint Performance**

Chris J. Beedie<sup>1</sup>, Philip Hurst<sup>2</sup>, Damian Coleman<sup>2</sup>, Abby Foad<sup>2</sup>. <sup>1</sup>University of Essex, Colchester, United Kingdom. <sup>2</sup>Canterbury Christ Church University, Canterbury, United Kingdom.  
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 (No relationships reported)

The placebo effect is a positive outcome arising from the belief that a beneficial intervention has been received. The nocebo effect is a negative outcome arising from the belief that an intervention is harmful. Both are considered the result of expectations that can be created through verbal suggestions and information. **Purpose:** To investigate placebo and nocebo effects on repeated sprint performance. **Methods:** Team sport athletes (n = 305) completed 5 × 20 m baseline repeat-sprints. Athletes were then randomly assigned to two groups and administered a placebo, which they were informed was a sport supplement that would influence subsequent repeat-sprint performance. Group 1 (Placebo, n = 163) was informed that the supplement would improve sprint and endurance performance, whereas group 2 (Nocebo, n = 142) was informed that the supplement would improve endurance but negatively affect sprint performance. The experimental sprint trials were repeated 20 minutes later. **Results:** Data are presented as mean percent change from the first baseline sprint trial and standard error of the mean. Speed diminished substantially during baseline trials for both groups (Placebo = -2.50 ± 0.33%; Nocebo = -1.95 ± 0.35%). For Nocebo, this trend toward reduced performance continued into experimental trials (-3.36 ± 0.44%, P < 0.001). However, for Placebo experimental trials, the magnitude of speed reduction

improved compared to baseline (-1.97 ± 0.37%, P = 0.122) and was significantly faster compared to Nocebo experimental trials (1.27 ± 0.57%, P = 0.027). **Discussion:** Consistent with previous research (Beedie et al., 2007), data presented here suggests that the information athletes' receive about sport supplements can significantly influence its efficacy. The expectation of receiving a beneficial supplement appears to have offset fatigue in the placebo group and facilitated performance. Whereas the expectation of receiving a harmful supplement, appears to have decreased performance and influenced the ability to maintain speed over consecutive trials in the nocebo group. Data have important implications for the information athletes receive prior to an intervention, and potential anti-doping implications (see Hurst et al., 2015 ACSM conference submission)

**C-17 Thematic Poster - Exercise Therapy in Cancer**

Thursday, June 2, 2016, 8:00 AM - 10:00 AM  
Room: 110

1279 **Chair:** Riggs J. Klika, FACSM. *Pepperdine University, Malibu, CA.*  
(No relationships reported)

1280 **Board #1** June 2, 8:00 AM - 10:00 AM  
**Self-Reported Fatigue Does Not Highly Correlate with Objectively Measured Fatigue in Cancer Survivors**

Trista L. Manikowske<sup>1</sup>, Jessica M. Brown<sup>1</sup>, Cristina Jansson<sup>2</sup>, Jeremy D. Smith<sup>2</sup>, Reid Hayward<sup>1</sup>. <sup>1</sup>University of Northern Colorado and the Rocky Mountain Cancer Rehabilitation Institute, Greeley, CO. <sup>2</sup>University of Northern Colorado, Greeley, CO.  
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(No relationships reported)

Despite its prevalence, cancer-related fatigue (CRF) is seldom assessed and treated in clinical practice. Due to the subjective and multifactorial causes of CRF, accurately assessing CRF is challenging. Self-reported measures are widely used and accepted for CRF assessment, however, these are not objective measures of fatigue. Direct assessment of fatigue through muscle function testing could provide further insight into how cancer survivors experience fatigue, which could lead to improved exercise-based interventions that target fatigue.

**PURPOSE:** To evaluate the relationship between subjective self-reported psychometric fatigue measures and objectively-measured muscular fatigue in cancer survivors. **METHODS:** Cancer survivors (N = 117; ages 60 ± 13 years) were asked to complete the Revised Piper Fatigue Scale (PFS) which produces a total score and four subscale scores: behavioral/severity, affective, sensory, and cognitive/mood. A handgrip fatigue index (HFI) was determined for each participant by repetitively squeezing a handgrip dynamometer 15 times with maximal force each repetition. Participants also completed 15 maximal force knee extensions at a joint velocity of 60 deg·s<sup>-1</sup> and a quadriceps fatigue index (QFI) was computed. Each fatigue index was computed as the difference between the average of the first two cycles and the average of the last two cycles divided by the average of the first two cycles and expressed as a percentage. **RESULTS:** Cancer survivors exhibited similar fatigue indices during hand grip (34±15%) and knee extension tests (35±11%) when compared with non-cancer populations from the literature. Significant relationships between the PFS total score and HFI (r<sup>2</sup> = .120; p = .001) and the PFS sensory subscale and HFI (r<sup>2</sup> = .143; p < .001) were observed, but less than 15% of the variance was explained in either relationship. No significant relationships were observed between PFS and QFI (p = .309). **CONCLUSION:** These results suggest that cancer survivors display similar rates of muscular fatigue compared with non-cancer populations and that self-reported fatigue measures are not good measures of local muscular fatigue rates in cancer survivors. As a result, subjective measures of fatigue should not be a primary determinant of the exercise dose in cancer survivors.

1281 **Board #2** June 2, 8:00 AM - 10:00 AM  
**Feasibility of an Aerobic Exercise Intervention in Rectal Cancer Patients During and After Neoadjuvant Chemoradiotherapy**

Andria R. Morielli, Nawaid Usmani, Normand G. Boulé, Tirath Nijjar, Joseph Kurian, Keith Tankel, Diane Severin, Kerry S. Courneya. *University of Alberta, Edmonton, AB, Canada.*  
(No relationships reported)

Standard treatment for locally advanced rectal cancer includes 5-6 weeks of neoadjuvant chemoradiotherapy (NACRT) followed by definitive surgery 6-8 weeks

later. NACRT improves outcomes but is also associated with substantial toxicity and side effects including declines in physical fitness that may impede symptom management, treatment response and post-surgical recovery. **PURPOSE:** The primary purpose of this phase I study was to assess the feasibility and safety of an aerobic exercise intervention in rectal cancer patients during and immediately after NACRT. Changes in objective health-related fitness and patient-reported outcomes were also tracked. **METHODS:** Rectal cancer patients scheduled to receive NACRT followed by definitive surgery were recruited from the Cross Cancer Institute in Edmonton Alberta. All participants received a supervised moderate intensity aerobic exercise program 3 days/week during NACRT followed by unsupervised aerobic exercise for ≥ 150 minutes/week post-NACRT. Feasibility was determined by eligibility rate, recruitment rate, follow-up rate and exercise adherence. Safety was assessed by tracking any serious adverse events that occurred during exercise testing or the supervised exercise sessions. Health-related fitness and patient-reported outcomes were assessed pre-NACRT, post-NACRT and pre-surgery. **RESULTS:** Of 45 rectal cancer patients screened, 32 (71%) were eligible and 18 (56%) were recruited. Follow-up rates post-NACRT were 83% for health-related fitness outcomes and 94% for patient-reported outcomes. Patients attended a median of 83% of their supervised exercise sessions and completed an average of 222 ± 155 minutes/week of their unsupervised exercise. No serious adverse events were observed. Most health-related fitness and patient-reported outcomes declined during NACRT and recovered from post-NACRT to pre-surgery. For example, estimated VO2 max declined from pre- to post-NACRT (mean change, -1.3 ml/kg/min; 95% CI, -3.6 to 1.7) and then increased from post-NACRT to pre-surgery (mean change +2.4 ml/kg/min; 95% CI, -0.9 to 5.7). **CONCLUSION:** Aerobic exercise is feasible and safe for rectal cancer patients during and after NACRT. Phase II randomized trials are needed to establish the benefits and harms of aerobic exercise in this patient population.

1282 **Board #3** June 2, 8:00 AM - 10:00 AM  
**Patient-reported Barriers to Exercise and Predictors of Exercise Adherence During Adjuvant Chemotherapy for Breast Cancer**

Kelcey A. Bland<sup>1</sup>, Amy A. Kirkham<sup>1</sup>, Cheri L. van Patten<sup>2</sup>, Sarah E. Neil-Sztramko<sup>1</sup>, Alis Bonsignore<sup>3</sup>, Karen A. Gelmon<sup>2</sup>, Donald C. McKenzie<sup>1</sup>, Kristin L. Campbell<sup>1</sup>. <sup>1</sup>University of British Columbia, Vancouver, BC, Canada. <sup>2</sup>British Columbia Cancer Agency, Vancouver, BC, Canada. <sup>3</sup>University of Toronto, Toronto, ON, Canada.  
(No relationships reported)

The benefits associated with exercise training during chemotherapy for breast cancer are well known. However, information regarding barriers and adherence to a supervised exercise-training program during cancer treatment is limited.

**PURPOSE:** To describe patient-reported barriers to exercise and identify predictors of adherence to a supervised exercise program during chemotherapy for breast cancer.

**METHODS:** Women with early stage breast cancer were enrolled in the Nutrition and Exercise During Adjuvant Treatment trial, a thrice weekly supervised aerobic and resistance exercise program for ≥50% of the duration of adjuvant chemotherapy (8-24 wks). Patient-reported barriers were collected at baseline using a standard exercise barriers questionnaire and are summarized as % of participants who reported barriers 'often' or 'very often.' Potential predictors of adherence included demographic, quality of life, fitness and medical variables. Program adherence was defined as % of sessions attended. Univariate linear regression was used to determine significant (p < 0.05) and potential (p < 0.10) predictors of adherence.

**RESULTS:** 68 participants (mean age=51±11 yrs) attended >1 study session, completing a mean of 11 weeks of exercise. The most common patient-reported barriers at baseline were exercise being perceived as boring (31.3%), or not a priority (28%), lack of equipment (21.5%), and fear of injury (21.5%). Intervention adherence to prescribed number of sessions was 64±14%. Marital status (p = 0.04) and having ≥3 comorbidities (β=-24.1, p = 0.01) predicted significantly lower adherence. Income >\$80,000 (β=-14.9, p=0.03), university education (β=+17.7, p = 0.04) and higher physical functioning (β = +0.5, p=0.02) predicted significantly higher adherence. Trends in adherence were also observed in those who had higher baseline physical activity (β = +0.2, p = 0.05), a child as a caregiver (β = -8.3, p = 0.09) and a diagnosis of hypertension (β = -8.0, p = 0.10).

**CONCLUSIONS:** Exercise being perceived as boring or not a priority, access to equipment, and fear of injury are important barriers to address in exercise program design. Furthermore, determining demographic factors linked to adherence may allow for identifying individuals with greater adherence challenges and adapting interventions accordingly.

1283 Board #4 June 2, 8:00 AM - 10:00 AM  
**A Community-Based Exercise Rehabilitation Programme Improves Physical And Psychological Health In Breast Cancer Survivors.**

Saskia van den Ende, Stacey Reading, Brendon Roxburgh.  
*University of Auckland, Auckland, New Zealand.*  
 (No relationships reported)

Following breast cancer therapy, upper-body symptoms and functional impairment sufficient to reduce quality of life (QOL) is common. Emerging evidence shows that participation in rehabilitative exercise programming following treatment can improve the physical and psychological health of those affected by cancer. **PURPOSE:** The purpose of this study was to investigate the effect of a 12 week community-based exercise rehabilitation programme on the physical and psychological health of breast cancer survivors. **METHODS:** Twenty one participants (55 ± 8.5 yrs) who were 1 ± 1.8 years post-treatment (n=1 surgery only, n=5 surgery and radiation, n=4 surgery and chemotherapy, n=11 surgery, radiation and chemotherapy) completed 12 weeks of exercise in a community-based rehabilitation clinic. Exercise sessions consisted of 30 to 45 minutes of low to moderate intensity aerobic exercise supplemented with resistance and flexibility exercises performed 2 to 3 times per week. Pre- and post-program assessment included anthropometric measures, estimated aerobic capacity (graded treadmill protocol to a RPE of 4 out of 10), upper body strength measures (predicted one repetition maximum (1RM) chest press and shoulder press), QOL (FACT-B Questionnaire) and upper body disability measures (DASH Questionnaire). Significant differences (p<.05) between pre- and post-program measures were identified by dependent sample t-test. Data are the mean ± SD. **RESULTS:** Participants attended 86 ± 13% of total prescribed sessions. BMI remained unchanged (29.4 kg.m<sup>2</sup> to 29.2 kg.m<sup>2</sup>). The submaximal workload eliciting a RPE of 4 significantly increased (5.5 ± 0.74 METs to 6.8 ± 1.1 METs) as did the predicted 1RM for chest press (11.0 ± 4.8kg to 15.0 ± 6.1kg) and shoulder press (7 ± 3.4kg to 11 ± 3.3kg). Self-reported QOL significantly improved (FACT-B score: 109.2 ± 16.9 to 115.9 ± 16.1) as did the FACT-B trial index score, (69.2 ± 11.4 to 73.1 ± 11.6) and upper body disability scores (21.4 ± 15.7 to 14.5 ± 11.6). **CONCLUSION:** Participation in a 12 week community-based exercise rehabilitation programme improves physical (estimated aerobic capacity and upper body strength) and psychological (FACT-B and DASH scores) health in breast cancer survivors.

1284 Board #5 June 2, 8:00 AM - 10:00 AM  
**Cancer Survivor Rehabilitation Program Results: Cognition Changes?**

Hillary Conner<sup>1</sup>, Tim Burnham<sup>1</sup>, Katie Kemble<sup>2</sup>. <sup>1</sup>Central Washington Univ., Ellensburg, WA. <sup>2</sup>University of Washington, Seattle, WA.  
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Cancer survivors are often left without guidance to rehabilitate themselves back to prior physical, emotional and psychosocial status. Chemo-brain (decreased cognitive function) has become a recognized problem for cancer survivors, however little evidence exists about interventions that may improve cognition for cancer survivors. **PURPOSE:** To measure the effectiveness of a cancer survivor rehabilitation program. **METHODS:** Forty-six post-treatment cancer survivors, (3 men, 43 women, 35-77 years) were subjects in a one group pre-post quasi-experimental design. Subjects were cleared for exercise by their primary oncologist. The program consisted of two 90 minutes sessions a week for 12 weeks. Each meeting was divided into 3 sections: an educational activity, cardiovascular endurance training, and a strength and flexibility session. The dependent measures included: aerobic capacity, body fat %, lower body flexibility, handgrip strength, quality of life, Schwartz fatigue scale, and the LASA scale (fatigue, anxiety, confusion, depression, energy and anger). A subset of this group (n = 7) participated in brain exercise games once a week for 15 minutes. This group completed the GPCOG screening test pre and post study. **RESULTS:** The following measures showed statistically significant (p < .05) improvements. Aerobic capacity increased 19.2%, body fat decreased by 1.8 %, lower body flexibility improved 14.1%, handgrip strength increased 12.6%. Quality of life increased 12.6%. Fatigue measured by the Schwartz scale decreased 21%, LASA scale results: fatigue decreased 36%, depression decreased 59%, confusion decreased 46%, energy increased 35%, anger decreased 44%, anxiety decreased 31%. Cognition increased 13.3% but did not reach statistical significance (p = .11). **CONCLUSIONS:** The combination of tools acquired in the cancer rehabilitation program proved effective at reducing symptoms often seen in post-treatment cancer survivors and improving overall quality of life. Additionally, the subset that participated in brain exercise showed improvement in cognition, however this measure did not reach statistical significance. Future studies may want to consider measures of cognitive changes in a larger group of cancer survivors in response to a rehabilitation program.

1285 Board #6 June 2, 8:00 AM - 10:00 AM  
**Randomized Trial Of Exercise On Body Composition In Breast Cancer Survivors Taking Aromatase Inhibitors**

Gwendolyn A. Thomas<sup>1</sup>, Brenda Cartmel<sup>1</sup>, Maura Harrigan<sup>1</sup>, Martha Fiellin<sup>1</sup>, Scott Capozza<sup>1</sup>, Yang Zhou<sup>1</sup>, Elizabeth Ercolano<sup>1</sup>, Cary Gross<sup>1</sup>, Dawn Hershman<sup>2</sup>, Jennifer Ligibel<sup>3</sup>, Kathryn Schmitz, FACSM<sup>4</sup>, Fang-yong Li<sup>1</sup>, Tara Sanft<sup>1</sup>, Melinda L. Irwin, FACSM<sup>1</sup>. <sup>1</sup>Yale University, New Haven, CT. <sup>2</sup>Columbia University, New York, NY. <sup>3</sup>Dana Farber Cancer Institute, Boston, MA. <sup>4</sup>University of Pennsylvania, Philadelphia, PA.  
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 (No relationships reported)

Current guidelines recommend that postmenopausal women with hormone receptor-positive stage I-III breast cancer take an aromatase inhibitor (AI) for 5 years. The primary side effect of AIs is bone mineral density (BMD) loss and increased risk of fracture, contributing to poor adherence and early discontinuation of the drug. However, some research suggests that adverse body composition changes may also occur, particularly in fat mass. In addition, breast cancer survivors who are overweight/obese are at elevated risk for AI related arthralgia, chronic diseases, and increased mortality. Thus, it is important to identify effective interventions for improving body composition, decreasing BMI, and attenuating adverse side effects of AIs in order to improve long term health and survival of breast cancer survivors. **Purpose:** We examined the effect of 12 months of aerobic and resistance exercise vs. usual care on changes in body composition, BMI, and BMD in postmenopausal breast cancer survivors taking AIs. **Methods:** 121 breast cancer survivors were enrolled in the Hormones and Physical Exercise (HOPE) study. Participants were randomized to either supervised twice-weekly resistance exercise training and unsupervised 150 minutes per week of aerobic exercise (N=61) or usual care (N=60) group. Dual energy X-ray absorptiometry (DXA) scans were conducted at baseline, 6-months, and 12-months to assess % body fat, lean body mass (LBM) and BMD. **Results:** At 12-months, the exercise group relative to the usual care group had a significant increase in LBM (0.32 vs -0.88, p=0.03), a decrease in percent body fat (-1.4 vs 0.48, p=0.03), and a decrease in BMI (-0.73 vs 0.17, p=0.03). BMD was not significantly different between groups at 12 months. **Conclusion:** A combined resistance and aerobic exercise intervention improved LBM, BMI and body fat, which may improve AI side effects and survival in breast cancer survivors taking AIs. Future studies should enroll women at AI initiation to determine if exercise attenuates BMD losses seen with AIs.

1286 Board #7 June 2, 8:00 AM - 10:00 AM  
**Comparing Indices of Neuromuscular Fatigue with Subjective Fatigue in Cancer Survivors**

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 (No relationships reported)

Cancer-related fatigue (CRF) is the most common patient reported side effect of cancer treatment. There is no universally accepted definition of CRF, thus it is rarely addressed in cancer patients and survivors. Although it is a multi-dimensional concept, including physiological and psychological aspects, it currently is quantified almost exclusively through subjective scales, thereby missing key physiological factors, specifically indicators of neuromuscular (NM) fatigue. Traditional NM fatigue tests are often single-joint isometric contractions and do not reflect activities of daily living (ADL) corresponding to quality of life. Since cycling is a whole-body dynamic exercise and a common exercise in rehabilitation for cancer survivors, we evaluated NM function before, during and after an incremental cycling test in cancer survivors. **PURPOSE:** To determine if there are differences in knee extensors (KE) NM function at rest and during exercise between subjectively fatigued and non-fatigued cancer survivors. **METHODS:** Cancer survivors (n=17, age 53 ± 12 years) completed the FACIT-F Scale and NM function testing before, during and following an incremental cycling test to task failure consisting of 3-minute stages separated by an isometric maximal voluntary contraction (MVC) and evoked stimulation of the femoral nerve. Pre-testing occurred on a chair with KE force measured isometrically by force transducer. Testing during cycling took place on a recumbent ergometer with instrumented pedals, which were immobilized instantaneously at the end of each stage, to measure isometric force. Unpaired t-tests compared resting twitch and MVC on the ergometer prior to exercise in 6 fatigued (FACIT-F: 25 ± 3) and 11 non-fatigued (FACIT-F: 44 ± 6) subjects based on FACIT-F 34/52 cut off for significant fatigue. **RESULTS:** KE twitch at rest normalized to body mass was significantly lower in the fatigued group than the non-fatigued group (0.85 ± 0.18 vs 1.05 ± 0.18 N·kg<sup>-1</sup>, p=0.04). There was no significant difference between groups for MVC (p=0.14) or any fatigue index (i.e. Δ % voluntary activation, peak twitch, MVC). **CONCLUSION:** Preliminary results show that fatigued cancer survivors may have a deteriorated muscle function at rest but are not more fatigable with an exercise that mimics ADL.

Study funded by an anonymous donor.

1287 Board #8 June 2, 8:00 AM - 10:00 AM  
**Resistance Exercise Prescription Using Rate Of Perceived Exertion In Exercise Oncology-a Novel Concept**  
 Ciaran M. Fairman<sup>1</sup>, Eric R. Helms<sup>2</sup>, Brian C. Focht, FACSM<sup>1</sup>.  
<sup>1</sup>The Ohio State University, Columbus, OH. <sup>2</sup>UT Millennium Institute, AUT University, Auckland, New Zealand. (Sponsor: Dr. Brian C. Focht, FACSM)  
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 (No relationships reported)

Currently, there exist general recommendations of physical activity for cancer population. Resistance Exercise (RE) recommendations are 2-3 days per week of 1-3 sets of 8-12 repetitions, at 60-70% 1RM of total body exercise. While these recommendations appear to be sufficient in an oncology setting, it could be argued that a generic prescription approach may very well be masking the full therapeutic potential of exercise. Consequently, there is a need to determine what dose, sequencing, combination, or indeed timing of exercise is not only effective, but optimal. Rate of Perceived Exertion (RPE) has been supported as a reliable method of quantifying resistance exercise intensity. **PURPOSE:** The purpose of this study was to assess the rate of perceived exertion as a method of monitoring resistance exercise intensity in prostate cancer patients, and to discuss the utilization of RPE to adjust session intensity and ensure an appropriate training stimulus. **METHODS:** 30 male prostate cancer patients performed each intensity three times. The protocol included performing the leg extension and chest press. at 50%, 75%, and 90% of the participants 1 repetition maximum (1RM). **RESULTS:** A within-subjects repeated measures ANOVA showed a significant difference among the mean RPE values of each intensity for each lift. The 75% intensity RPE values were significantly higher than the 50% intensity (p<0.05) RPE values and the 90% intensity RPE values were significantly higher than the 50% (p<0.05) and 75% (p<0.05) intensity RPE values respectively. **CONCLUSIONS:** RPE may be a reliable method of monitoring RE intensity, and may be a valuable tool to adjust a training stimulus to account for daily fluctuations in readiness to train.

**C-18 Thematic Poster - Fatigue**  
 Thursday, June 2, 2016, 8:00 AM - 10:00 AM  
 Room: 109  
 1288 **Chair:** Sandra K. Hunter, FACSM. *Marquette University, Milwaukee, WI.*  
 (No relationships reported)

1289 Board #1 June 2, 8:00 AM - 10:00 AM  
**The Effects of Trunk Fatigue on Proximal Joint Kinematics and Coupling During Running**  
 Paul W. Kline, Kristin D. Morgan, Katie Grim, Katelyn Ackerman, Brian Noehren, FACSM. *University of Kentucky, Lexington, KY.* (Sponsor: Brian Noehren, FACSM)  
 (No relationships reported)

Fatigue is a risk factor for injury and may alter neuromuscular coordination. The trunk accounts for a large percentage of overall body mass and relies on local musculature to control the body's center of mass (COM). As the trunk fatigues, it has a reduced ability to control the COM and may alter joint mechanics and coordination leading to injury. **PURPOSE:** To determine how trunk fatigue changes trunk and pelvis excursion and coupling during running. **METHODS:** Instrumented gait analysis was performed on 32 subjects (16 M, age 21 ± 3 yrs, H: 1.7 ± 0.1 m, M: 65.3 ± 12.5 kg, Tegner: 6.4 ± 1.3). Subjects ran at a self-selected speed (3.1 ± 0.5 m/s) until reporting a 14 on the Borg scale. Next, the subjects performed a trunk fatiguing circuit. Once fatigued, the subjects ran at their previous speed for a 2nd gait analysis. Visual3D and MATLAB were used to calculate joint excursion and angle-angle plots for the trunk and pelvis motions during the stance phase of running. A line of best fit was applied to all angle-angle plots to assess joint coupling. Paired t-tests were used to test differences between the fresh and fatigued conditions. **RESULTS:** There was a significant reduction in pelvic excursion when fatigued in all three planes (Table 1). There were no significant differences in trunk or hip excursion or joint coupling between the fresh and fatigued states. **CONCLUSIONS:** Reduced pelvic excursion may be an adaptation to reduce the work the trunk muscles perform. However, no changes in joint coupling were found suggesting that coordination patterns within limbs are maintained. Potentially, trunk

fatigue may affect conditions such as anterior knee pain which have been linked to altered pelvic mechanics. Research reported was supported through grant number TL1TR00015.

Table 1: Segment excursions and trunk-pelvis coupling during fresh and fatigued running.

Segment	Fresh (Mean ± SD)	Fatigued (Mean ± SD)	p-value
Trunk Excursion	Sagittal: 4.0 ± 1.2*	Sagittal: 4.1 ± 1.2*	.416
	Frontal: 6.0 ± 2.1*	Frontal: 6.0 ± 2.2*	.689
	Transverse: 31.4 ± 7.5*	Transverse: 30.7 ± 7.0*	.241
Pelvis Excursion	Sagittal: 6.8 ± 1.8*	Sagittal: 6.2 ± 1.7*	.009*
	Frontal: 13.0 ± 3.3*	Frontal: 11.7 ± 3.4*	.000*
	Transverse: 8.2 ± 3.2*	Transverse: 7.4 ± 2.9*	.016*
Trunk-Pelvis Coupling	Sagittal: -4.4 ± 7.7	Sagittal: -5.4 ± 8.4	.109
	Frontal: -0.75 ± 4.1	Frontal: -1.0 ± 2.6	.597
	Transverse: -2.2 ± 3.6	Transverse: -2.5 ± 3.1	.492

\*significant at p<0.05. Coupling is represented as the slope of the line of best fit for the angle-angle plot.

1290 Board #2 June 2, 8:00 AM - 10:00 AM  
**The Effect of Mental Fatigue on Neuromuscular Function**  
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 (No relationships reported)

A link between mental fatigue and neuromuscular function has been suggested but the mechanisms underlying this relationship are unclear. Elucidation of this relationship could benefit those who are affected by disorders characterized by fatigue or those affected by age-related frailty and falls. **PURPOSE:** To determine if mental fatigue has an effect on maximal force production or twitch properties of the muscle. **METHODS:** Seven young, healthy individuals (age=24.2±3.2 years; 4 females) participated in the study. Maximal voluntary contraction (MVC) force and stimulated contractile properties were assessed in the ankle dorsiflexor muscles. The latency and peak to peak amplitude of the M-wave were also recorded from the tibialis anterior. All measures were obtained before and after 20 minutes of the psychomotor vigilance task (PVT), a sustained attention task that induces mental fatigue, as indicated by increases in reaction time. **RESULTS:** Reaction time during the PVT was significantly longer over the last 5 minutes of the task, compared with the first five minutes (p=0.04), indicative of mental fatigue. Peak twitch force was significantly lower (p=0.01) after the mental fatigue task, compared with baseline. However, MVC (p=0.73), time to peak twitch force (p=0.61), and the half relaxation time of twitch force (p=0.26) were not significantly different after the mental fatigue task. Latency (p=0.94) and peak to peak amplitude (p=0.98) of the M-wave were also not significantly different after the mental fatigue task. **CONCLUSIONS:** Although most neuromuscular measures remained unchanged by mental fatigue, the reduction in peak twitch force suggests that mental fatigue may affect peripheral neuromuscular function.

1291 Board #3 June 2, 8:00 AM - 10:00 AM  
**Measuring Fatigue Induced Changes On Kinematic And Electromyography Measurements During Long-distance Road Cycling**  
 Carmen van den Hoven<sup>1</sup>, Rianne Huis in 't Veld<sup>1</sup>, Erik Maartens<sup>2</sup>, Anko Boelens<sup>3</sup>, Jasper Reenalda<sup>2</sup>. <sup>1</sup>OCOC Centre for Orthopaedic Surgery and Sports Medicine, Hengelo, The Netherlands, Hengelo, Netherlands. <sup>2</sup>Roessingh Research & Development, Enschede, Netherlands. <sup>3</sup>Team Giant Alpevine, Hengelo, Netherlands. (Sponsor: Brian W. Noehren, FACSM)  
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 (No relationships reported)

The highly repetitive movement makes cycling prone to injuries. Research showed the importance of effective muscle recruitment and kinematics in preventing these injuries. However, little evidence exists on how fatigue influences these factors, mainly due to a lack of possibilities to measure kinematics outside the laboratory. Advances in sensor technology allow for mobile measurement of neuromuscular control and kinematics to quantify the fatiguing effects of sport-specific duration and setting in cycling. **PURPOSE:** Quantifying the effects of sport-specific fatigue on neuromuscular activation and lower limb kinematics in road cycling. **METHODS:** 6 Elite female cyclists (Age: 22.8 ± 2.2. Height: 169 ± 7 cm. Weight: 57.3 ± 2.9 kg. Power > 4,5 W/kg) performed a 205 altitude meters hill climb (avg. incl. 8%) twice, interspersed by a flat 1 hour cycle at mild intensity. Bilateral surface electromyography (EMG) of the m. vastus medialis (VM) and m. vastus lateralis (VL) was combined with wireless inertial magnetic units (IMU's) at the lower and upper leg, sacrum and sternum to measure kinematics. A paired Wilcoxon signed-rank test was used to compare EMG (VL:VM activation ratio) and IMU data (3D knee and hip ROM) during the final minute of the first (UH1) and second, fatigued uphill ride (UH2).

**RESULTS:** Mean VL:VM ratio showed a non-significant increase of the right(R) (UH1: 1.19 +/- 0.08; UH2: 1.35 +/- 0.22;  $p < 0.06$ ) and left(L) leg (UH1: 1.20 +/- 0.08; UH2: 1.25 +/- 0.10;  $p < 0.34$ ). Sagittal-plane knee angles showed no significant difference between UH1 and UH2, though mean hip angles did show an increase in both R (UH1: 68.0 +/- 3.1<sup>o</sup>; UH2: 73.7 +/- 3.2<sup>o</sup>  $p < 0.031$ ) and L (UH1: 65.2 +/- 4.2<sup>o</sup>; UH2: 72.5 +/- 4.4<sup>o</sup>;  $p < 0.031$ ).

**DISCUSSION:** In this small population significant changes were seen in hip angle as a consequence of fatigue. Non-significant increases in VL/VM ratio were observed. Previous research in patella femoral pain syndrome (PFPS) showed a higher VL:VM ratio (1.78) in symptomatic than in healthy subjects (1.17). This might be an indicator of overuse after repetitive exposure. More subject are needed to test this hypothesis.

**CONCLUSIONS:** This study showed the possibility of continuously measuring muscle activation and kinematics in the sport-specific setting and objectified the effects of fatigue during uphill cycling.

1292 Board #4 June 2, 8:00 AM - 10:00 AM  
**Association Between Intellectual Capacity And Fatigue In Persons With Multiple Sclerosis**

Jeffrey R. Gould<sup>1</sup>, Andrew E. Reineberg<sup>1</sup>, Brice T. Cleland<sup>1</sup>, Kristi E. Knoblauch<sup>1</sup>, Marie T. Banich<sup>1</sup>, John R. Corbo<sup>2</sup>, Roger M. Enoka<sup>1</sup>. <sup>1</sup>University of Colorado Boulder, Boulder, CO. <sup>2</sup>University of Colorado Denver, Denver, CO.

(No relationships reported)

Fatigue is one of the most debilitating symptoms of multiple sclerosis (MS) and the underlying mechanisms are poorly understood. When exposed to a physical or cognitive challenge, persons with MS exhibit a decline in task performance and increased fatigue. These effects, however, can be attenuated by intellectual capacity. We hypothesized that the fatigue experienced by persons with MS would be inversely related to intellectual capacity.

**Purpose:** To examine the association between intellectual capacity, state and trait levels of fatigue, and fatigability in persons with MS.

**Methods:** Twelve adults with relapsing-remitting MS and 12 control (CO) subjects (1 male) were matched for age, sex, and intellectual capacity, which was estimated using the Verbal score of the Wechsler Abbreviated Scale of Intelligence. Trait fatigue was assessed using the modified fatigue impact scale (MFIS). Fatigability was measured as the decline in maximal voluntary (MVC) force following 60 isometric contractions (10-s contraction, 5-s rest) performed at 25% MVC with the knee extensor muscles. Estimates of state fatigue (rating of perceived exertion; RPE), force steadiness, and EMG activity were recorded at 7 time points during the fatiguing protocol.

**Results:** Persons with MS reported greater trait fatigue as measured by the MFIS questionnaire (MS: 43.1 ± 14.4; CO: 11.25 ± 8.4,  $P \leq 0.001$ ). Knee extensor strength did not differ for the two groups (MS: 112 ± 38 N·m; CO: 107 ± 44 N·m) and there were similar declines in MVC force (MS: 15 ± 19 N·m; CO: 13 ± 16 N·m) after the fatigue protocol. Verbal IQ was used to control for premorbid intellectual capacity (MS: 112 ± 13; CO: 114 ± 10). RPE increased during the fatiguing contraction for both groups ( $P < 0.001$ ), but was significantly greater in magnitude ( $P = 0.03$ ) and increased more rapidly for the MS group (group x time interaction,  $P = 0.05$ ). CV for force increased during the fatigue protocol (main effect for time,  $P = 0.05$ ) and force steadiness was less for the MS group (main effect for group,  $P = 0.02$ ). Verbal IQ was correlated with the decline in force steadiness ( $r = -0.82$ ,  $P = 0.001$ ).

**Conclusion:** Intellectual capacity was not associated with trait fatigue in persons with MS, but was associated with adjustments in neuromuscular function during the fatiguing contraction.

1293 Board #5 June 2, 8:00 AM - 10:00 AM  
**The Influence of Sport-Specific Fatigue on Neuromuscular Activation and Joint Angles in ACL Reconstructed Knees**

Rianne Huis in 't Veld<sup>1</sup>, Carmen van den Hoven<sup>1</sup>, Erik Maartens<sup>2</sup>, Stephanie Hoogendoorn<sup>3</sup>, Roy Hoogeslag<sup>1</sup>, Anil Peters<sup>1</sup>, Christiaan Rompen<sup>1</sup>, Jasper Reenalda<sup>2</sup>. <sup>1</sup>OCN Centre for Orthopaedic Surgery and Sports Medicine, Hengelo, Netherlands. <sup>2</sup>Roessingh Research & Development, Enschede, Netherlands. <sup>3</sup>University of Twente, Enschede, Netherlands.

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(No relationships reported)

Reconstructive surgery is done to re-establish dynamic knee stability after anterior cruciate ligament (ACL) rupture. Clinical results show that only 50% of patients return to their previous competitive level and 33% suffer a contralateral ACL rupture or re-rupture. Literature shows increased risk of rupture near the end of a competition, yet no research has been done on combined neuromuscular and kinematic changes following sport-specific fatigue in ACL reconstructed (ACLr) knees. Research has been restricted to laboratories, though advances in sensor technology now allow for outside, sport-specific measurements.

**PURPOSE:** Objectifying effects of sport-specific fatigue on joint angles and neuromuscular activation of the ACLr knee.

**METHODS:** 8 patients (5 male, 3 female, 21.6 ± 3.7 yrs, 179.5 ± 9.2 cm. 70 ± 27.6 kg) 1 year post ACLr (Hamstring tendon graft) ran 4x15 minutes on a 20m course, interspersed with hop-tests (HT) (drop-vertical jump (DVJ) and hop for distance (HfD)). Bilateral surface electromyography (EMG) of the m. vastus lateralis (VL) and m. biceps femoris (BF) was combined with wireless inertial magnetic units (IMU's) at the sacrum, upper and lower legs to measure kinematics. A repeated measures ANOVA ( $P < .05$ ) was used to compare EMG (VL:BF activation ratio) and IMU data (3D knee ROM) during landing phases of 5 HT series and each running block.

**RESULTS:** VL:BF ratio increased during the 2nd running block (0.83 ± 0.14 → 1.07 ± 0.08). Changes in knee flexion angles were seen ( $F_{4,28} = 40.96$ ,  $P < .001$ ). Post hoc Tukey analysis showed significant changes between the unfatigued 1st and slightly fatigued 3rd HT (DVJ: 18.3 ± 5.1<sup>o</sup> → 15.9 ± 5.7<sup>o</sup>. HfD: 22.3 ± 5.5<sup>o</sup> → 19.4 ± 6.1<sup>o</sup>). Non-significant decreases are seen in the last HT (DVJ: 9.9 ± 5.8<sup>o</sup>. HfD: 19.0 ± 6.1<sup>o</sup>). Max knee valgus angles during the DVJ HT increased with fatigue ( $F_{4,28} = 18.18$ ,  $P < .001$ . 2.7 ± 3.6<sup>o</sup> → 4.9 ± 3.0<sup>o</sup>). Strikingly, ACLr knees showed significant (Wilcoxon,  $P < 0.031$ ) lower valgus angles (4.0 ± 1.5<sup>o</sup>) compared to the healthy side (5.6 ± 2.4<sup>o</sup>) in fatigued HT.

**CONCLUSIONS:** This was the first study to combine neuromuscular and kinematic measurements in a sport-specific setting to objectify effects of fatigue. In line with the notion of increasing ACL ruptures towards the end of competition, sport-specific fatigue affected muscle activation and kinematics of the ACLr knee.

1294 Board #6 June 2, 8:00 AM - 10:00 AM  
**The Effect of Localized Upper Body Fatigue on Static and Dynamic Balance**

Jaclyn S. Powell, Kristen M. Blankenship, Esther Y. Kim, Jonathan M. Lloyd, Kristen L. Jagger, Adrian Aron. Radford University, Radford, VA. (Sponsor: Trent A. Hargens, FACSM)  
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(No relationships reported)

Fatigue is one of the mechanisms with a great impact on the neuromuscular motor control. Lower extremity fatigue has been shown to alter static and dynamic balance through the effects on the lower muscles involved in balance control. Upper body exercises that lead to localized fatigue are commonly utilized in physical therapy clinics.

**PURPOSE:** The aim of this study was to determine the effects of upper body muscle fatigue on dynamic and static balance in young and old populations.

**METHODS:** Static and dynamic balance assessments were performed on 17 males (age 36.6 ±

15.6 years) before and after an upper body fatigue protocol. Static balance was assessed on the NeuroCom Equitest system using the Sensory Organization Test protocol, while dynamic balance was evaluated using the Lower Quarter Y-Balance Test normalized to leg length. Fatigue was induced through arm ergometry testing consisted of 25 watt/minute (70-80 rpm) incremental exercise protocol until exhaustion. Lactate was measured before and after the fatigue protocol in order to provide an objective measure of the participant's fatigue level.

**RESULTS:** There was a significant difference between young and old groups when comparing dynamic balance performance on the right leg (92.4 ± 6.4 vs 81.2 ± 10.3,  $p < 0.001$ ). Similar results were found for the left leg (91.6 ± 6.3 vs 83.5 ± 9.6,  $p < 0.001$ ). No significant differences were found within each of the age groups when comparing pre- and post-fatigue for dynamic balance on the right leg ( $p = 0.70$ ) and left leg ( $p = 0.49$ ). Static balance performance was not different between young and old groups pre fatigue (81.2 ± 10.2 vs 82.2 ± 3.5,  $p = 0.31$ ) or post fatigue (79.8 ± 9.4 vs 83.3 ± 3.8,  $p = 0.46$ ). The same not significant trend for static balance was demonstrated within groups pre and post fatigue ( $p = 0.38$ ).

**CONCLUSIONS:** A single high intensity session of localized upper body fatigue did not significantly impact static or dynamic balance. It appears that core and upper extremity musculature were not recruited enough to alter the sensory and motor function. Age did not have an effect on the efficient use of strategies for postural control. These results suggest that clinicians may be able to safely implement intense upper body exercises without significantly increasing fall risk.

1295 Board #7 June 2, 8:00 AM - 10:00 AM  
**Effects of Gluteal Fatigue on Shoulder and Scapula Kinematics Among NCAA Division I Softball Athletes**

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(No relationships reported)

**PURPOSE:** The purpose of this study was to examine the effects of gluteal fatigue on shoulder and scapula kinematics during all phases of an overhead throw among National Collegiate Athletic Association (NCAA) Division I softball

players. **METHODS:** Ten NCAA Division I softball players (19.89 ± 1.36 years, 172.18 ± 8.52 cm, 74.64 ± 9.98 kg) volunteered. Over the course of three consecutive days athletes performed 60ft (18.3m) throws before and after a gluteal fatigue intervention. Kinematic data to describe the throwing motion were collected using an electromagnetic tracking system at a frequency of 100Hz. Repeated measures ANOVA were used to identify differences pre- and post-fatigue in shoulder elevation, rotation, and plane of elevation, scapula internal/external rotation, up/down rotation, and anterior/posterior tilt at all phases of throwing (foot contact, maximum external rotation, ball release, and maximum internal rotation). **RESULTS:** There was evidence of gluteal fatigue affecting the throwing motion in the Event x Test interaction for scapular anterior/posterior tilt [ $F(3,7) = 29.35, p < .01$ ] and scapular up/down rotation [ $F(3,7) = 5.54, p = .03$ ], and the main effect of Day and Test for shoulder elevation [ $F(2,8) = 5.01, p = .04, F(1,9) = 21.82, p < .01$ ]. Shoulder plane of elevation, shoulder elevation, and scapula internal/external rotation revealed no statistical significance. **CONCLUSION:** The overhead throwing motion places great demands on the shoulder joint. Research has shown shoulder injuries are among the most common injuries in overhead throwing athletes. Appropriate sequencing of scapular and shoulder motion reduces the risk of injury as well as improves ball velocity and accuracy.

**1296 Board #8 June 2, 8:00 AM - 10:00 AM**  
**Does Fatigue Alter Coordination Variability in Healthy Runners?**

Allison M. Brown<sup>1</sup>, Jocelyn F. Hafer<sup>2</sup>. <sup>1</sup>Rutgers, The State University of New Jersey, Newark, NJ. <sup>2</sup>University of Massachusetts Amherst, Amherst, MA. (Sponsor: Joseph Hamill, PhD, FACSM, FACSM)  
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 (No relationships reported)

Coordination variability (CV) may mediate risk of running injury by providing a variety of movement patterns with which to disperse cumulative loads on tissues. However both increases and decreases in segment CV have been associated with overuse running injury. Risk of overuse injury is also thought to increase with fatigue due to potential changes in running mechanics. It is not known if healthy runners exhibit a change in CV in response to a fatiguing run.

**PURPOSE:** To examine the effect of fatigue on CV of segment motions associated with overuse injury in healthy runners.

**METHODS:** 16 uninjured female runners (29±7 yrs) training ≥15 miles/wk completed a treadmill run to fatigue (Borg RPE 17/20; 24±7 min; 3.3±.2m/s). A modified vector coding technique was used to calculate CV (SD of phase angle) for pelvis frontal vs. thigh frontal (PFTF), thigh sagittal vs. shank sagittal (TSSS), thigh sagittal vs. shank transverse (TSST), and shank transverse vs. rearfoot frontal (STRF) couples from kinematic data. CV was compared at the beginning and end of the run during 4 gait cycle phases using paired t-tests with significance at p<.05.

**RESULTS:** CV was largely unchanged by the run to fatigue (Figure 1). Significant but small changes in CV were observed during early and mid stance in TSSS, and during late stance in PFTF.

**CONCLUSIONS:** The current study demonstrates minimal changes in CV in response to fatigue in healthy runners. This suggests that, in contrast to popular theory, healthy runners may not be at substantially greater risk of overuse injury when fatigued. With fatigue, runners may display differences in joint kinematics and kinetics but maintain an optimal level of CV, potentially distributing any altered stresses across a wider area/volume of tissues.

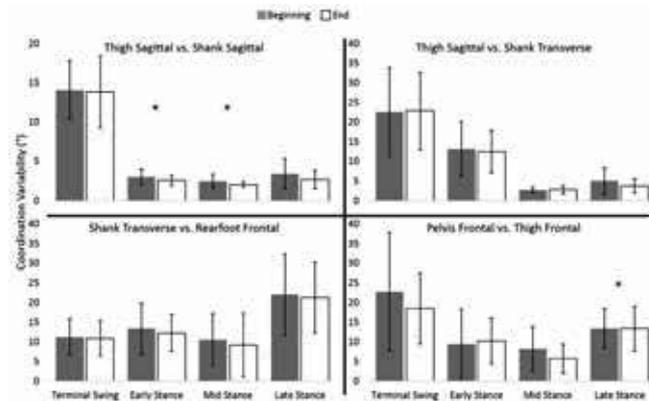


Figure 1. CV for couples of interest from the beginning and end of the fatiguing run across 4 gait cycle phases. \* indicates significant (p<.05) difference across time.

**C-19 Thematic Poster - Running**

Thursday, June 2, 2016, 8:00 AM - 10:00 AM  
 Room: 101

**1297 Chair: Peter Ronai, FACSM. Sacred Heart University, Milford, CT.**

(No relationships reported)

**1298 Board #1 June 2, 8:00 AM - 10:00 AM**  
**The Effect Of Foam Rolling On Recovery Between Two 800-m Runs**

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With the increased popularity of foam rolling as a means of recovery, it is important to establish the exact manner in which the practice is useful. **PURPOSE:** The purpose of this study was to examine the impact of foam rolling on recovery between two 800 m runs.

**METHODS:** Sixteen male middle distance runners (mean±sd; age, 20.5±.5 years; 800 m run time, 145.2±1.8 seconds) participated in the study, using a randomized, crossover design. The subjects completed two 800 m runs on a treadmill, separated by a 30 min rest, during which time a foam rolling protocol or passive rest period was performed. The speed of each run was as fast as possible. Subjects had access to speed controls, but were blinded to the actual speed. Blood lactate concentration and  $\dot{V}CO_2$  were measured prior to and following each run. Stride length, running economy, 800 m run time, and hip extension were measured during each run.

**RESULTS:**  $\dot{V}CO_2$ , stride length, running economy, 800 m run time, and hip extension were not significantly different between conditions ( $p > .05$ ). For blood lactate, no statistical interaction was found between condition and time ( $p > .05$ ).

**CONCLUSIONS:** Foam rolling between two 800 m runs separated by 30 min performed by trained male runners does not alter performance.

Supported by: None

**1299 Board #2 June 2, 8:00 AM - 10:00 AM**  
**Plyometric and Resistance Training Do Not Inhibit Running Economy for Up to 24 Hours**

Richard T. Marcello, Beau K. Greer, Anna E. Greer. Sacred Heart University, Fairfield, CT. (Sponsor: Peter Ronai, FACSM)  
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 (No relationships reported)

Many college runners supplement their run training with plyometric and resistance exercises, yet little is known about their acute effects on running performance.

**PURPOSE:** To investigate the acute effects of plyometric and resistance training (RT) on running economy (RE) in male collegiate distance runners. **METHODS:** Eight male distance runners recruited from a local Division I college completed a  $VO_2$  peak assessment and one repetition max (1RM) testing for four lower body exercises. Two weeks after initial testing, and using a crossover design, each runner completed a continuous 12 minute RE test with six minutes at 60% and 80%  $VO_2$  peak each, followed by a one hour RT protocol or rest (CONT). Running economy was assessed via oxygen consumption ( $VO_2$ ) and energy expenditure (kcal/min) during the last 2 minutes of each RE test intensity. RT consisted of three sets of five reps of two plyometric exercises as well as the four lower body exercises previously tested. All resistance work was performed at 85% of 1RM. Following the RT or CONT treatment, subjects immediately completed another RE test as well as one 24 hrs later. Subjects followed an identical protocol after a one week washout period with the alternate condition (RT or CONT).  $VO_2$ , respiratory exchange ratio (RER), energy expenditure (EE) and ventilation (VE) were recorded during all RE testing. Metabolic data were analyzed parametrically using a repeated measures ANOVA with a Tukey post hoc test. **RESULTS:** There were no significant ( $p > 0.05$ ) increases in  $VO_2$  or EE immediately nor 24 hr post-RT. VE was significantly greater ( $p < 0.05$ ) at 60% and 80%  $VO_2$  peak post-RT (57.01 ± 8.94, 89.26 ± 18.06 L/min) as compared to pre-RT (52.81 ± 9.36, 82.28 ± 16.37 L/min). RER was significantly greater ( $p < 0.05$ ) post-RT (0.94 ± .04) compared to pre-RT (0.93 ± .04) at 80%  $VO_2$  peak. **CONCLUSION:** These findings indicate that high intensity RT does not significantly affect RE in male collegiate distance runners.

THURSDAY, JUNE 2, 2016

1300 Board #3 June 2, 8:00 AM - 10:00 AM  
**The Correlation Between Blood Lactate And Cardiac Troponin I following A Set Of Intermittent Running**  
 Ting-Hao Liu, Kang-Hao Lu, Hung-Hsueh Chen, Kuei-Hui Chan. *National Taiwan Sport University, Taoyuan, Taiwan.*  
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 (No relationships reported)

Exercise intensity is considered to be a key factor affecting the release of cardiac troponin (cTn). However, most of the studies focus on responses of endurance sports or exercise. The experimental data of cTn and other biomarkers responses to intermittent exercise is still limited.

**Purpose:** To determine the correlations between plasma cardiac troponin I (cTnI) and blood lactate, body mass index (BMI), as well as physiological characteristics after intermittent running.

**Methods:** Eighteen healthy, physically active collegiate males performed a graded exercise test to determine their  $\dot{V}O_{2\max}$  and completed the intermittent running protocol 48 h later. This exercise protocol consisted of six 4-min running bouts and separated by 3 min of rest. Running velocity was set at an average of 90%  $\dot{V}O_{2\max}$ . Capillary blood samples were drawn before and immediately after exercise for measuring lactate. Venous blood samples were collected at pre- and 3 h post-exercise for measuring cTnI. The nonparametric Spearman's rank order correlation coefficient was used for statistic analysis.

**Results:** Plasma cTnI concentration was significantly increased following exercise. The delta cTnI was positively correlated with delta lactate ( $p = .013$ ,  $\rho = .57$ ). However, no significant correlations were found between cTnI and body mass index,  $\dot{V}O_{2\max}$ , as well as running velocity.

**Conclusion:** The intermittent running protocol of this study induced the elevation in cTnI. The release of cTnI was associated with blood lactate level. As endurance sports, the intensity of intermittent exercise might be a factor affecting the release of cTnI.

1301 Board #4 June 2, 8:00 AM - 10:00 AM  
**Impact Of Different Cross-training Modes On Economy And Functional Movement In High School Runners**  
 Max R. Paquette<sup>1</sup>, Mark Temme<sup>2</sup>, Shelby A. Peel<sup>1</sup>, Ross Smith<sup>1</sup>, Jeffrey N. Dwyer<sup>1</sup>. <sup>1</sup>University of Memphis, Memphis, TN. <sup>2</sup>OrthoMemphis, Memphis, TN.  
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Injuries often force runners to cross-train in an attempt to maintain fitness with less or no pain. Little research has been conducted to identify the most optimal cross-training modalities for runners. **PURPOSE:** To compare running economy, hip adduction and functional movement screening (FMS) before and after training from three types of cross-training modalities in high school runners. **METHODS:** 31 high school male runners were assigned to one of four groups including running only (RUN; n=9) and, running plus one of cycling (CYCLE; n=6), indoor elliptical (ELL; n=7) or, outdoor elliptical bike (EBIKE; n=9). For four weeks, runners completed the same running training but easy runs (2 per week) were replaced by CYCLE, ELL or EBIKE. Before and after the training interventions, runners performed laboratory tests including running economy (RE:  $\dot{V}O_2$  at set speed), biomechanical running analysis on a treadmill and functional movement screening (FMS). Hip adduction excursion was computed with kinematic data collected using a motion capture system. The two FMS exercises were active straight leg raise and deep squat. Paired t-tests and Cohen's *d* effect sizes were used to compare each variable before and after training for all groups. **RESULTS:** Only the EBIKE group showed a significant improvement in RE before (42.8±4.3 ml/kg/min) and after training (41.2±3.0 ml/kg/min;  $p=0.05$ ,  $d=0.48$ ). The RUN (12.2±2.2° and 9.6±2.7°;  $p=0.07$ ,  $d=1.11$ ) and CYCLE (11.7±2.2° and 10.4±1.2°;  $p=0.07$ ,  $d=0.97$ ) groups showed a significant reduction in hip adduction excursion before and after training. Finally, only the EBIKE group showed a significant improvement in the two FMS exercise score before and after training (3.9±0.8 and 4.9±0.8;  $p=0.03$ ,  $d=1.36$ ). **CONCLUSION:** EBIKE training may be the most effective modality to improve RE. However, the applicability of this finding is questionable due to a small effect size ( $d=0.48$ ). Hip adduction excursion during stance was more effectively reduced with RUN or CYCLE training. The reduction in hip adduction may have been the result of strengthening drills included in the runners' training. Finally, large improvements in FMS scores suggest that EBIKE training could potentially reduce injury risk in high school male runners (1).

Reference

1. Hotta, T., et al. *J Strength Cond Res*, 2015. 29(10): 2808-15.

1302 Board #5 June 2, 8:00 AM - 10:00 AM  
**Effect Of A 6-Wk Running Training Programme Using The Self-Paced VO2max Protocol In Recreational Runners**  
 James S. Hogg, Sarah L. Coakley, James G. Hopker, Alexis R. Mauger. *University of Kent, Chatham, United Kingdom.*  
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 (No relationships reported)

The self-paced  $\dot{V}O_{2\max}$  test (SPV) has been shown to be an effective alternative to an incremental graded exercise test (GXT) in assessing maximal oxygen consumption ( $\dot{V}O_{2\max}$ ) in non-motorised and motorised treadmill running. However, the identification of effective training parameters has yet to be investigated. **Purpose:** This study assessed the feasibility and effectiveness of prescribing training via the SPV compared to the GXT. **Methods:** Ten recreationally active males (36 ± 3 y; 1.74 ± 0.08 m; 70.0 ± 10.6 kg) and six females (26 ± 3 y; 1.66 ± 0.04 m; 58.0 ± 4.7 kg) were randomised into two training groups (GXT and SPV) and completed a 6-week training programme participating in 4 running sessions-a-week. Prior to training, participants completed 3 lab visits: SPV, GXT, and a combined Lactate Threshold (LT) and Critical Speed (CS) visit. The GXT was continuous and incremental in style, with prescribed 1 km·hr<sup>-1</sup> increases every 2 min until the attainment of  $\dot{V}O_{2\max}$ . Participants in the GXT group then completed a time-to-exhaustion (TTE) effort at velocity at  $\dot{V}O_{2\max}$  ( $v_{\dot{V}O_{2\max}}$ ) to determine the time for which  $\dot{V}O_{2\max}$  could be maintained ( $T_{\dot{V}O_{2\max}}$ ). The SPV consisted of 5 x 2 min incremental stages, where running speed throughout each stage could be continuously adjusted according to five prescribed RPE levels: 11, 13, 15, 17, and maximal perception of exertion (RPE 20). The LT consisted of 1 km·hr<sup>-1</sup> increments every 4 min until LT2 had been obtained. Participants then ran 9, 6, and 3 laps of a 400m outdoor synthetic running track to calculate CS. The training programme consisted of two interval sessions, a recovery run, and a tempo run. In the GXT group, interval training speeds were determined by  $T_{\dot{V}O_{2\max}}$  and 'mean speed at RPE 20' in the SPV group.  $\dot{V}O_{2\max}$ , LT and CS were then retested post-training. **Results:** In the GXT group,  $\dot{V}O_{2\max}$  significantly improved following training in both the GXT ( $P = 0.003$ ) and SPV ( $P = 0.001$ ) tests (54.0 ± 6.0 vs. 57.5 ± 6.1 mL·kg<sup>-1</sup>·min<sup>-1</sup> and 54.1 ± 8.3 vs. 57.4 ± 6.5 mL·kg<sup>-1</sup>·min<sup>-1</sup>, respectively). In the SPV group significant improvement was shown in the SPV ( $P = 0.029$ ) (51.4 ± 5.0 vs. 55.6 ± 5.4 mL·kg<sup>-1</sup>·min<sup>-1</sup>). **Conclusion:** The present study has shown that the SPV is effective in prescribing training to improve  $\dot{V}O_{2\max}$  and that 'mean speed at RPE 20' is an effective alternative to  $v_{\dot{V}O_{2\max}}$  as a training parameter for interval training.

1303 Board #6 June 2, 8:00 AM - 10:00 AM  
**The Decline In Marathon Performance Begins At About 35 Years Of Age In Top Runners.**  
 Gerald S. Zavorsky, FACSM<sup>1</sup>, Kelly-Ann Tomko<sup>2</sup>, James M. Smoliga<sup>3</sup>. <sup>1</sup>Georgia State University, Atlanta, GA. <sup>2</sup>University of Bridgeport, Bridgeport, CT. <sup>3</sup>High Point University, High Point, NC.  
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 (No relationships reported)

Marathon running is a major event in North America in which several hundred thousand individuals participate each year. **PURPOSE:** To examine the rate of decline (worsening) in marathon performance with age by analyzing the winning age-group finishing times as well as the median finishing times for each age group from the three largest marathons in North America: New York, Boston, and Chicago, between 2001-2014. **METHODS:** Age, sex, finishing time, year, and location of the race was compiled from publicly available databases. The rate of decline in the winning marathon time with age, and the rate of decline for the median marathon time with age, was conducted using multiple linear regression (stepwise procedure) to determine which independent variables (continuous variable: age; categorical variables: sex, location of marathon, year of marathon) were predictors of a winning marathon time (first dependent variable as a continuous variable) and the median marathon time (second dependent variable as continuous variable). Since regression is sensitive to extreme cases, outliers were removed. Any data point that exceeded the chi-square criteria (standard deviation of the residuals > 3.0) were eliminated. Then curve fitting was used to determine whether the rate of decline in marathon performance per year was more of a linear or quadratic function. **RESULTS:** When the winners of each age group were assessed in 5-year increments from 16-19 up through 70-74 years of age (n = -40 per age group), the fastest times occurred between 25 and 34 years of age, and then became slower after the age of 34 ( $p < 0.001$ ). Female winners slow down at a faster rate than male winners (females = 2:54 per year, 95% CI = 2:46 to 3:02, n = 306; males = 2:03 per year, 95% CI = 1:59 to 2:08, n = 319). Neither location nor year of the marathon affected the rate of decline. The rate of decline for the "average Joe/Jane" did not begin until after 44 years of age, thereafter, the rate of decline was faster in men (average Joe = 2:34 per year, 95% CI = 2:18 to 2:51, n = 148; Average Jane = 1:57 per year, 95% CI = 1:38 to 2:16, n = 139). **CONCLUSION:** In runners of all abilities, the rate of decline with age is roughly linear (adjusted  $r^2 = 0.79-0.89$ ,  $p < 0.001$ ) with top runners beginning to decline at 35 years of age and the average Joe/Jane beginning to decline at 45 years of age.

1304 Board #7 June 2, 8:00 AM - 10:00 AM

**The Effect of Training on Cardiac Biomarkers Post-Marathon**

Gabriela Narowska, Amanda Lafalce, David Jou, Kelly Malloy, Rachel Pata, John Martin-Beaulieu, Karen Myrick, Richard Feinn, Thomas Martin. *Quinnipiac University, Hamden, CT.*  
(No relationships reported)

**PURPOSE:** To determine the effect training had on cardiac troponin I (cTnI) and B-Type Natriuretic Peptide (BNP) levels post-marathon. **METHODS:** 13 female (42.5 ± 12.0 yrs old) and 9 male runners (46.5 ± 13.9 yrs old) recreational runners were recruited to run the 2015 Hartford Marathon. A venous blood draw was taken from each subject at 12 hours pre-race, immediately post-race and 20 hours post-race. cTnI and BNP levels were measured at each time point using a portable analyzer (Abbott iSTAT). Subject's weekly mileage and weekly long runs were recorded for a 12-week period prior to the marathon. Long runs were tallied and delineated into 3 categories: 16-20 miles, 20-25 miles and 25+ miles. Pearson correlations were used to determine associations between markers of training to cTnI and BNP. **RESULTS:** All subjects completed the marathon (4:12:45 ± 0:38:39). On average, subjects ran 30.9 ± 13.1 miles per week with a 11.1 ± 2.5 mile average long run leading up to the marathon. Subjects completed 2.9 ± 2.2, 16+ mile long runs and 1.2 ± 1.3, 20+ mile long runs during training. Training load did not correlate with pre-race cardiac markers (all p-values >0.20). A negative correlation was found between average weekly mileage and post-race cTnI levels, runners with a higher weekly mileage had lower cTnI levels ( $r=-0.469$ ,  $p=0.028$ ). No correlations were found for average long run and cTnI or BNP at either post-race time point. However, positive correlations were found for both BNP and cTnI when examining the number of long runs at a particular distance. The more 16+ mile long runs a subject ran, the higher the BNP levels 24 hours post-race ( $r=0.501$ ,  $p=0.017$ ), and the greater the number of long runs a subject ran over 20+ miles, the higher the cTnI levels were immediately post-race ( $r=0.437$ ,  $p=0.042$ ). **CONCLUSION:** Recreational runners who ran more miles per week experienced less cardiac stress post-race. However, runners who ran more long runs, especially those who ran runs greater than 20 miles in length, experienced more cardiac stress post-marathon. Training regiments for recreational runners should use caution when prescribing long runs of greater than 20 miles, as they may not allow for full recovery prior to the marathon. It may be more beneficial to prescribe training regiments that emphasize more constant training and higher weekly mileage.

**C-20 Free Communication/Slide - Nutritional Status of Athletes**

Thursday, June 2, 2016, 8:00 AM - 10:00 AM  
Room: 313

1305 **Chair:** Stella L. Volpe, FACSM. *Drexel University, Philadelphia, PA.*  
(No relationships reported)

1306 June 2, 8:00 AM - 8:15 AM

**Changes in Muscle Lipid and  $rVO_2$  following Vitamin D Repletion and Aerobic Training in Aged Individuals**

David T. Thomas, Maja Redzic, Mingjun Zhao, Melissa White, Guoqiang Yu. *University of Kentucky, Lexington, KY.*  
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(No relationships reported)

The extramyocellular (EMCL) and intramyocellular (IMCL) lipid depots continue to be of interest in metabolic health. We recently reported a positive linear relationship between 25(OH)D status and IMCL in healthy, aged individuals that was independent of body mass and physical activity.

**PURPOSE:**

Compare the magnitude of lipid redistribution and local muscle oxygen consumption rate following combined treatment of vitamin D repletion and aerobic training (DAT) compared to vitamin D repletion alone (D), aerobic training alone (AT), and control conditions (Ctl).

**METHODS:**

Aged subjects (≥60 yo) with vitamin D insufficiency (25(OH)D ≤ 32 ng/mL) were randomized to a double blinded, 2X2, four group design. Vitamin D<sub>3</sub> (10,000IU X 5 days/week) or placebo was provided for 12 weeks with 1 additional week (7 consecutive days) of aerobic training or no training. Gastrocnemius IMCL and EMCL were measured with magnetic resonance spectroscopy and fat segmentation. Hybrid near-infrared spectroscopy and diffuse correlative spectroscopy measured local tissue blood flow, oxygen saturation, and VO<sub>2</sub> during and following (recovery) from a gastrocnemius fatiguing protocol. All measurements were completed at week 0 and immediately following the study.

**RESULTS:**

Five females and 6 males completed all measures. Mean age and BMI were 68.6±7YO and 25.5±4kg/m<sup>2</sup>, respectively. Mean 25(OH)D concentrations increased significantly in subjects receiving vitamin D (45 ± 19) vs. placebo (11± 9)( $p<.05$ ). Although not significant, both DAT (n=3) and AT (n=3) experienced a mean reduction in IMCL:EMCL ratio of 26% while subjects who did not exercise experienced a mean increase of 3%. This corresponded to a 37% increase in  $rVO_2$  during full recovery in DAT compared 8% in AT and an average reduction in  $rVO_2$  (-16%) in subjects who did not exercise ( $p=0.2$ ).

**CONCLUSIONS:**

Although preliminary, these data suggest a trend that is consistent with the hypothesis that vitamin D, when combined with exercise, may potentiate the positive metabolic benefits of exercise by affecting muscle lipid depots and altering tissue-level VO<sub>2</sub>. These data also highlight the inexpensive and noninvasive optical measurement of hemodynamics in muscle, providing an indication of effective metabolic response to a dietary supplement and exercise intervention.

1307 June 2, 8:15 AM - 8:30 AM

**Bone Health, Nutritional Intake, Physical Activity and Quality of Life: Professional Jockeys in Hong Kong**

Eric T. Poon, John O'Reilly, Stephen H. Wong, FACSM. *The Chinese University of Hong Kong, Hong Kong, Hong Kong.*  
(No relationships reported)

Weight-making practices regularly engaged by horse-racing jockeys are suggested to impair physiological and mental health. Related studies from the Asian regions are rare.

**PURPOSE:** To compare bone health markers, nutritional intake, physical activity habits and quality of life between professional jockeys in Hong Kong and gender, age and BMI matched controls. **METHODS:** 14 professional male jockeys (horse racing experience: 3-27 yrs; mean age: 29.1 ± 6.1 years; BMI: 20.3 ± 1.6 kg m<sup>-2</sup>) and 14 controls (mean age: 26.0 ± 6.5 years; BMI: 21.1 ± 1.7 kg m<sup>-2</sup>) were recruited. Both groups completed a range of assessments including: (i) Anthropometry via skinfold measurement and body scale; (ii) Bone biomarkers via blood analysis and dual-energy X-ray absorptiometry (DEXA); (iii) Nutritional intake via 3-day food diary and validated food frequency questionnaire (FFQ); (iv) Past and current physical activity patterns via bone-specific physical activity questionnaire (BPAQ); and (v) Quality of life (QOL) questionnaire. Independent t-tests were used to identify inter-group differences. Correlation analysis was conducted to determine relationships between variables. **RESULTS:** The jockey group displayed significantly lower bone mineral density (BMD) at both calcanei than the control group (left: 0.50 ± 0.06 vs. 0.63 ± 0.07; right: 0.51 ± 0.07 vs. 0.64 ± 0.10 g.cm<sup>-2</sup>, both  $P<0.01$ ). 13 out of 14 jockeys (93%) showed either osteopenia or osteoporosis for at least one side of their calcanei based on WHO classification. Daily energy intake was lower in jockeys compared with controls (1360 ± 515 vs. 1985 ± 1046 kcal.day<sup>-1</sup>,  $P<0.01$ ). Vitamin D intake is significantly correlated with left calcaneus BMD ( $P<0.05$ ,  $R=0.657$ ). No significant difference was found for BPAQ and QOL score. **CONCLUSION:** Our results revealed suboptimal bone conditions and dietary intake among professional jockeys in Hong Kong, in accordance with existing Western literature. Further research should examine the effects of improved exercise and nutritional habits on the skeletal health of elite jockeys.

1308 June 2, 8:30 AM - 8:45 AM

**Omega-3 Fatty Acid Levels among Collegiate Athletes: Associations with General and Sport Anxiety.**

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**PURPOSE:** Omega-3 polyunsaturated fatty acids have been linked to mood disorders in the general population. To date, few investigations have evaluated blood omega-3 fatty acid levels in athletes, as well as their associations with anxiety and resilience. **METHODS:** Fifty-four female athletes (19.5 ± 1.3 yr) from a Division I NCAA program volunteered for this study. Sports represented included basketball (n = 13), soccer (n = 23), rifle (n = 11), and golf (n = 7). Finger sticks were used to obtain dried blood spot samples, which were sent to a commercial laboratory (OmegaQuant, Sioux Falls, SD) to quantify whole-blood fatty acids. The HS-Omega-3 Index®, which is the sum of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in erythrocyte membranes and is expressed as a percent of total erythrocyte fatty acids, was calculated. Other fatty acids quantified were  $\alpha$ -linolenic acid (ALA), docosapentaenoic acid (DPA), linoleic acid (LA), and arachidonic acid (AA). Participants completed the Beck Anxiety Inventory (BAI; range 0-63), the Sport Anxiety Scale-2 (SAS-2; range 15-60), and a mental toughness scale (MTS; range 11-55). Spearman's rho co-efficients were used to examine associations between fatty acid levels and anxiety scores. MTS data were limited to 53 participants due to missing data on one participant. Data are median (interquartile range [IQR]).

**RESULTS:** Median levels of fatty acids were as follows: ALA, 0.39% (0.33-0.48%); EPA, 0.47% (0.33-0.61%); DPA, 1.1% (0.9-1.2%); DHA, 2.6% (2.2-3.0%); LA, 24.3% (23.3-25.7%); and AA, 11.2% (10.4-12.1%). The median HS-Omega-3 Index® was 4.9% (4.2-5.4%). Scores on the BAI, SAS-2, and MTS were 8 (3-18), 25 (23-33), and 44 (42-48), respectively. None of the fatty acids were significantly correlated with SAS-2 scores. HS-Omega-3 Index® ( $\rho = -.32, p = .02$ ), EPA ( $\rho = -.40, p < .01$ ), and DPA ( $\rho = -.33, p = .02$ ) were negatively correlated with BAI scores. DPA was positively correlated with MTS scores ( $\rho = .27, p = .049$ ).

**CONCLUSIONS:** Whole-blood omega-3 polyunsaturated fatty acids are associated with general but not sport-specific anxiety in female collegiate athletes. Increasing the intake omega-3 polyunsaturated fatty acids may help manage some symptoms of general anxiety in female athletes.

1309 June 2, 8:45 AM - 9:00 AM

### The Amateur Cyclist Gearing Up Nutrition for a 94.7km Challenge

Dina C. Janse van Rensburg, FACSM, Ilse Sparks, Catharina C. Grant, Audrey Jansen van Rensburg, Phathokuhle C. Zondi.  
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(No relationships reported)

South Africa hosts two of the world's largest individually timed one day cycle races with approximately 35 000 cyclists per race. Despite the fact that these events are major international drawcards and that cycling is a popular recreational activity globally, there is limited research on the use of nutrition and supplements in amateur cyclists. Most research has been done in Europe and America. Much of the current body of knowledge has been gleaned from cyclists involved in cycle tours typically 5 days or longer or from professional cyclists attending training camps. **PURPOSE:** To analyse the nutrition and supplement practices of amateur cyclists involved in endurance cycling. **METHODS:** A retrospective questionnaire was sent to all registered entrants participating in the Momentum 94.7 Cycle Challenge 10 days before the event. Details of the study were provided and cyclists 18 years or older were directed to a web-link in order to complete the questionnaire. The questionnaire was voluntary and anonymous and participants could abandon at any time. Questions interrogated dietary practices and supplement use leading up to the race, and planned nutrition strategy during the race. **RESULTS:** The response rate was 8.35%, and represented the overall race demographics with 75% Male and 25% Female respondents. Most respondents fell in the 30-50 year age group. 61% of respondents used supplements with the most common reason cited being a need to boost energy. Only 56% knew the ingredients contained in supplements used, and 77% adhered to the prescribed dosage. Of the 51% that used carbo-loading, 82% guessed how much should be used rather than following specific guidelines. A sports drink was the most common way to consume carbohydrates during and after the race. **CONCLUSION:** In this study most cyclists use supplements and adhere to the prescribed dosage. It is concerning that a significant percentage of cyclists do not know the ingredients in the supplements they use and are therefore at risk for inadvertent doping. Only half of the respondents use carbo-loading with an alarming number guessing how much they need. There is a huge market for supplementation and cyclists are at risk of being exploited. Amateur cyclists need more education on supplement use and carbo-loading.

1310 June 2, 9:00 AM - 9:15 AM

### Lower Cathelicidin Concentrations In Irish Athletes Compared To Healthy Controls: A Role For Vitamin D?

Joshua J. Todd<sup>1</sup>, Emeir M. McSorley<sup>1</sup>, Kirsty Pourshahidi<sup>1</sup>, Sharon M. Madigan<sup>2</sup>, Eamon Laird<sup>3</sup>, Ruth R. Weir<sup>1</sup>, Martin Healy<sup>4</sup>, Pamela J. Magee<sup>1</sup>. <sup>1</sup>University of Ulster, Coleraine, United Kingdom. <sup>2</sup>Irish Institute of Sport, Dublin, Ireland. <sup>3</sup>Trinity College, Dublin, Ireland. <sup>4</sup>St. James Hospital, Dublin, Ireland. (Sponsor: Giles Warrington, FACSM)

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(No relationships reported)

The biologically active vitamin D metabolite (1 $\alpha$ -dihydroxyvitamin D) has been linked to regulation of human cathelicidin antimicrobial peptide (LL-37) *in vitro*. Recent studies in athletes indicate that vitamin D inadequacy is associated with lower concentrations of LL-37 and that this may increase risk of upper respiratory tract infection (URTI). **PURPOSE:** To compare circulating LL-37 concentrations between athletes and healthy controls and to establish if total 25-hydroxyvitamin D (25[OH] D) was a significant determinant of this antimicrobial peptide. **METHODS:** A total of 221 stored, fasted plasma samples from male and female athletes (elite rugby  $n=12$ , elite boxing  $n=12$ , Gaelic football  $n=77$ ) and age and sex-matched healthy controls ( $n=120$ ) were analysed in duplicate for LL-37 concentrations using an enzyme-linked immunosorbent assay. Total 25(OH)D concentrations were quantified by liquid chromatography-tandem mass spectrometry as part of the previous studies.

Comparison of 25(OH)D and LL-37 concentrations between athletes and controls was made using Mann-Whitney *U* tests. Linear regression was used to test if 25(OH) D concentration was a significant determinant of LL-37 concentration after adjusting for season of sampling. **RESULTS:** Median [IQR] 25(OH)D concentrations were 49.76[39.37] and 28.90[23.55] nmol/L for athletes and healthy controls respectively,  $P<0.001$ . LL-37 concentrations were significantly lower in athletes compared to healthy controls (26.92[17.04] versus 47.91[59.93] ng/mL respectively,  $P<0.001$ ). Nevertheless 25(OH)D was not found to be a significant determinant of LL-37 concentration in athletes ( $\beta=0.052, P=0.611$ ) or healthy controls ( $\beta=0.170, P=0.224$ ). **CONCLUSION:** Our preliminary findings demonstrate a significant difference in LL-37 concentration between athletes and the general population. Yet the significant positive association between 25(OH)D and LL-37 concentrations reported in endurance athletes may not apply to those competing in intermittent sports; possibly owing to a decreased likelihood of experiencing exercise-induced immunosuppression resulting from prolonged high-intensity exercise. Further studies are required to determine if lower LL-37 concentrations translate into athletes being at greater risk of URTI than the general population.

1311 June 2, 9:15 AM - 9:30 AM

### Dietary Status of Male and Female Triathletes During A Competitive Season

Barbara S. McClanahan<sup>1</sup>, Christopher M. Vukadinovich<sup>2</sup>, Deborah L. Slawson<sup>3</sup>, Kenneth D. Ward<sup>1</sup>, Michelle B. Stockton<sup>1</sup>. <sup>1</sup>University of Memphis, Memphis, TN. <sup>2</sup>St. Jude Children's Research Hospital, Memphis, TN. <sup>3</sup>East Tennessee State University, Johnson City, TN. (Sponsor: Lawrence Weiss, FACSM)

(No relationships reported)

**PURPOSE:** Optimal nutrition is important for all athletes and especially for long endurance athletes such as triathletes. A standard triathlon includes a 1.5-kilometer (0.93 mile) swim, 40-kilometer (25-mile) bike, and 10-kilometer (6.2 mile) of run and typically takes more than three hours to complete. Given the exhaustive nature of triathlon training and competition dietary intake, composition and proportional macronutrient intake are critical training and maintenance considerations. Increasing carbohydrate intake is a common recommendation for endurance athletes, however, there has been a recent emphasis on increasing intake of protein. Therefore, the aim of this study is to describe the nutritional intake of competitive triathletes during a competitive season with particular attention to the proportional contributions of macronutrient to total energy intake. **METHODS:** Participants were 19 male (36.9  $\pm$  10.36 years old) and 19 female triathletes (32  $\pm$  6.93 years old). Body composition was determined through dual-energy x-ray absorptiometry (DXA). A seven-day dietary recall was used to assess total energy, macronutrient and micronutrient intake. **RESULTS:** Body fat percent for male and female triathletes was 11.24% ( $\pm$ 4.03%) and 21.3% ( $\pm$ 5.0%) respectively. Average daily energy intake for males was 2614 ( $\pm$ 780) kcal and 1709 ( $\pm$ 464) kcal for females. Relative contribution to total energy intake of fat was 25.4% for males and 24.8% for females, protein was 19% for males and 17.8% for females, and carbohydrates was 53% for both males and females. **CONCLUSION:** Macronutrient intake was within general health recommendations, but was contrary to common recommendations for endurance athletes. Recognizing the importance and contribution of sufficient calorie and macronutrient intake in long endurance competition it was surprising that nutrient intake in triathletes in this study did not exceed general recommendations. Further studies are required in order to better understand the effect such practices may have on athletic performance.

1312 June 2, 9:30 AM - 9:45 AM

### Nutritional and Metabolic Profile of Elite Synchronized Swimmers in Brazil

Franz H. Burini<sup>1</sup>, Flavio Cruz<sup>2</sup>, Rodrigo Minoru Manda<sup>1</sup>, Rafael Rezende<sup>1</sup>, Gabriel Vilches<sup>1</sup>, Hugo Kano<sup>1</sup>, Roberto Carlos Burini, FACSM<sup>1</sup>. <sup>1</sup>UNESP Medical School, Botucatu, Brazil. <sup>2</sup>Confederação Brasileira de Desportos Aquáticos CBDA, Rio de Janeiro, Brazil. (Sponsor: Roberto Burini, FACSM)

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(No relationships reported)

Athletes are exposed to several factors that can be modulated, affecting health and performance. Dietary pattern, quantitative and qualitative issues, is a key point to maintain athlete's health and should be adjusted to training log, during pre and on sport season. Mismatches may lead to decrease in health and performance, and athletes competing on such modalities like Synchronized Swimming are overexposed, based on performance and aesthetic appeal. **PURPOSE:** The aim of this study was to evaluate the nutritional pattern and metabolic biomarkers of elite Synchronized Swimmers from the Brazilian National Team. **METHODS:** 14 female elite athletes (19 $\pm$ 5yrs) from the National Team were evaluated for resting metabolic rate (RMR) with a portable metabolic analyzer (K4-COSMED®) and dietary intake pattern (24h and 3 day record questionnaire for software analysis), followed by blood tests after a 8h fasting situation.

RESULTS: Body Mass Index (BMI) was  $20.2 \pm 4.1 \text{ kg/m}^2$ . RMR was  $1246 \pm 238 \text{ kcal/day}$ . Caloric intake was  $1250 \pm 360 \text{ kcal/day}$ . Qualitative analysis evidenced carbohydrate intake of  $3.1 \pm 1.2 \text{ g/kg}$  (DRI:  $6\text{--}10 \text{ g/kg}$ ), protein intake  $1.7 \pm 0.6 \text{ g/kg}$  and lipid intake of  $0.4 \pm 0.2 \text{ g/kg}$ . Linolenic acid intake was  $3.4 \pm 1.8 \text{ g}$ , and Leucine  $7.6 \pm 2.4 \text{ g}$ . Fiber intake was  $14 \pm 3 \text{ g}$  (DRI:  $30 \text{ g}$ ). Iron and calcium intake were  $6.4 \pm 2.3 \text{ g}$  and  $659 \pm 278 \text{ mg}$ .

Hemoglobin values range from  $11.5$  to  $14.5 \text{ g/dL}$  (nL:  $12.5\text{--}15 \text{ g/dL}$ ). Glucose, insulin and trylycerides values range from  $69$  to  $98 \text{ mg/dL}$ ,  $1.3$  to  $8.9 \text{ U/mL}$  and  $34$  to  $81 \text{ mg/dL}$ .

Cortisol values were higher than  $20 \mu\text{g/dL}$  in 82% of the athletes, and ranged from  $8.7\text{--}31.2 \mu\text{g/dL}$ . Thyroid stimulating hormone (TSH) values ranged from  $0.047$  to  $2.1 \text{ mIU/L}$ .

CONCLUSION: The present study evidences abnormalities that should be focused on the multidisciplinary matter, avoiding deleterious dietary patterns, such as restrictive diet (quantitative pattern) that may lead to Relative Energy Deficiency in Sports (RED-S) syndrome, and may guide to focus on specific nutrients which could lead to decrease in performance, despite health risks and such evaluations that permits improvements of the athletes should be encouraged.

1313 June 2, 9:45 AM - 10:00 AM

### Evaluation Of Nutrition Information And Communication Strategies For Young Elite Athletes

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(No relationships reported)

Eating behavior and knowledge on interrelations between exercise, nutrition, performance and health is often inadequate in young elite athletes (YEA). Regular nutrition supervision may improve nutrition knowledge and presumably ameliorate food intake. Therefore, both nutritional counseling and education of YEA should be conducted by nutrition professionals as a low-threshold offer and should be attractive to this special target population. However, it is unknown which kind of nutritional counseling and education is attractive to YEA.

PURPOSE: To evaluate strategies for nutritional education and counseling for young elite athletes at the Olympic sports center (OSC) in Stuttgart, Germany.

METHODS: 78 YEA from elite schools of sports associated to the OSC Stuttgart ( $17.1 \pm 1.6$  years) were asked in a cross-sectional design via a standardized questionnaire for preferred information and communication channels, desired frequency and kind of nutrition supervision.

RESULTS: Important sources of nutrition information for YEA are their family and friends (80% of the YEA), internet (73%), coaches (72%) and the nutrition consultant (70%) at the OSC Stuttgart. 52% of the respondents would like to be informed regularly on current nutrition topics. Besides the personal contact, E-Mail, telephone and also communication via app and social networks are preferred. Furthermore, most YEA (86%) would appreciate the implementation of nutrition information and cooking recipes into a special "OSP-App". The bigger part of the respondents desires an individual nutritional counseling and 88% are interested in a personalized diet plan. 58% of the YEA wish to be nutritionally supported via professional individual counseling at least every 3 months.

CONCLUSIONS: Results indicate that personal nutritional supervision including individualized diet plans are desired by YEA. In particular, nutritional counseling should also be conducted using new media and social networks to improve availability and attractiveness of nutritional education for YEA. In addition, coaches and peers - as they are important information sources for YEA - should be integrated into low-threshold nutritional education programs.

## C-21 Free Communication/Slide - Special Populations

Thursday, June 2, 2016, 8:00 AM - 10:00 AM

Room: 102

1314 **Chair:** Loretta Di Pietro, FACSM. *George Washington University, Washington, DC.*

(No relationships reported)

1315 June 2, 8:00 AM - 8:15 AM

### Effect of High-Intensity Interval Training versus Moderate-Intensity Continuous Training on Cardiac Function in Older Adults

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(No relationships reported)

Aging is associated with cardiac remodeling and reduced cardiac function. Preliminary evidence indicates that high-intensity interval training (HIIT) may ameliorate some of these age-related changes, but there are no conclusive data that are based on randomized control trials.

PURPOSE: To perform a randomized control trial to examine the effect of HIIT versus moderate-intensity continuous training (MICT) on cardiac function in healthy older adults. METHODS: A total of 36 sedentary older adults (age:  $65 \pm 1$  years; range:  $55\text{--}76$  years), free of cardiovascular disease, participated in this study. Subjects were randomly assigned to HIIT ( $n=12$ ), MICT ( $n=10$ ) or non-exercise control ( $n=14$ ) group. Supervised isocaloric HIIT and MICT were performed on Airdyne® stationary bicycles, 4 times per week, for 8 weeks. HIIT consisted of cycling for 40 minutes at an alternating moderate and high intensity (70% and 90% of maximal heart rate, respectively), while MICT consisted of cycling for 47 minutes at a moderate intensity (~70% of maximal heart rate). Resting left ventricular structure and function (two-dimensional and M-mode echocardiography including conventional and tissue Doppler) and peak oxygen consumption (open-circuit spirometry during graded exercise treadmill test) were assessed at baseline and at the end of the intervention.

RESULTS: HIIT resulted in a small but significant improvement in ejection fraction ( $55.4 \pm 0.6\%$  to  $57.8 \pm 0.7\%$ , pre vs. post;  $p=0.004$ ) while no significant changes were observed in MICT ( $56.0 \pm 0.5$  to  $57.0 \pm 0.7\%$ ,  $p=0.2$ ) and control ( $56.3 \pm 1.0$  to  $55.0 \pm 1.3\%$ ,  $p=0.05$ ). A greater improvement in ejection fraction was associated with a greater improvement in peak oxygen consumption ( $r=0.60$ ,  $p=0.004$ ). Left ventricular diastolic function (early (E) to late diastolic peak filling velocity:  $1.06 \pm 0.04$  to  $1.02 \pm 0.04$ , early diastolic mitral annular velocity ( $e'$ ):  $9.8 \pm 0.3$  to  $9.4 \pm 0.3 \text{ cm/s}$ ,  $E/e'$ :  $8.5 \pm 0.4$  to  $8.5 \pm 0.4$ , pre vs. post) and measures of cardiac structure remained unchanged in all groups following the 8-week intervention ( $p>0.05$ ). CONCLUSIONS: Eight weeks of HIIT resulted in small improvements in ejection fraction and these improvements were positively related with exercise-induced improvements in peak oxygen consumption.

1316 June 2, 8:15 AM - 8:30 AM

### Reliability and Validity of Accelerometers Worn During Pregnancy and Postpartum

Michelle R. Conway<sup>1</sup>, Mallory R. Marshall<sup>2</sup>, Rebecca A. Schlaff<sup>3</sup>, Karin A. Pfeiffer, FACSM<sup>1</sup>, James M. Pivarnik, FACSM<sup>1</sup>. <sup>1</sup>Michigan State University, East Lansing, MI. <sup>2</sup>Samford University, Birmingham, AL. <sup>3</sup>Saginaw Valley State University, University Center, MI.

(No relationships reported)

Current physical activity recommendations for women experiencing a normal pregnancy reflect recent research showing numerous health benefits for mother and offspring. However, few studies have evaluated physical activity measurement devices during pregnancy, as anatomical and physiological changes throughout gestation can affect an instrument's accuracy. PURPOSE: Our purpose was to determine the reliability and validity of accelerometers worn on the hip and ankle during pregnancy and postpartum. METHODS: Thirty women performed six activities of daily living and one treadmill walk at approximately 21 and 32 weeks of pregnancy, and 12 weeks postpartum. There were two visits at each time period, one week apart. Energy expenditure ( $\text{VO}_2$ ) was measured by indirect calorimetry (criterion measure), while physical activity was quantified (counts per minute) by accelerometers, worn on elastic belts at the right hip and ankle. Intraclass correlation coefficients (ICC) were calculated on participants with complete data to assess monitor reliability at each time period and Pearson correlation coefficients (PCC) were calculated to evaluate monitor validity compared to indirect calorimetry. RESULTS: Eleven ICCs were between  $0.4\text{--}0.59$ , 15 were between  $0.6\text{--}0.79$ , and 13 were greater than 0.8. Only three were below 0.4.

Reliability of both hip and ankle locations was highest for walking in a hallway and lowest for folding laundry. Pregnancy status and accelerometer location did not appear to have an effect on monitor reliability. Overall, validity coefficients were less robust with sixty-three of 84 PCCs between the accelerometer worn at the ankle and hip being less than 0.39, regardless of whether  $VO_2$  was expressed in absolute or relative terms. Seventeen were between 0.4-0.59, and four were between 0.6-0.79. Highest validity was seen with the ankle accelerometer during a picking up toys activity (PCC=0.73 for absolute and 0.67 for relative  $VO_2$ ). Pregnancy status, accelerometer location, and task did not affect monitor validity. **CONCLUSION:** Accelerometers worn on the hip and ankle show moderate reliability but low validity for measuring physical activity during pregnancy and postpartum. Overall, reliability and validity results were lower than those found in the nonpregnant adult population.

1317 June 2, 8:30 AM - 8:45 AM

### Predicting Peak Oxygen Uptake From Submaximal Exercise After Spinal Cord Injury

Julia O. Totosy de Zepetnek<sup>1</sup>, Jason S. Au<sup>1</sup>, Adrienne L. Hol<sup>2</sup>, Janice J. Eng<sup>2</sup>, Maureen J. MacDonald<sup>1</sup>. <sup>1</sup>McMaster University, Hamilton, ON, Canada. <sup>2</sup>University of British Columbia, Vancouver, BC, Canada.

(No relationships reported)

**Purpose:** To determine the validity of the six-minute arm test (6MAT) in predicting peak oxygen consumption ( $VO_{2peak}$ ) in individuals with chronic spinal cord injury (SCI). **Methods:** Fifty-two individuals with chronic SCI (age 38±10 years; American Spinal Injury Association Impairment Scale A-D, neurological level of injury C1-L2, years post-injury 13±10 years) completed an incremental arm  $VO_{2peak}$  test and a submaximal 6MAT. Oxygen consumption data from both tests were used to create a predictive equation with regression analysis. Subsequently, a cross-validation group of an additional 10 individuals with SCI (age 39±13 years; AIS A-D, NLI C3-L3, YPI 9±9 years) were used to determine the predictive power of the equation. **Results:** All subjects were able to complete both the  $VO_{2peak}$  and 6MAT assessments. Regression analysis yielded the following equation to predict  $VO_{2peak}$  from end-stage 6MAT  $VO_2$ :  $VO_{2peak} (mL \cdot kg^{-1} \cdot min^{-1}) = 1.501(6MAT \text{ } VO_2) - 0.940$ . Correlation between measured and predicted  $VO_{2peak}$  was excellent ( $r=0.89$ ). No significant difference was found between measured ( $17.41 \pm 7.44 \text{ mL} \cdot kg^{-1} \cdot min^{-1}$ ) and predicted ( $17.42 \pm 6.61 \text{ mL} \cdot kg^{-1} \cdot min^{-1}$ )  $VO_{2peak}$  ( $p=0.97$ ). When cross-validated with a sample of 10 individuals with SCI, correlation between measured and predicted  $VO_{2peak}$  remained high ( $r=0.89$ ), with no differences between measured ( $18.81 \pm 8.35 \text{ mL} \cdot kg^{-1} \cdot min^{-1}$ ) and predicted ( $18.73 \pm 7.27 \text{ mL} \cdot kg^{-1} \cdot min^{-1}$ )  $VO_{2peak}$  ( $p=0.75$ ). **Conclusions:** Results suggest that 6MAT  $VO_2$  can be used to predict  $VO_{2peak}$  among individuals with chronic SCI. The 6MAT should be used as a clinical tool for assessing aerobic capacity when peak exercise testing is not feasible.

**Key Words:** Arm Ergometry; Peak Oxygen Consumption; Prediction Equation, Submaximal Exercise Test, Spinal Cord Injury

1318 June 2, 8:45 AM - 9:00 AM

### Changes In Leg Power Are Responsible For Clinically Meaningful Improvements In Parkinson'S Disease

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(No relationships reported)

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Motor function as measured by the Unified Parkinson's Disease Scale motor subsection (UPDRS-motor) is predictive of disability, disease progression and treatment effect among patients with Parkinson's disease. Clinically meaningful changes of this measure have been identified. Among physiologic attributes commonly targeted in rehabilitation, we attempted to identify those attributes in which changes led to clinically meaningful differences (CMD) in the UPDRS-motor outcome.

**PURPOSE:** To examine the impact of changes in leg power, leg strength and balance on motor function in older adults with PD. **METHODS:** Secondary analysis of data from older adults with Parkinson's disease (n=14, 9M/5F; H&Y stage: I-III; age: 71.6 ± 6.6 y; weight: 77.8 ± 18.8 kg; height: 1.73 ± .1 m; PD duration: 6.9 ± 4.4 y) participating in a 12-week randomized controlled trial of power training was performed. Leg press power and strength normalized to participants' body weight was measured using pneumatic resistance machines. Balance was measured through the mini-Balance Evaluation System Test. Motor function was assessed using a continuous outcome defined by recording a moderate CMD of UPDRS-motor score (4.5-6.7 points). Multivariate linear regression models were constructed to evaluate possible confounding between physiologic variables and relevant covariates. **RESULTS:** After controlling for baseline values of leg power, strength, balance and UPDRS-motor score, leg power was the only attribute in which changes were significantly associated with a CMD in UPDRS-motor score ( $\beta=1.14$ , 95% CI .27, 4.43,  $p=.032$ ).

**CONCLUSION:** Improvements in leg power, independent of strength and balance, appear to make an important contribution towards clinically meaningful improvements in the UPDRS-motor score. Exercise interventions should be designed to target leg power in order to enhance motor function.

1319 June 2, 9:00 AM - 9:15 AM

### The Relationship Between Lower Extremity Functional Strength and Aerobic Performance in Youth with Cerebral Palsy

Christen J. Mendonca, Sinclair A. Smith, Margaret E. O'Neil. Drexel University, Philadelphia, PA.

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(No relationships reported)

### The Relationship Between Lower Extremity Functional Strength and Aerobic Performance in Youth with Cerebral Palsy

Mendonca CJ, Hawkins JL, Smith SA, O'Neil ME, Drexel University, Philadelphia, PA

Youth with cerebral palsy (CP) have lower aerobic performance, decreased physical activity, and increased energy cost of walking compared to peers with typical development. Adolescents with mobility limitations are at increased risk for cardiometabolic comorbidities. In youth with CP, lower extremity strength is the strongest predictor of the oxygen cost of walking (7.5%) and quadriceps strength is strongly correlated to  $VO_{2peak}$ . **Purpose:** To examine the relationship between functional lower extremity strength and aerobic performance in youth with CP.

**Methods:** Twelve (n=12) ambulatory youth with CP aged 9-21 years (mean = 15.67, SD = 3.7); 9 (75%) males; at Gross Motor Function Classification (GMFCS) levels I = III participated. Youth were GMFCS I (n=1), GMFCS II (n=6), and GMFCS III (n=5). Seven participants have unilateral CP while five have a bilateral distribution. Functional strength was measured using a 30 second repetition maximum (RM) sit to stand test. Aerobic performance was measured using the shuttle run test (SRT) for youth with CP at GMFCS levels I, II and III. Outcomes for the SRT are levels completed, total distance and maximum heart rate. Youth rated fatigue using the OMNI rate of perceived exertion (RPE). Data analysis included the Spearman Rank Correlation Coefficient ( $r_s$ ) to examine associations between strength and aerobic performance. **Results:** There is a strong positive correlation between repetitions completed on the 30 second RM sit to stand test and total distance in the SRT. ( $r_s = .62$ ,  $p < .05$ , 95%CI .07 to .88). No other significant associations were identified.

**Conclusion:** Findings support existing evidence that lower extremity strength predicts walking, and total lower extremity strength normalized to weight declines between the ages of 9 and 18y in youth with CP. Results suggest that lower extremity intervention strategies should be included in exercise programs that aim to increase aerobic endurance in youth with CP.

Supported by the Wallace H. Coulter Foundation

1320 June 2, 9:15 AM - 9:30 AM

### Aerobic Fitness is Predicted by Ventricular Size but not Function In Female Youth Athletes

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(No relationships reported)

The relationship between aerobic fitness, physical maturity, ventricular morphology and function in children is poorly defined.

**Purpose:** To define the relationship between aerobic fitness and cardiac morphology and function in children and whether this relationship varies with physical maturity.

**Methods:** 44 adolescent female athletes (13-18 years) underwent resting 2-D echocardiography for measurements of right ventricular end-diastolic diameter (RVEDD), RV fractional area change (RVFAC), tricuspid annular plane systolic excursion (TAPSE), left-ventricular end-diastolic volume (LVEDV), LV stroke volume (LVSV) and ejection fraction (LVEF) and maximal cycle ergometer testing for determination of maximal aerobic capacity ( $VO_{2max}$ ). Variables were initially compared across Tanner stage (3-5). Participants were stratified by Tanner stage and grouped by fitness level (high fit, low fit) based on  $VO_{2max}$  median split and variables were compared between groups. Finally, multivariate regression was used to determine the independent predictors of  $VO_{2max}$  using Tanner, RVEDD, LVEDV, RVFAC, and LVEF as covariates.

**Results:** No significant differences were identified between Tanner 3, 4, and 5 with respect to  $VO_{2max}$  (2.97 v 3.21 v 3.54 L/min, respectively,  $p=0.18$ ), RVEDD (2.4 v 2.5 v 2.9 cm,  $p=0.415$ ), RVFAC (47.0 v 43.5 v 42.5 %,  $p=0.625$ ), TAPSE (2.45 v 2.40 v 2.35 cm,  $p=0.67$ ), or LVEF (64.0 v 61.0 v 60.5 %,  $p=0.347$ ), while increases across Tanner stage were noted in LVEDV (76.0 v 76.5 v 85.5 ml,  $p=0.033$ ), and LVM (95.7 v 99.2 v 124.2,  $p<0.001$ ). Compared to low fit, high fit participants had significantly greater RVEDD ( $p=3.0$  v 2.4 cm,  $p=0.002$ ), but not LVEDV (77.5 v 76.0 ml,  $p=0.319$ ), LVM (110.5 v 100.6 g,  $p=0.49$ ), LVEF (58.0 v 62.5 %,  $p=0.192$ ), RVFAC ( $p=42.5$  v 45.0 %).

%,  $p=0.70$ ), or TAPSE ( $p=2.4 \text{ v } 2.4 \text{ cm}$ ,  $p=0.97$ ). After inclusion in the multivariable model,  $VO_{2max}$  was independently associated with LVEDV ( $p=0.021$ ), RVEDD ( $p=0.046$ ), but not Tanner ( $p=0.79$ ), LVEF ( $p=0.37$ ) or RVFAC ( $p=0.48$ ).

**Conclusion:** In adolescent female athletes, higher fitness is associated with both increased LV and RV size, but not ventricular function. Similarly, ventricular size increased with physical maturity, while ventricular function did not.

1321 June 2, 9:30 AM - 9:45 AM  
**Effect Of A Suspension-trainer Based Movement Program On Performance And Functional Movement In Youth**

Christine W. St Laurent, Brittany Masteller, Thomas G. St Laurent, Carol Bigelow, Sofiya Alhassan, FACSM, John R. Sirard. *University of Massachusetts Amherst, Amherst, MA.* (Sponsor: Sofiya Alhassan, FACSM)  
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 (No relationships reported)

Suspension-training is a physical activity modality that may have potential to improve fitness and athletic performance in youth. However, the efficacy of this training method in youth has not been studied. **PURPOSE:** To assess the efficacy of a suspension-training movement program, compared to controls, on performance and functional movement in youth athletes. **METHODS:** Participants ( $n=28$ ) participated in at least one organized sport (46% male; mean $\pm$ sd: age  $9.3\pm 1.5$  yrs; BMI percentile  $68.6\pm 27.5$ ). Outcome variables were measured at baseline and within two weeks after the last session. Standing long jump (SLJ, cm) and the 4x10 meter shuttle run (SR, sec) assessed performance. A standard functional movement (FM) test battery assessed movement stability and mobility (maximum possible score=18). Following baseline assessments, participants were randomly assigned to intervention (INT;  $n=17$ ) or control (CON;  $n=11$ ) groups. The INT group participated in a six-week suspension-training movement program, adapted from a new school-based physical activity curriculum, for two one-hour sessions per week. Repeated measures analyses of variance were used to assess group differences (INT versus CON) in baseline to follow-up changes in performance. **RESULTS:** Compared to CON, INT participants achieved statistically significantly greater changes, baseline to follow-up in FM scores (INT:  $+4.06\pm 2.54$ , CON:  $-0.91\pm 2.51$ ;  $p<0.01$ ). The mean change in SR time was significantly slower for INT compared to CON (INT:  $0.47\pm 1.18$ , CON:  $-0.85\pm 1.22$ ;  $p<0.01$ ). No significant within- or between-group effects were detected for the SLJ. **CONCLUSION:** The suspension-training based movement program used here may be beneficial to improve functional movement in children. Results of this study suggest that youth fitness and performance program designers may want to incorporate suspension-training to improve movement stability and mobility. Future interventions using this training modality in youth would benefit from larger, more diverse samples and a longer intervention program delivered in school settings. Supported by: Equipment donation by Fitness Anywhere, LLC, San Francisco, CA

1322 June 2, 9:45 AM - 10:00 AM  
**Physical Literacy Domain Scores in Canadian Children Meeting and not Meeting Canada's Physical Activity Guidelines**

Kevin Belanger<sup>1</sup>, Mark S. Tremblay, FACSM<sup>1</sup>, Patricia E. Longmuir<sup>1</sup>, Joel Barnes<sup>1</sup>, Dwayne Sheehan<sup>2</sup>, Jennifer L. Copeland<sup>3</sup>, Sarah J. Woodruff<sup>4</sup>, Brenda Bruner<sup>5</sup>, Barbi Law<sup>5</sup>, Luc J. Martin<sup>6</sup>, Angela M. Kolen<sup>7</sup>, Michelle Stone<sup>8</sup>, Sherry Huybers Withers<sup>8</sup>, Kristal Anderson<sup>9</sup>, Kirstin N. Lane<sup>9</sup>, Nathan Hall<sup>10</sup>, Melanie Gregg<sup>10</sup>, Travis J. Saunders<sup>11</sup>, Dany MacDonald<sup>11</sup>.  
<sup>1</sup>Children's Hospital of Eastern Ontario Research Institute, Ottawa, ON, Canada. <sup>2</sup>Mount Royal University, Calgary, AB, Canada. <sup>3</sup>University of Lethbridge, Lethbridge, AB, Canada. <sup>4</sup>University of Windsor, Windsor, ON, Canada. <sup>5</sup>Nipissing University, North Bay, ON, Canada. <sup>6</sup>Queen's University, Kingston, ON, Canada. <sup>7</sup>St. Francis Xavier University, Antigonish, NS, Canada. <sup>8</sup>Dalhousie University, Halifax, NS, Canada. <sup>9</sup>Camosun College, Victoria, BC, Canada. <sup>10</sup>University of Winnipeg, Winnipeg, MB, Canada. <sup>11</sup>University of Prince Edward Island, Charlottetown, PE, Canada. (Sponsor: Dr. Mark Tremblay, FACSM)  
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 (No relationships reported)

**Purpose:** To compare differences in physical literacy (PL) domain scores between Canadian children meeting Canada's physical activity (PA) guidelines and those not meeting the guidelines. **Methods:** Children ( $n = 2,215$ ) aged 8-12 years, with parental consent, from seven Canadian provinces had their PL levels measured by trained research staff using the Canadian Assessment of Physical Literacy (CAPL). The CAPL is valid, reliable, and consists of 4 domains (physical competence; daily

behaviour; knowledge and understanding; and motivation and confidence) that provide a composite PL score—scoring was adjusted for age in all domains and for sex in the physical competence domain. Weekly PA levels were measured by pedometers that were worn by participants for a minimum of 3 valid days ( $\geq 10$  h wear time/day). Children were grouped for analysis based on those meeting Canadian PA guidelines ( $\geq 12,000$  steps  $\geq 6$  days/week) and those not meeting the guidelines. All comparisons were performed using ANCOVAs to control for age, sex and seasonality differences in PA. **Results:** After controlling for age, sex and seasonality, children meeting PA guidelines had significantly higher physical competence ( $F = 67.92$ ,  $p<0.0001$ ) and motivation and confidence ( $F = 21.01$ ,  $p<0.0001$ ) domain scores compared to children not meeting the guidelines. No differences were observed in children meeting PA guidelines compared to children not meeting the guidelines for the knowledge and understanding domain ( $F = 78.21$ ,  $p = 0.53$ ). **Conclusion:** These results reinforce the importance of Canadian children meeting PA guidelines, as there seem to be favourable associations with physical competence measures and motivation and confidence scores.

C-22 Clinical Case Slide - Lower Extremity - Foot and Ankle

Thursday, June 2, 2016, 8:00 AM - 9:20 AM  
 Room: 202

1323 **Chair:** Andrea Stracciolini, FACSM. *Children's Hospital Boston, Boston, MA.*  
 (No relationships reported)

1324 **Discussant:** Jim Macintyre, FACSM. *Center for Orthopedic and Rehabilitation Excellence, West Jordan, UT.*  
 (No relationships reported)

1325 **Discussant:** Kelly Lynne Roberts Lane, FACSM. *Fix It Physical Therapy, Mahtomedi, MN.*  
 (No relationships reported)

1326 June 2, 8:00 AM - 8:20 AM  
**Eversion Ankle Injury-Football**  
 Carl H. Russell, James B. Robinson. *University of Alabama, Tuscaloosa, AL.*  
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 (No relationships reported)

**HISTORY:** A 15-year-old high school offensive lineman presented the day after sustaining an ankle injury. With his left foot planted he was "rolled up" from the lateral side, causing an eversion type injury. There was immediate pain and swelling and he was unable to continue playing. He was unable to bear weight immediately following the injury and at presentation. He was initially treated with a walking boot, ice, compression and crutches and sent to the injury clinic the next morning. **PHYSICAL EXAMINATION:** Non-weight bearing, severe swelling diffusely, moderate ecchymosis, decreased ROM in all directions. Markedly tender over distal tibia, distal fibula, deltoid ligament and distal syndesmosis. Ligamentous testing limited due to pain and severity of swelling. Marked pain with stress external rotation of the ankle. No tenderness noted on palpation of proximal fibula. Neurovascular exam was within normal limits.

**DIFFERENTIAL DIAGNOSIS:**

1. Syndesmosis injury
2. Distal tibia fracture
3. Distal fibula fracture
4. Maisonneuve fracture
5. Medial ankle sprain

**TEST AND RESULTS:**

- Ankle anterior-posterior, mortise and lateral radiographs:
  - Oblique fracture of the distal fibular diaphysis
  - Salter-Harris type II fracture of the distal tibia with widening of the medial tibial physis and an intact distal anterior tibiofibular ligament with intact mortise
  - Mortise view showed no widening of the medial clear space
  - MRI ankle
    - Salter-Harris type II fracture of distal tibia. Periosteum extending into fracture line medially
    - Distal fibula fracture
    - Intact syndesmosis and anterior and posterior tibiofibular ligaments
- FINAL DIAGNOSIS:**
  - Salter-Harris type II fracture with entrapped periosteum
  - Distal fibula fracture

## TREATMENT AND OUTCOMES:

1. Treated with open reduction and internal fixation of the distal Salter II fracture with removal of entrapped periosteum from physis
2. Currently in post-operative long walking boot and undergoing rehabilitation

1327 June 2, 8:20 AM - 8:40 AM

**Persistent Left Foot pain in a Male Collegiate Soccer Player**

Eric Requa, Mark Lavallee, FACSM. *York Hospital, York, PA.* (Sponsor: Mark E. Lavallee, M.D., C.S.C.S., F.A.C.S.M., FACSM)

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(No relationships reported)

## HISTORY

Male collegiate soccer player presents with left foot pain for 6 months. He developed pain on the dorsum of his foot after sprinting and felt a pop during Junior season. His pain worsened over several months. Initial x-ray was normal. MRI of the foot demonstrated navicular avulsion fracture. Surgery was declined as he hoped to continue playing. He underwent a period of conservative treatment including NSAIDs, immobilization and non-weight bearing in off-season. He had improvement, however dorsal foot pain recurred with running during training. Repeat imaging showed a non-union of the navicular avulsion fracture. He continued to play for 4 months of his senior year, until pain was intolerable.

## PHYSICAL EXAM

Gait: antalgic

Inspection: pes cavus, no swelling, bruising

Full Range of motion

Palpation: TTP of talar navicular

Single Heel raise: painful

Talar tilt: painful

Achilles: intact, non-tender

Neurovascular: intact.

## DIFFERENTIAL DIAGNOSIS

Navicular Fracture

OCD

Stress Fracture

Metatarsal fracture

Tibiotalar Impingement

Midfoot Arthritis

Extensor tendonitis

Morton's Neuroma

Lisfranc Injury

## TESTS AND RESULTS

9/15 X-ray left foot - non-union avulsion fracture of dorsal navicular

3/14 MRI left foot - OCD of navicular with bone marrow edema

10/15 MRI left foot - marrow edema scattered throughout navicular with hypointense line on anterior/lateral aspect of navicular - incomplete stress fracture

4/14 CT left foot -non-displaced fracture on dorsal aspect of navicular with surrounding bone marrow edema

U/S left foot - navicular avulsion fracture on dorsum of foot

Labs:

PTH 17

TSH 1.71

Vit D - 34

CMP - normal

## FINAL WORKING DIAGNOSES:

Avulsion Fracture of left talar navicular

Stress Fracture of left talar navicular

## TREATMENT AND OUTCOMES

Initial injury, made non-weightbearing 4-6 weeks, immobilization and oral NSAIDs during off season

After persistent pain and declining surgery -U/S guided corticosteroid injection performed into avulsion fracture site and gradual return to play attempted during senior season.

After continued pain, repeat MRI showed incomplete navicular stress fracture. Non-weight bearing for 8 weeks in Cam Boot, and crutches. Carbon fiber shoe insert placed to limit talar-navicular flexion.

Continued pain to fracture site with running. He missed the remainder of his senior year season.

1328 June 2, 8:40 AM - 9:00 AM

**High Intensity Interval Training causing Acute Hindfoot Injury in a Young Female Athlete**

Mimi Zumwalt, Kathlyn Drexler, Travis Winston, Matthew Ferguson. *Texas Tech University Health Science Center, Lubbock, TX.* (Sponsor: Jacalyn J. Robert-McComb, FACSM)  
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(No relationships reported)

**HISTORY:** A 24 year-old female medical student avid gym participant sustained an injury to her left hindfoot region during a series of box jumps while completing her early morning workout. She was seen in the local emergency department, given crutches then referred to the Orthopedic Sports Clinic 2 days after a routine high intensity interval training (HIIT) session. She was performing repetitive jumping/landing as fast as she can while trying to "beat her time". She suddenly felt a pop upon rebound from the ground on her 200th jump causing her to fall down. She states it felt like someone "threw a barbell at her calf". Subsequently, she had difficulty bearing weight on the injured extremity secondary to severe pain.

**PHYSICAL EXAMINATION:** Left ankle/foot exam reveals ecchymosis overlying the posterior distal leg at the musculotendinous junction, extreme tenderness to palpation of her calf, palpable defect just proximal to the calcaneus, inability to plantarflex her ankle and positive Thompson's sign. No bony tenderness.

## DIFFERENTIAL DIAGNOSIS:

1. Plantaris rupture
2. Gastrosoleus tear
3. Achilles tendon avulsion

## TEST AND RESULTS:

Anterior-posterior (AP), lateral, and mortise radiographs of the left ankle reveal subtle increased soft tissue opacity posterior to the talus plus AP and lateral radiographs of the left tibia/fibula reveal no osseous or soft tissue abnormalities

## FINAL WORKING DIAGNOSIS:

Acute TendoAchilles Rupture

## TREATMENT AND OUTCOMES:

1. Primary open direct surgical repair was performed successfully 4 days post-injury. Operative photos confirm near-complete rupture of the Achilles tendon.



2. She was placed in a post-operative boot 6-8 weeks with partial weightbearing during the early healing period.
3. Weightbearing was progressed to full at 3 months.
4. Physical activity increased over the next month.
5. Other than ankle stiffness/weakness, patient has no pain. She has started gentle physical therapy rehabilitation exercises and is allowed to return to the gym to train but is prohibited from any explosive maneuvers.

1329 June 2, 9:00 AM - 9:20 AM

**Foot Pain - Baseball**

Eric J. Dein<sup>1</sup>, Lara Atwater<sup>1</sup>, Paul Talusan<sup>2</sup>, Cesar Cesar Netto<sup>3</sup>, Moses Lee<sup>3</sup>, Talal Zahoor<sup>3</sup>, Lew C. Schon<sup>3</sup>. <sup>1</sup>Johns Hopkins University School of Medicine, Baltimore, MD. <sup>2</sup>University of Michigan, Ann Arbor, MI. <sup>3</sup>Union Memorial Hospital, Baltimore, MD. (Sponsor: Andrew Tucker, FACSM)  
Email: edein1@jhmi.edu  
(No relationships reported)

**HISTORY:** A 38-year-old Major League Baseball player presented after feeling a pop in the plantar aspect of his left foot. Four days prior to injury, he noticed tightness in the arch of his foot medially and laterally. He experienced a pop through the center of his foot after batting when rolling his ankle while planting foot to run out of batter's box. After diving back to the base on a pick-off attempt, he experienced pain on the lateral side of his foot going up his lateral leg.

**PHYSICAL EXAMINATION:** Left lower extremity neurovascularly intact with no atrophy or deformity. Exam demonstrated peroneal longus tendon weakness with weakness of eversion and weakness of plantarflexion of the 1st metatarsal bone. Peroneal brevis tendon was palpable upon eversion and intact. No instability. The left heel strike is 5 to 10 degrees of varus with splinting secondary to pain without correction to neutral with ambulation. Contralateral side neutrally aligned and achieves 5 degrees of valgus with ambulation. Increased abduction and more lateral heel strike of the left heel. Foot progression angle on the left side is about 10 degrees, compared to zero.

**DIFFERENTIAL DIAGNOSIS:** 1. Peroneal longus tear

2. Peroneal brevis tear
3. Peroneal tenosynovitis
4. Fracture/diastasis of os peroneum
5. Peroneal subluxation
6. Stress fracture
7. Sural neuritis

**TEST AND RESULTS:** 1. Foot radiographs demonstrate no abnormalities  
2. MRI: rupture of peroneus longus tendon with retraction to lateral margin of calcaneus.

**FINAL WORKING DIAGNOSIS:** Peroneal longus rupture

**TREATMENT AND OUTCOMES:** 1. Left peroneal longus tendon debridement with re-attachment to fifth metatarsal with iliac bone marrow aspiration and injection.  
2. 10 days post-operatively removed from posterior splint and permitted to invert against resistance to midline but not to cross midline. Eversion allowed but not against resistance. Ambulation in plantarflexion permitted.  
3. Return to jogging at two months, progressively increasing exercises of figure-of-8s, A-skips, and agility.  
4. Return to full baseball activity at 3 months including baserunning, cutting, and sliding. Minor League rehabilitation delayed due to unrelated baseball injury following hit-by-pitch.  
5. Return to Major League Baseball at 4 months at pre-injury activity level prior to conclusion of the season.

**C-23 Clinical Case Slide - Neurology**

Thursday, June 2, 2016, 8:00 AM - 10:00 AM  
Room: 203

1330 **Chair:** Robert J. Johnson, FACSM. *University of Minnesota, Minneapolis, MN.*  
(No relationships reported)

1331 **Discussant:** Terry Nicola, FACSM. *UIC Sports Medicine Center, Chicago, IL.*  
(No relationships reported)

1332 **Discussant:** Sourav Poddar. *University of Colorado Health Sciences Center, Denver, CO.*  
(No relationships reported)

1333 June 2, 8:00 AM - 8:20 AM

**Significant Functional Improvement in a Person with Multiple Sclerosis Utilizing Dynamic Neuromuscular Stabilization**

F V. Harding, Kenneth Mengel. *Fortanasce & Associates, Upland, CA.*  
(No relationships reported)

**HISTORY:**

A 65 year old woman, diagnosed with Multiple Sclerosis 30 years ago, received treatment for neurologic, orthopaedic, and functional manifestations of the disease >20 yrs. Desired to regain ability to walk in public using an assistive device (Independent Limited Community Ambulation).

**PHYSICAL EXAMINATION:**

Presented with severe weakness lower extremities bilaterally  
Significant balance disturbances due to weakness  
Lacked dorsiflexion during gait  
Prescribed NMES unit to attain dorsiflexion, unit failed to elicit any response in involved musculature

**DIFFERENTIAL DIAGNOSIS:** Long standing remitting-relapsing MS

**TEST AND RESULTS:**

Manual Muscle Test (MMT): Ankle PF/DF: 0/5  
5 times sit to stand: unable unless seat height is increased, with hand hold stabilization  
Gait: MinA ModA: 7.5 - 15 m Maximum  
**FINAL WORKING DIAGNOSIS:** Remitting-relapsing MS, severe weakness, gait and balance disturbances

**TREATMENT AND OUTCOMES:**

Lower extremity exercise program using the principles of Dynamic Neuromuscular Stabilization  
Sit to stand w/o hand hold assist > 15x  
Gait: Contact Guard, MinA >= 120 m  
MMT: Ankle PF/DF: 3-/5  
Walks with assistive device in public: Independent Limited Community Ambulation

1334 June 2, 8:20 AM - 8:40 AM

**Seeing Double - Football**

Jonathan P. Bonnet, James R. Clugston. *University of Florida, Gainesville, FL.*  
Email: jonathanbonnet@gmail.com  
(No relationships reported)

**HISTORY:**

A 20-year-old collegiate wide receiver complained of double vision after making head-to-body contact with another player, causing his helmet to slide down and hit his left eye. On the sideline he reported seeing double when looking down, but not when looking up or straight ahead. Denied blurry vision, loss of consciousness, headache, dizziness, fogging, nausea, or pain. Past medical history significant only for a concussion 1 year ago without prolonged recovery or vision symptoms.

**PHYSICAL EXAM:**

Sideline exam revealed mild swelling in the left upper eyelid with diplopia on downward gaze. Locker room exam revealed an otherwise normal neurologic exam. Cranial nerves II-XII were intact except for the diplopia with downward gaze. Extraocular movements appeared intact without nystagmus, and pupils that were equal, round and reactive to light without conjunctival redness. Memory, concentration and cerebellar function were intact.

**DIFFERENTIAL DIAGNOSIS:**

1. Concussion
2. Left periorbital contusion
3. Left Third, Fourth, or Sixth Cranial Nerve Palsy
4. Cerebral Vascular Accident
5. Orbital fracture with nerve entrapment

**TESTS AND RESULTS:**

- SCAT3 Symptom Evaluation: positive for 1 symptom, "Don't Feel Right" which he attributed to double vision, with a severity of 1 (Baseline (BL) 2/2)  
- Standardized Assessment of Concussion: 29 (BL 27)  
- Balance Error Scoring System: 20 (BL 19)  
- King-Devick Testing: 31.9 secs (BL 34.2 secs)  
- Vestibular/Ocular Motor Screen: did not provoke symptoms with any maneuvers.  
- Convergence testing in the horizontal (90°) plane was 6, 6, and 7 cm.  
- As diplopia was with downward gaze, convergence was then measured in the inferior (45°) plane 24, 24, and 22 cm.  
- His vision returned to normal without diplopia in 45 minutes. Convergence remeasured at 7 cm in the 90° plane and 7.5 cm in the 45° plane. Exertional maneuvers (pushups, squats, catching passes thrown low) performed without symptom recurrence.  
**FINAL DIAGNOSIS:** Transient distal trochlear nerve (CN IV) palsy due to acute soft tissue contusion of periorbital structures

## TREATMENT AND OUTCOMES:

He returned to the game 1 hour from the incident without further complaints. Follow up visit 1 day later and throughout the next week revealed continued absence of symptoms.

GRANT FUNDING: None

1335 June 2, 8:40 AM - 9:00 AM

### Decline Of Function And Weakness In A Special Olympian With Trisomy 21

Brennan J. Boettcher, Jeffrey A. Strommen. *Mayo Clinic, Rochester, MN.* (Sponsor: Karen L. Newcomer-Aney, FACSM)  
(No relationships reported)

**HISTORY:** A 46 year-old gold medalist Special Olympian in softball, basketball and swimming presented in February 2013 to his local care provider with right leg weakness. He did not undergo any further diagnostics or treatment initially. In March he began to fall and became dependent on a walker for ambulation. Subsequent evaluation felt as if his decline in function was related to knee osteoarthritis which was symptomatically treated with injections of corticosteroid x 2 in the right knee. By June, the patient was requiring his arms to help pull himself up stairs to get into his apartment. He once again presented for further evaluation.

**PHYSICAL EXAMINATION:** Muscle Strength (L/R, scale 0-5): Iliopsoas 3/4; Adductors 4/4; Abductors 4/4; Knee Extension 1/3; Knee Flexion 1/3; Dorsiflexion 1/3; Plantarflexion 5/5. Upper limb strength was normal.

Reflexes (Scale 0-4) were hypoactive but symmetric in the upper extremities at +1; Patellar were +3; Ankle reflexes were +4 bilaterally with sustained clonus. Babinski upgoing bilaterally. Moderate vibration and proprioception deficits at the bilateral MTP joints.

Able to ambulate but locked his knees for stability.

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**DIFFERENTIAL DIAGNOSIS:** Extradural compression of cord (tumor or infection)

Intradural tumor or infection

Spinal stenosis

Transverse Myelitis

Central Nervous System Demyelinating Syndrome

Paraneoplastic Syndrome

Vascular Malformation

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**TEST AND RESULTS:** An MRI was obtained and an intradural T2-T3 spinal cord lesion was noted. He was transferred to Mayo Clinic after a short rehabilitation course locally for further treatment and workup. A short trial of IV steroids decreased his weakness, but this returned quickly after discontinuation. Based on imaging findings and steroid responsiveness, neurosarcoidosis was felt to be the most likely diagnosis.

**FINAL WORKING DIAGNOSIS:** T2-3 neurosarcoidosis with myelopathy:

**TREATMENT AND OUTCOMES:** 1- Treatment with prednisone 60 mg daily

2- Inpatient rehabilitation- 3 hours of PT/OT 5 days/week

3- Continues on prednisone taper at 14 months following discharge, down to 6 mg daily.

4- He continues to attend physical therapy sessions regularly.

5- At his 1 year followup, patient is back to living independently with his wife.

Some weakness persists; he remains unable to participate in Special Olympics.

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1336 June 2, 9:00 AM - 9:20 AM

### Lower Extremity Weakness in a Soccer Athlete

Marie A. Schaefer, Thomas Pommering. *Nationwide Children's Hospital, Dublin, OH.*  
(No relationships reported)

#### HISTORY

A 14-year-old male soccer player presented with bilateral lower leg pain and weakness. Ten days prior, he was at a lake cottage in Indiana, where he had an acute onset of bilateral leg pain, fatigue, and headache. He had a difficult time walking with a wide-based gait. Family attributed the symptoms to fatigue from intensive soccer conditioning. Over the next few days, leg pain and weakness improved, but, at soccer, he had a difficult time running and increased leg pain. He denied fevers, chills, neck pain, nausea, vomiting, diarrhea, rash, insect bites, bowel or bladder dysfunction, or upper extremity weakness. He had recent exposure to lake water, but no family members with similar symptoms. Family history was negative for neurologic, cardiac, or rheumatologic disease.

#### PHYSICAL EXAMINATION

Well-appearing child with normal vital signs. Difficulty getting off the examination table with antalgic, wide-based gait. Diminished 4/5 strength of the bilateral proximal quadriceps, but otherwise with normal strength of the upper and lower body. Tender to

palpation of the bilateral calf and quadriceps muscles without muscle or joint swelling. Neurological exam with normal deep tendon reflexes (DTRs), negative clonus, and negative Babinski. Skin without lesions.

#### DIFFERENTIAL DIAGNOSIS

1. Viral myositis
2. Inflammatory myopathy
3. Guillain-barré syndrome
4. Neuroparasitic infection
5. Muscular dystrophy
6. Rhabdomyolysis

#### TEST AND RESULTS

Labs: CK 486 U/L at presentation, decreased to 66 U/L. CBC, electrolytes, TSH, ESR, CRP, urinalysis, myoglobin, CSF, ANA, and Lyme serology all normal.

Imaging: Spine MRI with prominent ventral nerve root enhancement of the caudal equina (a common finding seen in Guillain-barré syndrome although not specific).

EMG: Motor nerve conduction with significant reduction in compound muscle action potential amplitude.

#### FINAL/WORKING DIAGNOSIS

Guillain-barré syndrome (GBS) with likely subacute/acute motor axonal neuropathy

#### TREATMENT & OUTCOMES

1. Referred to neuromuscular disorders clinic with progressive loss of DTRs.

2. Admitted to the hospital following EMG suggestive of GBS and received intravenous immunoglobulin.

3. Discharged on 60 mg of oral prednisone daily with the plan to taper.

4. Currently in weekly physical therapy with complete resolution of pain and weakness.

1337 June 2, 9:20 AM - 9:40 AM

### Shoulder Pain - Registered Nurse

Srikanth Nithyanandam. *University of Kentucky, Lexington, KY.*

Email: sri.nisi89@uky.edu

(No relationships reported)

**HISTORY:** 59yr old Caucasian female, non-smoker, presents to the Sports Medicine clinic with approximately one-year history of gradual onset left shoulder pain. She complained of dull aching pain with movements over her left shoulder joint and decreased range of motion with overhead activities. She noted to have progressive weakness throughout the day and would typically wake up the next day with improved pain and strength. She had seen multiple physicians over the past one year and an MRI was completed. The patient was not informed of any abnormalities in her MRI. She has completed a corticosteroid injection and physical therapy without any relief. She denied any numbness or tingling over her extremities.

#### PHYSICAL EXAMINATION:

Examination of bilateral shoulders revealed no erythema, effusion, deformity, obvious atrophy or ecchymosis. Passive ranges of movements were normal. Mild tenderness to palpation over the bicipital groove and along her right trapezius muscle was noted. Hawkin's test was positive bilaterally. Empty can sign was negative bilaterally, although strength difference was appreciated with 4/5 on left side and 5/5 on the right side. Resisted internal and external rotations were normal with similar strength differences. O'Brien's, apprehension/relocation test, Yergason's test, Speed's test were all found to be negative.

Examination of her cervical spine was normal. Upper extremity pulses were 2+, equal and bilateral.

**DIFFERENTIAL DIAGNOSIS:** 1. Rotator cuff tendinopathy

2. Sub acromial impingement

3. Cervical radiculopathy

4. Thoracic outlet syndrome

5. Stretch injury of brachial plexus

6. Parsonage Turner syndrome

**TEST AND RESULTS:** MRI left shoulder:

Mild teres minor muscle atrophy with extremely subtle edema within the supraspinatus, infraspinatus, teres minor and deltoid musculature was noted. Edema pattern was consistent with Parsonage Turner syndrome.

Mild insertional tendinosis of the supraspinatus and infraspinatus tendons with no high-grade partial or full-thickness rotator cuff tear noted.

EMG:

Pending at the time of submission

**FINAL WORKING DIAGNOSIS:** Parsonage Turner Syndrome

**TREATMENT AND OUTCOMES:** 1. Corticosteroid sub acromial injection

2. Follow up in 4 weeks after physical therapy

3. Consideration of Gabapentin/Carbamazepine for symptom control

1338 June 2, 9:40 AM - 10:00 AM

**Shoulder Injury - Swimming**

Benjamin V. Bring, Natalie Dick, Doug DiOrio. *Riverside Methodist Hospital, Columbus, OH.*  
 Email: benjamin.bring@ohiohealth.com  
 (No relationships reported)

**History:** A 21 year old collegiate swimmer presents to the training room with neck and scapular pain for 2 weeks. He initially noticed arm weakness associated with weight-lifting as well as pain in the surrounding shoulder muscles. The patient denies history of shoulder injury prior to pain onset. Pain is worse with overhead weight lifting and rest improves his symptoms. Pain is 3-5/10 at its worst, usually with activity only. The patient was started on steroid treatment for a total of 15 days that did not improve his symptoms. He denies radiculopathy, paresthesias, and numbness but complains of persistent right arm fatigue during exercise and with overhead swimming strokes. Review of systems, recent illness, and social history were all negative.

**Physical Examination:** Examination reveals prominent medial border of the right scapula with push-up motion against a wall (scapular winging) and 5/5 strength throughout the right upper extremity except for mild weakness with external rotation in the right arm. He had limited range of motion with right shoulder abduction and scapular dyskinesia with arm abduction past 90 degrees. There was no lateral winging with forced abduction. He had restricted range of motion at C4/5 and T4/5 and had +2 reflexes for biceps, triceps, and brachioradialis. Other clinical findings include normal sensation in bilateral upper extremities, trigger point in the right rhomboid, negative Spurling's, and no bony tenderness.

**Differential Diagnosis:**

1. Long thoracic nerve palsy (serratus anterior)
2. Neuralgic Amyotrophy (Parsonage Turner Syndrome)
3. Brachial plexus injury
4. Mass Lesion

**Test and Results:**

EMG - Right long thoracic mononeuropathy with no generalized plexopathy or cervical radiculopathy.

Ultrasound - Right long thoracic neuropathy with diffuse enlargement of long thoracic nerve, atrophy of right serratus anterior muscle, and no brachial plexus abnormalities. MRI - Not indicated at this time due to supportive evidence from results of EMG and Ultrasound.

**Final Diagnosis:** Neuralgic Amyotrophy (Parsonage Turner Syndrome)

**Treatment:**

1. Physical therapy -range of motion and flexibility
2. Limit shoulder and overhead activity
3. Acupuncture for 4 weeks
4. Osteopathic manipulation of thoracic and cervical spine including myofascial release and HVLA
5. TENS unit

**C-24 Clinical Case Slide - Upper Extremity- Elbow**

Thursday, June 2, 2016, 8:00 AM - 10:00 AM  
**Room:** 206

1339 **Chair:** Bryan Wiley. *Kaiser Permanente, Rancho Cucamonga, CA.*  
 (No relationships reported)

1340 **Discussant:** Jerrad P. Zimmerman. *Carle Clinic, Urbana, IL.*  
 (No relationships reported)

1341 **Discussant:** Tracy Ray, FACS. *Duke University, Durham, NC.*  
 (No relationships reported)

1342 June 2, 8:00 AM - 8:20 AM  
**Non-operative Treatment Of Ulnar Collateral Ligament Tear Using Platelet Rich Plasma Injection**  
 Kyle Dolan. *University of South Carolina, Columbia, SC.*  
 (No relationships reported)

**NON-OPERATIVE TREATMENT OF ULNAR COLLATERAL LIGAMENT TEAR USING PLATELET RICH PLASMA INJECTION** Kyle Dolan, ATC; Christopher Mazoue, MD, Matthew Pollack, MD University of South Carolina, SC & University of South Carolina Sports Medicine, SC

Ulnar collateral ligament (UCL) tears are a common injury that softball players are pre-disposed to. Traditionally, athletes undergo Tommy John reconstruction of the UCL to repair the damaged ligament. Research has shown the ability of an athlete to return to competition at the same level, as prior to injury. **History/Physical Examination:** An 18 year old female softball player presented in pre-participation screenings at the University of South Carolina, with symptoms consistent with UCL pathology. **Differential Diagnosis/Test and Results:** Following magnetic resonance imaging (MRI) to confirm suspected pathology, the athlete, physician and athletic trainer conferred on course of treatment. A platelet rich plasma injection was decided upon as intervention. **Final Working Diagnosis:** A 3 ml ultrasound guided PRP injection was prepared via centrifuge and injected by a physician specializing in injections that day. A diagnostic ultrasound guided injection was completed in the mid-substance anterior bundle of the UCL. The athlete had 1 week of rest following the injection before beginning rehabilitative treatment, as suggested by the University of Wisconsin published rehabilitation guidelines post PRP injection. From October to January the athlete took part in rehabilitative treatment. The team athletic trainer used a modified elbow hyperextension taping procedure, in order to reduce pain in the affected arm during sport specific activity. The herring bone pattern over the UCL was utilized with a proximal anchor and a distal anchor to reduce the amount of valgus stress on the elbow. After consulting with a bracing company, a custom valgus prevention brace was made in order to replace the need for daily taping of the athletes elbow. The athlete was able to utilize the brace, as well as rehabilitative exercise to reduce her symptoms, and participate in high level athletics. **Conclusion:** The use of PRP injection, in conjunction with bracing could be a potential non-operative treatment for partial UCL tears of the elbow, suggested by the findings of this case.

1343 June 2, 8:20 AM - 8:40 AM

**Acute Elbow Pain in an Olympic Weightlifter**

Abbie Kelley. *York Hospital, York, PA.* (Sponsor: Mark Lavallee, FACS) (No relationships reported)

**HISTORY:** 61 yo male Japanese weightlifter, who sustained an acute right elbow injury after attempting a 52kg snatch at the International Weightlifting Federation Masters Championship. The lift was witnessed by the medical team. He was unable to complete the lift and subsequently dropped the weight behind him. He complains of excruciating pain at the elbow. He denies any history of trauma or injury to the elbow in the past.

**PHYSICAL EXAMINATION:** Patient is awake, alert, and oriented x3 in acute distress, secondary to pain. Inspection of the right elbow reveals a deformity of the elbow with the olecranon displaced posteromedially. There are no overlying skin changes. Patient is unable to flex and extend elbow. Sensory of the upper arm, forearm and hand are intact. Distal radial and ulnar pulses are intact and brisk bilaterally. Hand is warm without pallor.

**DIFFERENTIAL DIAGNOSIS:** 1. Acute Elbow Dislocation 2. Supracondylar/ Intercondylar/Epicondylar Distal Humeral Fracture 3. Trochlear Fracture 4. Capitellar Fracture 5. Radial Head Fracture 6. Proximal Ulnar Fracture 7. Radial Head Subluxation 8. Triceps Tendon Rupture 9. Displaced Osteochondral Lesion of the Elbow

**TEST AND RESULTS:** X-ray of the right elbow shows a complete posterior elbow dislocation. Post-Reduction X-ray of the right elbow shows a completely reduced elbow with a 2cm x 1cm ossification just distal to the medial epicondyle, possibly representing an old fracture vs. heterotopic ossification vs. osteochondral loose body.

**FINAL/WORKING DIAGNOSIS:** Right Elbow Dislocation

**TREATMENT AND OUTCOMES:** At the venue, prior to obtaining the X-ray, several unsuccessful attempts were made to immediately reduce the right elbow. After about 20 minutes of unsuccessful reduction attempts, the patient was transported to the ED in a MediSeam vacuum splint for reduction under conscious sedation. En route to the hospital, he was given 5mg of Morphine IV. At the hospital, he was given 2.5mg of Diazepam and 0.25mg of Rapifen for sedation, and the elbow was successfully reduced by 2 physicians. He was placed in a sling and told to keep the elbow flexed at 90 degrees until seen in follow up in Japan.

1344 June 2, 8:40 AM - 9:00 AM

**Elbow Injury - Baseball**

Shawn D. Felton, Arie J. van Duijn. *Florida Gulf Coast University, Fort Myers, FL.* (Sponsor: Mitchell L. Cordova, FACS) Email: sfelton@fgcu.edu (No relationships reported)

**HISTORY:**

21-year-old NCAA Division IA baseball athlete with history of left shoulder impingement with some mild undersurface tearing of the distal infraspinatus tendon and elbow pain reported with decreased terminal velocity but denies any loss of accuracy. Athlete further noted he changed his pitching technique at the beginning

of the fall season to resemble a side-arm approach rather than throwing over the top. Athlete underwent conservative treatment for approximately 2½ months with limited results.

**PHYSICAL EXAMINATION:**

Athlete was examined in athletic training room. No obvious deformities, gross edema or evidence of acute injury. Normal palpation of soft tissues, tendon and bony structures. Athlete presented with 5/5 graded muscular strength of the elbow flexors, extensors, pronators and supinators with limited active ROM with extension. The following tests were negative: Valgus Extension Overload, Varus and Valgus Stress, O'Brien and O'Driscoll.

**DIFFERENTIAL DIAGNOSIS:**

1. Medical Collateral ligament sprain
2. Ulnar Neuritis
3. Common Flexor Tendon Pathology
4. Medial Epicondylitis
5. Valgus Extension Overload

**TEST AND RESULTS:**

Elbow AP/Lateral/Oblique Radiographs:

- Moderate posterior olecranon osteophyte, otherwise within normal limits.

MRI indirect arthrogram

- Low grade stress injury within the proximal ulna, No OCD

- No intra-articular body or soft tissue masses

MSK Diagnostic Ultrasound Imaging

- Discontinuity of medial trochlear bony surface of the humerus

**FINAL/WORKING DIAGNOSIS:**

Left valgus extension overload of elbow and left elbow grade 4 chondromalacia of the posteromedial humerus.

**TREATMENT AND OUTCOMES:**

The athlete underwent arthroscopic extensive debridement surgery and was found to have a moderate size posteromedial olecranon exostosis that was impinging on the posteromedial humerus. In addition, the athlete was found to have a 1 cm x 1.5 cm grade 4 chondromalacia involving the posteromedial humerus. A gentle chondroplasty and posteromedial olecranon resection was performed. Although the diagnosis and procedure is common among throwing athletes, this case clearly illustrated the use of diagnostic musculoskeletal ultrasound in identifying these types of lesions. The athlete has made a full recovery.

1345 June 2, 9:00 AM - 9:20 AM

**Medial Elbow Pain-Baseball**

Arie J. van Duijn, Shawn D. Felton. *Florida Gulf Coast University, Fort Myers, FL.* (Sponsor: Mitchell L Cordova, FACSM)

Email: avanduij@fgcu.edu

(No relationships reported)

**HISTORY:** 22-year-old NCAA Div. 1 baseball pitcher with one year history of right medial elbow pain. Prior history of medial condyle growth plate fracture at age 16. Initial injury occurred during pitching in a mid-season baseball game, with complaints of pain and swelling in the medial forearm and numbness in the ulnar nerve distribution. X-rays were normal. Diagnosis was medial epicondylitis, and treatment consisted of rest, massage, modalities including thermal ultrasound and ice, and cortisone injection two months after injury. The athlete resumed strengthening and ROM exercises, and began throwing program one month later which he continued over summer. After resuming competitive throwing in the fall his symptoms reappeared, and was again diagnosed with medial epicondylitis and treated as outlined above for 4 months with minimal results.

**PHYSICAL EXAMINATION:**

Edema was noticed in the medial proximal forearm and around the common flexor tendon. Numbness was reported along the ulnar nerve distribution. No point tenderness was present at the medial epicondyle. ROM and strength of the elbow, wrist, and fingers was WNL.

**DIFFERENTIAL DIAGNOSIS:**

1. Medial Epicondylitis
2. Ulnar nerve entrapment
3. Loose body medial elbow joint compartment
4. Common flexor tendon pathology

**TEST AND RESULTS:**

Ultrasound imaging of medial elbow:

-hyperechoic intra-articular body 0.5 cm medial to the trochlea, 0.73 cm in length, encroaching on the medial collateral ligament and the common flexor tendon.

Elbow A/P, lateral, and oblique radiographs:

-WNL

**FINAL/WORKING DIAGNOSIS:**

Intra-articular bony loose body encroaching on the medial collateral ligament, the common flexor tendon, and likely encroaching on the ulnar nerve just proximal to the medial joint line.

**TREATMENT AND OUTCOMES:** After consulting with orthopedic surgeon, athlete elected to retire from competitive baseball, not to pursue surgical removal of the loose body, and reported resolution of symptoms following the discontinuation of throwing

activities. This case report illustrated how diagnostic musculoskeletal ultrasound imaging can contribute to accurate diagnosis of sources of medial elbow pain, and earlier use may have resulted in a better clinical outcome by properly identifying the underlying bony pathology, allowing for more appropriate intervention.

1346 June 2, 9:20 AM - 9:40 AM

**Elbow Injury-golf**

Alex B. Behar<sup>1</sup>, Daniel R. Bunzol<sup>2</sup>. <sup>1</sup>Rush University Medical Center, Chicago, IL. <sup>2</sup>University of Illinois at Chicago, Chicago, IL.

Email: Alex\_b\_Behar@rush.edu

(No relationships reported)

**HISTORY:** 58 year old female with a history of intracerebral hemorrhage and right hemiparesis presented with right arm pain for 6 months. She described the pain as "tightness in the thumb and around the 5th digit". The pain was rated 3/10 with burning on the medial elbow and forearm without paresthesias. She noticed the pain after being diagnosed with medial epicondylitis and wearing an elbow strap. Social history included secretarial duties consisting of typing and handwriting. She associated her pain in the right forearm with typing and handwriting. Functionally, she ambulated with a cane on the right side for support. No history of trauma to the right arm.

**PHYSICAL EXAMINATION:** No abnormalities appreciated on inspection. She had full active range of motion of the upper extremities. Focal tenderness was noted over the medial epicondyle of the right upper extremity. Strength to the bilateral upper extremities was 5/5 and symmetric. Sensation was decreased in the right 5th digit to light touch. She complained of pain over the right medial elbow with resisted wrist flexion, + Tinel's at the right medial epicondyle, and negative valgus stress tests of the right elbow. Modified Ashworth Scale 0/4 in the upper extremities.

**DIFFERENTIAL DIAGNOSIS:** 1) Medial epicondylitis 2) Cervical radiculopathy 3) Ulnar mononeuropathy

**TEST AND RESULTS:** Electromyography and nerve conduction studies were performed to determine the etiology of the right pollex and 5th digit sensory changes. Results were positive for right ulnar nerve mononeuropathy at or just below the elbow consistent with cubital tunnel syndrome and right median sensory mononeuropathy at the wrist consistent with mild carpal tunnel syndrome. No evidence of brachial plexopathy or cervical nerve root lesion.

**FINAL WORKING DIAGNOSIS:** Compressions mononeuropathy of the ulnar nerve at the cubital tunnel secondary to medial epicondylitis orthotic.

**TREATMENT AND OUTCOMES:** The patient was educated about the neuropathies and her activities were restricted to minimize elbow flexion and trauma to the medial epicondyle. She was recommended to avoid further use of her tendonitis brace as this contributed to compression of the cubital tunnel and ultimately caused her ulnar mononeuropathy. The patient improved with a 4 week course of physical therapy and follow up.

1347 June 2, 9:40 AM - 10:00 AM

**Neurogenic Thoracic Outlet Syndrome Presenting as Chronic Elbow Pain After Obstacle Course**

Shane L. Larson<sup>1</sup>, Scott W. Pyne, FACSM<sup>2</sup>, David Reilly<sup>3</sup>, Nicholas Cardinale<sup>2</sup>. <sup>1</sup>Fort Belvoir Community Hospital, Fort Belvoir, VA. <sup>2</sup>US Naval Academy, Annapolis, MD. <sup>3</sup>Walter Reed National Military Medical Center, Bethesda, MD. (Sponsor: Scott Pyne, MD FACSM, FACSM)

(No relationships reported)

**HISTORY:** A 20-year-old female US Naval Academy freshman sustained a left elbow injury after repetitive shoulder abduction movements while completing a required obstacle course. She denied specific trauma, including a fall. There was no numbness, tingling, or radiation of pain. Five days later, she reported her left elbow pain to her physician. Originally diagnosed with an elbow contusion versus epicondylitis, the patient's progressive left elbow pain lasted for more than 6 months when she developed ulnar dysesthesias in her hand.

**PHYSICAL EXAMINATION:** Examination revealed diffuse elbow tenderness with swelling. Normal neurovascular examination was demonstrated. Elbow strength and range of motion were normal. Neck and shoulder exams demonstrated no abnormalities. Swelling resolved in one week. Exam remained unchanged for several months before she developed ulnar distribution pain. Then, an Allen test reproduced and worsened her elbow pain and neurologic symptoms.

**DIFFERENTIAL DIAGNOSIS:**

1. Elbow Contusion
2. Chronic Regional Pain Syndrome
3. Intraarticular Body, Elbow Fracture
4. Brachial Plexopathy
5. Thoracic Outlet Syndrome

**TEST AND RESULTS:**

Left elbow anterior-posterior, lateral radiographs:

— no acute osseous abnormality

Left elbow MRI:  
 — likely resolving bony contusion of radial head without evidence of fracture  
 CT Left Elbow:  
 — normal evaluation of the left elbow  
 EMG left upper extremity:  
 — normal electrodiagnostic study  
 Left brachial plexus MRI:  
 — normal left brachial plexus  
 Chest MRI, with contrast:  
 — findings consistent with thoracic outlet syndrome localized to costoclavicular space  
 Left upper extremity venogram:  
 — no evidence of venous occlusion or compression  
**FINAL/WORKING DIAGNOSIS:**  
 Neurogenic Thoracic Outlet Syndrome  
**TREATMENT AND OUTCOMES:**  
 1. Relative rest, ice, compression and NSAIDs for 4 weeks without improvement.  
 2. Activity modification and trial of acupuncture demonstrated minimal improvement in presenting elbow pain.  
 3. Left scalene block with complete relief of symptoms, indicating neurogenic thoracic outlet syndrome.  
 4. Partial left first rib resection with resolution of chronic left elbow pain and ulnar nerve dysesthesias.  
 5. Range of motion, shoulder, and neck strengthening exercises started gradually 6 weeks post-surgery.

**C-25 Free Communication/Poster - Body Composition**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
 Room: Exhibit Hall A/B

1348 Board #1 June 2, 8:00 AM - 9:30 AM  
**Relationship between Body Composition, Physical Activity Level and Lower Back Symptoms: A Pilot Study**

Marta I. Amaral, Stephanie Alemar. *University of Puerto Rico-Rio Piedras Campus, San Juan, Puerto Rico.*  
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 (No relationships reported)

Lower back problems is one of the most common physiological conditions because the lumbar region allows flexion of the trunk and supports body mass. Lower back symptoms can be related to physical inactivity, body composition and discapacity. The Center for Disease Control reported, in 2012, that 19% of young adults between the ages of 18-24 years, and 25 % of adults ages 25 to 44 years had significant lower back pain affecting their laboral capacity. **PURPOSE:** Determine the relationship between body composition, physical activity level and lower back symptoms/discapacity among college students. **METHODS:** Physical Activity level was evaluated using the International Physical Activity Questionnaire-short version (IPAQ). Body Composition was assessed using: 1) three sites skinfold technique to determine percent body fat (PBF, women: triceps, suprailliac and thigh; men: chest, abdominal and thigh), 2) body mass index (BMI: weight/ height) and 3) waist circumference (WC). The lower back symptoms and discapacity was determine using the Oswestry Disability Index (ODI). **RESULTS:** 21 college students (71.4% women, 28.6% men) participated in this study. They reported an average score of 6.9±6.1 percent of discapacity. The average BMI was 22.7±9.3; the average waist circumference was 75.3±24.2 cm. The average percent body fat was 22.0±10.3%. The Pearson's correlation analysis found a significant relationship between WC and PBF (r=0.59, p<0.01). Also, that PBF was significantly related to ODI (r=0.46, p=0.01). When, we examined the data to determine gender differences, significant differences were found for PBF (females had higher BPF, p<0.05) and ODI (females reported a higher score ODI, p<0.05). A multiple regression analysis showed that the variable that better predicts discapacity was percent body fat (r=0.60, p= 0.013). **CONCLUSIONS:** This study suggest that percent body fat was related to waist circumference, and more importantly to a higher discapacity index. Also, that percent body fat was the better predictor of discapacity caused by lower back symptoms.

1349 Board #2 June 2, 8:00 AM - 9:30 AM  
**Reference Values for Body Fat Percentage obtained from Dual Energy X-Ray Absorptiometry in Adults**  
 Mary S. Tuttle<sup>1</sup>, Whitney A. Welch<sup>2</sup>, Ann M. Swartz, FACSM<sup>2</sup>, Alexander H.K. Montoye<sup>1</sup>, Matthew Harber, FACSM<sup>1</sup>, Leonard A. Kaminsky, FACSM<sup>1</sup>. <sup>1</sup>Ball State University, Muncie, IN. <sup>2</sup>University of Wisconsin-Milwaukee, Milwaukee, WI. (Sponsor: Leonard Kaminsky, FACSM)  
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 (No relationships reported)

Dual energy x-ray absorptiometry (DXA) is an established technique for the measurement of body composition (BC). Reference values for BC variables, particularly percent body fat (%BF) are necessary for accurate interpretation. Reference standards are available for only one of the three major DXA manufacturers. It is known that %BF values may differ by manufacturer. Presently, there are no reference values for %BF measurements obtained from GE Healthcare Lunar DXA systems. **PURPOSE** To develop reference values by age group and sex for DXA-derived %BF with GE Lunar systems. **METHODS** A de-identified sample of 3,673 subjects (2,291 women, 1382 men) was obtained from Ball State University's Clinical Exercise Physiology Laboratory and University of Wisconsin-Milwaukee's Physical Activity & Health Research Laboratory. All scans were completed between July 2003 and October 2015 using a Lunar Prodigy DXA or iDXA. Percentiles were calculated and a factorial ANOVA was used to determine the difference in the mean %BF values between age groups and sex. **RESULTS** Normative percentiles of %BF from the GE lunar DXA systems by age group for both sexes are displayed in the table. Women had higher %BF than men in all age groups (p<0.01). There was an increase in %BF with each age group up to 50 years of age (p<0.01) in both sexes. Thereafter, no significant changes in %BF were observed with the two older age groups.

Age (Years)	Subject N		80th		60th		40th		20th	
	F	M	F	M	F	M	F	M	F	M
20-29	566	387	24.4	14.0	29.7	18.5	34.8	22.7	42.0	28.7
30-39	198	109	27.3	16.0	34.3	23.2	41.2	30.2	47.4	37.3
40-49	273	148	31.8	22.2	38.1	28.4	43.6	31.5	49.5	36.9
50-59	445	217	34.0	24.1	40.2	29.4	45.0	33.7	49.4	37.9
60-69	445	240	35.5	25.2	40.8	29.6	45.0	33.5	49.1	37.4
70-79	184	169	35.5	25.7	39.6	29.4	43.5	34.0	48.2	37.4

**CONCLUSION** These reference values provide clinicians and researchers using a GE Lunar DXA with a resource for interpretation of %BF specific to this instrumentation. Future research is needed to determine reference values for other BC measurements, including lean mass, available from whole-body DXA scans.

1350 Board #3 June 2, 8:00 AM - 9:30 AM  
**Correlation Between Muscle Mass And Muscle Function In Community-dwelling Elderly Women Of Northeast Mexico**

Oswaldo Ceballos-Gurrola, Maria Cristina Enriquez-Reyna, Eduardo Cavazos-Hernandez, Erik Ramirez. *Universidad Autonoma de Nuevo Leon, San Nicolas de los Garza, N. L., Mexico.*  
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 (No relationships reported)

The European Working Group on Sarcopenia in Older People (EWGSOP) recommends testing the presence of low muscle mass and low muscle function for the diagnosis of sarcopenia. Low muscle function may be evaluated by means of either grip strength, usual gait speed, or physical performance; nevertheless, recent studies have demonstrated that the relation between appendicular skeletal muscle mass index (ASMI) and definitions of low muscle function could be weak. The relation between muscle mass and muscle strength varies depending on factors such as age and body mass, therefore interchangeable use of these indicators of muscle function may not be appropriate. **PURPOSE:** To assess the relationship between muscle mass, handgrip strength, usual gait speed, and physical performance in community-dwelling elderly women of northeast Mexico. **METHODS:** Cross-sectional study with 415 elderly women (60 years old or more) from public senior clubs. In order to assess muscle mass, ASMI was measured by means of bioelectrical impedance. Maximum handgrip strength was measured using dynamometer, whereas stopwatch was used to assess gait speed. In addition, Short Physical Performance Battery (SPPB) was applied. Analyses were carried out for the whole sample and based on different age groups and body mass index categories. Spearman correlation coefficients were calculated. **RESULTS:** Considering the whole sample, ASMI showed correlation with usual gait speed and SPPB (r = .192, and r = -.204, respectively; p < .01). However, no association was

found between ASMI and handgrip strength in the whole sample or in any age group separately ( $r = .056$ ;  $p = .256$ ). In people over 80, usual gait speed and physical performance were not associated with ASMI ( $p > .05$ ). ASMI was only associated with handgrip strength in the group of obese elderly women ( $BMI > 30\text{kg/m}^2$ ,  $r = .154$ ,  $p = .039$ ). **CONCLUSION:** In elderly women without obesity, ASMI was correlated with usual gait speed and physical performance evaluated using SPPB, but not using handgrip strength. This study confirms the need to review the reliability of grip strength as gold standard indicator of muscle function.

1351 Board #4 June 2, 8:00 AM - 9:30 AM

### Appendicular Muscle Mass per Body Weight and Waist Circumference were Appropriate Indexes for Sarcopenic Obesity

Taishi Furushima<sup>1</sup>, Motohiko Miyachi<sup>2</sup>, Motoyuki Iemitsu<sup>1</sup>, Haruka Murakami<sup>2</sup>, Hiroshi Kawano<sup>3</sup>, Yuko Gando<sup>2</sup>, Ryoko Kawakami<sup>4</sup>, Kiyoshi Sanada<sup>1</sup>. <sup>1</sup>Ritsumeikan University, Shiga, Japan. <sup>2</sup>National Institute of Health and Nutrition, Tokyo, Japan. <sup>3</sup>Kokushikan University, Tokyo, Japan. <sup>4</sup>Waseda University, Saitama, Japan.

(No relationships reported)

**PURPOSE:** The purposes of this study were 1) to examine the association between difference of indexes for sarcopenic obesity (SO) and risk factors of metabolic syndrome (MetS) and 2) to determine the more appropriate indexes for SO in middle-aged and older Japanese men.

**METHODS:** This study provides a cross-sectional investigation in 100 middle-aged and older Japanese men ( $56 \pm 12$  years). We used two indexes for sarcopenia: 1) Appendicular skeletal muscle mass (ASM) divided by height squared ( $ASM/Ht^2$ ,  $\text{kg/m}^2$ ) and 2) ASM as a percentage of body weight ( $ASM/Wt$ , %). ASM was measured by dual energy X-ray absorptiometry. On the other hand, we used three indexes for obesity: 1) waist circumference (WC, cm), 2) body mass index ( $BMI$ ,  $\text{kg/m}^2$ ) and 3) body fat percentage (% fat, %). MetS risk score was derived by standardizing and then summing the following continuously-distributed variables: fasting blood glucose (FBG), serum triglyceride (TG) / HDL cholesterol (HDL-C) and mean blood pressure (MBP), to obtain the Z-score. SO risk score was derived from the difference in subtraction ( $ASM/Wt$  Z-score minus WC, BMI, % fat Z-score).

**RESULTS:**  $ASM/Wt$  was observed significantly age-adjusted partial correlation with MetS risk score ( $r = -0.30$ ,  $P < 0.01$ ), but not  $ASM/Ht^2$ . On the other hand, WC ( $r = 0.46$ ,  $P < 0.001$ ), BMI ( $r = 0.39$ ,  $P < 0.05$ ) and % fat ( $r = 0.36$ ,  $P < 0.001$ ) were observed significantly age-adjusted partial correlation with MetS risk score. Multiple regression analysis revealed that the MetS risk score was independently associated with SO risk score (derived by  $ASM/Wt$  and WC), but not with SO risk score (derived by  $ASM/Wt$  and BMI,  $ASM/Wt$  and % fat).

**CONCLUSIONS:** These results suggest that  $ASM/Wt$  and WC are more closely related with risk factors of MetS in Japanese SO. Therefore,  $ASM/Wt$  and WC may be more appropriate indexes for the detection of SO.

1352 Board #5 June 2, 8:00 AM - 9:30 AM

### Functional Deficits Precede Muscle Mass Loss: Implications for Sarcopenia Diagnosis

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(No relationships reported)

Sarcopenia is the loss of muscle mass due to aging. However, most definitions of sarcopenia now include performance measures to also incorporate decreases in physical function. The European Working Group on Sarcopenia in Older People (EWGSOP) recently developed guidelines for identifying sarcopenia that include measures of gait speed and hand grip strength (HGS), both of which have been independently linked with impaired function, and increased morbidity and mortality. Regardless of these functional measures, however, loss of muscle mass is still fundamental to the guidelines and is required to be classed as sarcopenic.

**PURPOSE:** To examine the prevalence of sarcopenia in middle-aged and older adults (>50 years) according to EWGSOP guidelines and whether functional decline is prevalent in participants with normal muscle mass.

**METHODS:** Community-dwelling adults underwent the Short Physical Performance Battery - a series of functional measures including gait speed, chair rise, and standing balance assessments, along with HGS, stair climb tests and a Dual Energy X-Ray Absorptiometry scan for body composition. Data are expressed as mean  $\pm$  SD.

**RESULTS:** A total of 66 participants (age  $62.8 \pm 8.0$  years; 65% female) completed the study. No participants were classed as sarcopenic according to the EWGSOP guidelines as none had appendicular lean mass ( $\text{kg}/\text{height}^2$ ) ( $ALM/h^2$ ) below the proposed cut off points. Despite this, almost 50% of participants had low gait speed (<0.8 m/s) and 20% had low HGS (<20kg female and <30kg male). Participants

with low gait speed had worse total physical performance scores ( $8.75 \pm 1.63$  vs  $10.74 \pm 1.50$ ;  $P < 0.001$ ) and reduced Stair Climb power ( $251 \pm 92$  vs  $296 \pm 70$  W;  $P = 0.029$ ). Interestingly, those with low HGS also demonstrated the same reductions. HGS was positively correlated with arm, leg and total lean mass, and  $ALM/h^2$  ( $r = 0.504$ ;  $P < 0.001$ ), while being negatively correlated with appendicular fat mass and percentage, as well as % body fat ( $r = -0.525$ ;  $P < 0.001$ ).

**CONCLUSIONS:** Functional measures, such as gait speed and HGS, are easily implemented in a clinical setting and reflect deficits in stair climb power. These changes appear to precede changes in muscle mass based on the EWGSOP classifications. Routine HGS testing may identify those at risk of developing sarcopenia and allow earlier intervention.

1353 Board #6 June 2, 8:00 AM - 9:30 AM

### Indexes for Sarcopenia and Obesity Have The Difference Association with Metabolic Syndrome Risk Factors.

Taichi Murakami<sup>1</sup>, Motohiko Miyachi<sup>2</sup>, Motoyuki Iemitsu<sup>1</sup>, Haruka Murakami<sup>2</sup>, Hiroshi Kawano<sup>3</sup>, Yuko Gando<sup>2</sup>, Ryoko Kawakami<sup>4</sup>, Kojiro Ishii<sup>5</sup>, Noriko Satoh-Asahara<sup>6</sup>, Kiyoshi Sanada<sup>1</sup>. <sup>1</sup>Ritsumeikan University, Shiga, Japan. <sup>2</sup>National Institute of Health and Nutrition, Tokyo, Japan. <sup>3</sup>Kokushikan University, Tokyo, Japan. <sup>4</sup>Waseda University, Saitama, Japan. <sup>5</sup>Doshisha University, Kyoto, Japan. <sup>6</sup>National Hospital Organization Kyoto Medical Center, Kyoto, Japan.

(No relationships reported)

The coexistence of sarcopenia and obesity is referred to as sarcopenic obesity. This condition is associated with a higher risk for metabolic syndrome (MetS) than obesity or sarcopenia alone. However there is little information on the relationships between the indexes for sarcopenia and/or obesity and the risk factors for metabolic syndrome in sarcopenic obesity.

**PURPOSE:** To assess the relationships between the indexes for sarcopenia and/or obesity and the risk factors for metabolic syndrome in Japanese sarcopenic obesity.

**METHODS:** Japanese sarcopenic obesity men ( $n = 19$ ,  $59 \pm 16$  years) and women ( $n = 9$ ,  $59 \pm 3$  years) were participated in this study. Skeletal muscle index (SMI; appendicular muscle mass/height<sup>2</sup>) was calculated by dual-energy X-ray absorptiometry. Sarcopenia was defined as values one standard deviation below the sex-specific means SMI for young adults. Obesity was defined as waist circumference > 85cm in men and > 90cm in women. Subjects were classified into higher and lower SMI group, and higher and lower waist circumference (WC) group using gender-specific mean values in this study. Total cholesterol, LDL-cholesterol, HDL-cholesterol, triglycerides, glucose and HbA1c were measured in all subjects. Brachial-ankle pulse wave velocity (baPWV) was measured by the volume plethysmographic method.

**RESULTS:** In all subjects, one-way ANCOVA with adjustment for gender as a covariate indicated that the baPWV in higher WC group was significantly higher than that in lower WC group ( $n = 28$ ,  $p = 0.0138$ ). However there was no significant difference with the baPWV between higher and lower SMI group. The baPWV in men was observed significantly positive correlation with WC ( $n = 19$ ,  $r = 0.472$ ,  $p = 0.0414$ ), but not with SMI. On the other side, HbA1c in men was observed significantly negative correlation with SMI ( $r = -0.486$ ,  $p = 0.0349$ ), but not with WC.

**CONCLUSIONS:** In Japanese sarcopenic obesity men, WC was associated with greater arterial stiffness and SMI was associated with glycation of serum proteins.

1354 Board #7 June 2, 8:00 AM - 9:30 AM

### Greater Cardiovascular Fitness Moderates The Relationship Between Body Fat And Resting Testosterone: Nhanes 2003-2004

Peter A. Hosick, Evan L. Matthews, Steve Leigh. Montclair State University, Montclair, NJ.

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(No relationships reported)

Increased adiposity can disrupt normal endocrine function, which may perpetuate obesity. Obese individuals have reduced resting and exercising testosterone levels. This indicates that excess adipose tissue seen in obesity may interfere with the normal adaptive responses to exercise. Recent research has suggested that fitness and physical activity may mitigate some of the endocrine disruption associated with obesity.

However, little is known about the effect of cardiovascular fitness on the relationship between obesity and testosterone. **PURPOSE:** To determine if cardiovascular fitness can influence the relationship between the level of adiposity and resting testosterone concentration in males. **METHODS:** The responses of 37 obese ( $BMI > 30$ ) and 60 normal weight ( $BMI 18.6 > 24.9$ ) males between the ages of 18 and 35 from the 2003-2004 National Health and Nutrition Examination Survey (NHANES) were analyzed. Bivariate correlation coefficients were computed for resting testosterone level (RTL), percent body fat (BF%), and cardiovascular fitness (CVF). Partial correlation coefficients were computed between RTL and BF% controlling for CVF. **RESULTS:** Mean values for Bivariate correlations between RTL and BF% (Normal:  $r = -0.445$ ,  $p$

< 0.001; Obese:  $r = -0.362$ ,  $p = 0.028$ ), and between RTL and CVF (Normal:  $r = 0.395$ ,  $p = 0.009$ ; Obese:  $r = 0.485$ ,  $p = 0.022$ ) were significant for both groups. However, when the relationship between RTL and BF% was analyzed controlling for CVF a significant relationship was not longer present in either group (Normal:  $r = -0.228$ ,  $p = 0.146$ ; Obese:  $r = -0.244$ ,  $p = 0.287$ ). **CONCLUSION:** Greater BF% is associated with reduced RTL. Cardiovascular fitness moderates the relationship between BF% and RTL, such that the decreased RTL due to greater BF% may be mitigated by increased CVF. Therefore, exercise resulting in increased CVF may improve endocrine function regardless of weight status.

1355 Board #8 June 2, 8:00 AM - 9:30 AM  
**Sex-specific Variability In Body Composition Estimations By Bioelectrical Impedance Analysis As Compared To Dual Energy X-ray Absorptiometry And Hydrostatic Weighing.**  
 Michelle K. Alencar<sup>1</sup>, Kelly Johnson<sup>2</sup>, Ann L. Gibson, FACSM<sup>3</sup>, Edgar Sanchez<sup>4</sup>, Leilina Nguyen<sup>5</sup>. <sup>1</sup>California State University-Long Beach, Long Beach, CA. <sup>2</sup>University of New Mexico, Albuquerque, NM. <sup>3</sup>University of New Mexico, Albuquerque, CA. <sup>4</sup>California State University-San Bernardino, San Bernardino, CA. <sup>5</sup>California State University-San Bernardino, San Bernardino, CA. (Sponsor: Ann Gibson, FACSM)  
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 (No relationships reported)

Estimations of body composition in overweight and obese adults can be made using techniques such as hydrostatic weighing (HW), dual energy X-ray absorptiometry (DXA), single frequency vertical (SF-BIA) and multi-frequency supine (MF-BIA) bioelectrical impedance analyses.  
**PURPOSE:** The purpose of this study was to determine if sex-specific differences would be apparent in BIA estimations of body fat (%BF) when compared to DXA and HW for overweight and obese adults.  
**METHODS:** In a single session, 13 men (29.4±3.6 kg/m<sup>2</sup>) and 12 women (30.8±4.6 kg/m<sup>2</sup>) consented and were randomly assessed by DXA, vertical SF-BIA, and supine MF-BIA; HW was performed last. A 2 (sex) x 4 (method) RMANOVA was used. Post-hoc t-tests were applied as appropriate. Analyses were performed via SPSS v23 with significance at the .05 level.  
**RESULTS:** There were significant main effects for method ( $F(1,23) = 52.244$ ,  $p < .001$ ) and sex ( $F(1,23) = 42.39$ ,  $p < .001$ ); men were consistently leaner than women. For the men (26.23±6.0 yr), MF-BIA (25.1±7.1%BF) and SF-BIA (20.1±5.7%BF) were similar to HW (20.8±6.1%BF;  $p = .123$  and  $.368$ , respectively). Compared to DXA (25.5±6.6%BF), MF-BIA was similar ( $p = 0.863$ ), but SF-BIA underestimated DXA %BF ( $p < .001$ ).  
**CONCLUSIONS:** Sex-specific similarities and differences in %BF are evident when comparing vertical SF-BIA and supine MF-BIA to HW and DXA. For the men, MF-BIA, but not SF-BIA, yielded similar results to HW and DXA. For the women, MF-BIA was similar to HW, but, like SF-BIA, was significantly lower than DXA. For this sample, MF-BIA appears interchangeable with DXA (men) and HW (both sexes).

1356 Board #9 June 2, 8:00 AM - 9:30 AM  
**Obstructive Sleep Apnea Increases Visceral Fat Deposition but Not Total Body Fat Percentage**  
 Ryan Martin, Gabrielle Giersch, Courtney Stosnider, Jacob D. Ridings, Christopher J. Womack, FACSM, Trent A. Hargens, FACSM. James Madison University, Harrisonburg, VA.  
 (No relationships reported)

Obstructive Sleep Apnea Increases Visceral Fat Deposition but Not Total Body Fat Percentage  
 Ryan A. Martin<sup>1</sup>; Gabrielle E. W. Giersch<sup>1</sup>; Courtney Stosnider<sup>1</sup>; Jacob D. Ridings<sup>1</sup>; Christopher J. Womack, FACSM<sup>1</sup>; Trent A. Hargens, FACSM<sup>1</sup>  
<sup>1</sup>Human Performance Laboratory, Department of Kinesiology, James Madison University, Harrisonburg, VA  
 Obstructive Sleep Apnea (OSA) is a prevalent sleep disorder in which obesity is a risk factor. Despite this relationship, OSA increases the risk for developing diabetes mellitus (DM) independent of total body adiposity. The mechanisms linking OSA and DM are complex and not well understood. Visceral fat is a well-established risk factor for DM due to its increased metabolic properties, and may be a contributing factor in the link between OSA and DM.  
**Purpose:** To examine the differences in total body and visceral fat in OSA vs. non-OSA controls.  
**Methods:** Ten OSA and 21 control subjects were grouped by an at-home, sleep-screening device. All OSA subjects were classified as having moderate-severe OSA. Total body and visceral fat was assessed by DEXA. Physical activity was measured in each subject by hip-worn accelerometry.  
**Results:** OSA subjects were significantly older (39.5 + 14.0 vs. 28.1 + 11.5 years;  $P = 0.02$ ) and had a higher BMI (32.96 + 7.13 vs. 28.5 + 3.2;  $P = 0.02$ ) than controls. There

was no difference between groups in mean steps per day. Total percent body fat did not differ between groups before or after adjustment for age and BMI (35.31 + 7.4 vs. 34.51 + 8.7 for OSA and control subjects, respectively). Visceral fat percentage was significantly higher in OSA before adjusting for age and BMI (5.2 + 3.2 lbs vs. 1.8 + 1.6 lbs;  $P = 0.014$ ). This difference remained significant after adjustment ( $P < 0.01$ ). Further, the apnea-hypopnea index (AHI), the measure to quantify OSA severity, was highly correlated with visceral fat ( $r = 0.74$ ;  $P < 0.01$ ).  
**Conclusion:** Results suggest that, despite no difference in total body adiposity, visceral fat is increased in those with OSA. Visceral fat has been associated with decreased insulin sensitivity and glucose intolerance. This may be one of the many contributory mechanisms involved in the increased risk and prevalence of DM in OSA.

1357 Board #10 June 2, 8:00 AM - 9:30 AM  
**Aerobic Training Decrease Body Fat may via Zinc Alpha2 Glycoprotein**  
 Zhijian RAO<sup>1</sup>, Rengfei SHI<sup>1</sup>, Yun CHANG<sup>2</sup>. <sup>1</sup>Shanghai university of sport, Shanghai, China. <sup>2</sup>China Institute of Sport Science, Beijing, China.  
 (No relationships reported)

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<sup>2</sup> China Institute of Sport Science (CISS), Beijing, China  
 Previous studies have reported that aerobic training reduces body fat content. Zinc alpha2 glycoprotein (ZAG), a lipid mobilizing factor, is negatively correlated with fat mass. The function of ZAG is associated with reduced fatty acid synthase (FAS) expression and increased hormone-sensitive lipase (HSL) expression in liver of obese mice. We hypothesized that aerobic training up-regulate the expression of ZAG, leading to reduction of body fat.  
**PURPOSE:** To determine the underlying association between aerobic training and the expression of ZAG. **METHODS:** High-fat-diet (HFD)-induced obese mice were divided into two groups, control group (C, n=10) and aerobic training group (T, n=10). Training protocol is 8 weeks moderate intensity treadmill running (10m/min for the first four weeks, 12m/min for the last four weeks, 60min/day, 5 days/week). Measure the body weight twice a week. After 8 weeks intervention experiment, all animals were sacrificed following overnight fasting, the visceral adipose tissue were dissected and weighed, and liver tissue were excised and homogenized. ZAG, FAS and HSL mRNA expression were detected by PCR technique. Data were analyzed by student's t-test, with statistical significance being set at  $p \leq 0.05$ .  
**RESULTS:** Aerobic training decrease body weight (C, 76.80±7.13g vs. T, 69.50±3.64g,  $p < 0.05$ ), and also reduce visceral adipose weight (C, 5.14±1.29g vs. T, 2.81±1.53g,  $p < 0.05$ ). Aerobic training increase ZAG mRNA expression in adipose tissue (C, 1.26±0.31 vs. T, 2.53±0.58,  $p < 0.05$ ), but it doesn't change in liver (C, 0.95±0.24 vs. T, 0.99±0.29,  $p > 0.05$ ). FAS expression in liver decreased (C, 0.037±0.016 vs. T, 0.106±0.006,  $p < 0.05$ ), HSL expression in liver slightly increased (C, 0.0078±0.0017 vs. T, 0.0087±0.0024,  $p > 0.05$ ). **CONCLUSION:** These indicated that aerobic training may increase ZAG mRNA expression in adipose tissue, and ZAG prohibits fat synthesis through decrease FAS mRNA expression. Aerobic training decrease body fat may via ZAG, but the detail mechanism requires future trials to confirm.

1358 Board #11 June 2, 8:00 AM - 9:30 AM  
**Trials to Criteria for Residual Lung Volume in College Aged Females**  
 Kristin Mathews, Rebecca Romine, Juliane Genevro, Michael Yee, Ryan Kunkle, Marissa Sumida, Ronald Hetzler, FACSM. University of Hawaii, Manoa, Honolulu, HI. (Sponsor: Dr. Ronald K. Hetzler, FACSM)  
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 (No relationships reported)

**PURPOSE:** To determine the number of trials needed to achieve a RLV measurement on land or submerged in water that compares to the recommended criteria value.  
**METHODS:** Thirty female subjects (22.5 ± 3.8 yr, 167.3 ± 9.1 cm, 66.9 ± 9.7 kg) had RLV collected 5 times across two different conditions (on land and fully submerged in water). Separate repeated-measures ANOVA were used to compare RLV means across the following criteria: means of the first two trials (FIR), the first two consecutive trials within 100mL (ROW), the first two trials (consecutive or non-consecutive) within 100ml (WIN), the lowest two trials within 100ml (LOW), and the number of trials necessary to satisfy criteria (TTC) of FIR, ROW, WIN and LOW. The alpha level was set at  $p < 0.05$ .  
**RESULTS:** There was no significant difference between RLV means on land or submerged. When measured on land, TTC for FIR was significantly less than ROW, WIN, and LOW, and it took significantly more trials to obtain LOW than ROW and WIN. There was no significant difference between TTC for ROW and WIN on land. Mean differences between TTC for FIR, ROW, WIN and LOW submerged were all significantly different.

Table 1. Mean for RLV(L) across trials on land and submerged in water, and of FIR, ROW, WIN, LOW, and TTC in each condition.

	RLV Land	RLV Submerged
Trial 1	1.00 ± 0.36	0.93 ± 0.29
Trial 2	0.99 ± 0.45	0.93 ± 0.26
Trial 3	0.92 ± 0.30	0.92 ± 0.34
Trial 4	0.95 ± 0.36	0.90 ± 0.30
Trial 5	0.98 ± 0.46	0.93 ± 0.33
FIR	1.00 ± 0.39	0.93 ± 0.26
Trial to Criteria	2.00 ± 0.00	2.00 ± 0.00
ROW	0.97 ± 0.33	0.91 ± 0.30
Trial to Criteria	2.33 ± 0.71	2.63 ± 1.13
WIN	0.96 ± 0.33	0.91 ± 0.29
Trial to Criteria	2.30 ± 0.70	2.43 ± 0.82
LOW	0.89 ± 0.37	0.87 ± 0.28
Trial to Criteria	4.33 ± 0.37	3.93 ± 0.98

**CONCLUSION:** In young, healthy females the lack of significance between trials suggests that two trials may be sufficient to determine RLV. However, because significant differences between trials to reach criteria exist, the number of trials needed to determine RLV depends upon the criteria selected. Based on means and standards deviations, it is recommended that at least 4 trials be used for ROW and WIN, and at least 5 trials be used to determine LOW for accurate determination of an individual's RLV.

1359 Board #12 June 2, 8:00 AM - 9:30 AM  
**Trials to Criteria for Residual Lung Volume in College Aged Males**

Rebecca K. Romine, Kristin A. Mathews, Juliane K. Geneviro, Michael S. Yee, Ryan G. Kunkle, Ronald K. Hetzler, FACSM. *University of Hawaii, Manoa, Honolulu, HI.* (Sponsor: Dr. Ronald K. Hetzler, FACSM)  
 Email: rromine@hawaii.edu  
 (No relationships reported)

**PURPOSE:** To determine the number of trials needed to achieve a RLV measurement on land or submerged in water that compares to recommended criteria value.

**METHODS:** Thirty male subjects (23.8 ± 3.5 yr, 175.7 ± 8.7 cm, 82.0 ± 15.4 kg) had RLV collected five times across two conditions (on land and fully submerged in water). Separate repeated-measures ANOVA were used to compare RLV means across the following criteria: means of the first two trials (FIR), the first two consecutive trials within 100mL (ROW), the first two trials (consecutive or non-consecutive) within 100ml (WIN), the lowest two trials within 100ml (LOW), and the number of trials necessary to satisfy criteria FIR, ROW, WIN and LOW. The alpha level was set at p<0.05. **RESULTS:** Mean RLV on land showed a significant decrease from trial 1 to 2 of 0.074L, trial 1 to 3 of 0.097L, and trial 1 to 5 of 0.097L (p<0.05). Mean values for LOW (0.99L) were significantly less compared with FIR, ROW, and WIN (1.19L, 1.13L, and 1.05L respectively) on land, and significantly less than FIR (1.11L) submerged. The LOW were obtained in a mean of 4 trials, significantly more trials than FIR, ROW, and WIN in each condition. There was no significant difference between trials to criteria for LOW on land (3.97) compared to submerged (4.07).

Table 1. Mean for RLV (L) across trials on land and submerged in water, and of FIR, ROW, WIN, LOW, and trials to criteria in each condition.

	RLV Land	RLV Submerged
Trial 1	1.21 ± 0.30	1.11 ± 0.33
Trial 2	1.14 ± 0.28	1.08 ± 0.27
Trial 3	1.11 ± 0.31	1.09 ± 0.31
Trial 4	1.13 ± 0.31	1.09 ± 0.27
Trial 5	1.12 ± 0.29	1.12 ± 0.33
FIR	1.19 ± 0.28	1.11 ± 0.29
Trial to Criteria	2.00 ± 0.00	2.00 ± 0.00
ROW	1.13 ± 0.26	1.02 ± 0.28
Trial to Criteria	2.75 ± 0.95	2.65 ± 1.01
WIN	1.05 ± 0.26	1.02 ± 0.29
Trial to Criteria	2.65 ± 0.86	2.44 ± 0.63
LOW	0.99 ± 0.26	0.98 ± 0.28
Trial to Criteria	3.97 ± 0.82	4.07 ± 0.88

**CONCLUSION:** For healthy, young male subjects the number of trials needed to determine RLV depends upon the criteria selected. Based on means and standards deviations, it is recommended that at least 4 trials be used for ROW and WIN, and at least 5 trials for LOW. Additionally, FIR is not an appropriate criterion due to changes in RLV in subsequent trials.

C-26 Free Communication/Poster - Cancer, Exercise, and Muscle

Thursday, June 2, 2016, 7:30 AM - 12:30 PM

Room: Exhibit Hall A/B

1360 Board #13 June 2, 9:00 AM - 10:30 AM  
**Muscle Fiber Cross-sectional Area Is Unaffected 14 Days Following A Clinical Dose Of Radiation**

Krishan Bhakta<sup>1</sup>, Vinny Alvionita<sup>1</sup>, Michael J. Baker<sup>2</sup>, Lewis Akers<sup>3</sup>, Munjal M. Acharya<sup>4</sup>, Charles L. Limoli<sup>4</sup>, Vincent J. Caiozzo, FACSM<sup>4</sup>, Joshua A. Cotter<sup>1</sup>. <sup>1</sup>California State University, Long Beach, Long Beach, CA. <sup>2</sup>Fullerton College, Fullerton, CA. <sup>3</sup>Irvine Valley College, Irvine, CA. <sup>4</sup>University of California, Irvine, Irvine, CA. (Sponsor: Vincent Caiozzo, FACSM)  
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 (No relationships reported)

Skeletal muscle regeneration has previously been shown to be blunted following a dose of 7 Gy gamma irradiation with cardiotoxin injury. It has yet to be established if the same dose of radiation effects non-injured skeletal muscle. **PURPOSE:** The objective of the current study was to investigate the effects of a 7 Gy dose of irradiation on the cross-sectional area (CSA) of the tibialis anterior (TA).

**METHODS:** Adult male mice (C57BL/6J) were assigned to one of 6 groups: 1) 4 day control, 2) 4 day irradiated (IRR), 3) 7 day control, 4) 7 day IRR, 5) 14 day control, 6) 14 day IRR. Each mouse was injected with saline before irradiation as part of a larger study. Following injection, mice in the irradiation groups were exposed to a dose of 7 Gy of gamma irradiation which is considered to be a clinically relevant dose. Following each time period the TA was removed and prepared for histological analysis by hematoxylin and eosin staining. Approximately 100 fibers of each muscle sample were analyzed with ImageJ software to estimate average fiber CSA. Data were analyzed by one-way ANOVA in GraphPad Prism.

**RESULTS:** No differences were found between control and IRR mean fiber size at any of the time periods.

**CONCLUSIONS:** These results indicate that a dose of 7 Gy of gamma irradiation may blunt myogenesis following cardiotoxin injury but does not alter fiber CSA up to 14 days following exposure.

1361 Board #14 June 2, 9:00 AM - 10:30 AM  
**Role of Testosterone on Muscle Protein Synthesis during Prostate Cancer Treatment**

Erik D. Hanson<sup>1</sup>, Andre R. Nelson<sup>2</sup>, Daniel W.D. West<sup>3</sup>, John Violet<sup>4</sup>, Lannie O'Keefe<sup>2</sup>, Stuart M. Phillips, FACSM<sup>3</sup>, Alan Hayes<sup>2</sup>. <sup>1</sup>University of North Carolina at Chapel Hill, Chapel Hill, NC. <sup>2</sup>Victoria University, Melbourne, Australia. <sup>3</sup>McMaster University, Hamilton, ON, Canada. <sup>4</sup>Peter MacCallum Cancer Centre, Melbourne, Australia. (Sponsor: Stuart Phillips, FACSM)  
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 (No relationships reported)

Androgen deprivation therapy (ADT) is a common treatment for prostate cancer (PCa), but low testosterone levels result in muscle loss. Muscle protein synthesis (MPS) stimulated after resistance training may help to partially reverse muscle loss. However, some studies show attenuated load-mediated hypertrophy during ADT whereas others suggest that testosterone is not essential for normal accretion of lean mass.

**Purpose:** To examine the effect of whey protein, whey protein + resistance exercise, and testosterone on MPS in men with PCa on ADT and age-matched controls (CON).

**Methods:** Men with PCa on ADT (N=8) and healthy CON (N=10) consumed a standardised diet (1g protein·kg<sup>-1</sup>·day<sup>-1</sup>) for 2d prior to the intervention. After an overnight fast, L-[ring-<sup>13</sup>C<sub>6</sub>] phenylalanine was infused and participants engaged in unilateral knee extension resistance exercise followed by ingestion of 40g of whey protein. Bilateral biopsies (*vastus lateralis*) were taken to determine rates of MPS. Differences between groups, legs and time points were determined using mixed model ANOVA. Data are expressed as mean ± SD.

**Results:** There were no group differences for age, mass, % fat, or physical function status. MPS in ADT patients was suppressed relative to CON (0.0180 ± 0.0024 vs.

0.0250 ± 0.0040 %·hr<sup>-1</sup>, P=0.01) at baseline. Protein increased MPS over baseline in both groups (ADT=0.0298 ± 0.0068, CON=0.0564 ± 0.0145 %·hr<sup>-1</sup>, both P<0.001), but to a greater extent in CON (P=0.003). Resistance exercise + protein also increased MPS relative to baseline (ADT=0.0631 ± 0.0085, CON=0.0833 ± 0.0262 %·hr<sup>-1</sup>, both P<0.001). This increase was greater than protein alone (P<0.001), but the change in MPS with resistance exercise + protein was similar between groups (ADT=0.0451 ± 0.0083, CON=0.0584 ± 0.0271, P=0.38).

**Conclusions:** ADT in men with PCA reduces basal and protein feeding-induced rises in MPS. However, when protein ingestion follows resistance exercise the MPS response is no different than that of controls. These data suggest that testosterone plays a role in maintaining skeletal muscle mass but is not necessary to initiate a robust response in MPS following resistance exercise. Therefore, structured resistance exercise programs with planned protein ingestion would be advantageous in men undergoing ADT for PCA.

1362 Board #15 June 2, 9:00 AM - 10:30 AM  
**Effects of Endurance Training and Doxorubicin on Hindlimb Muscle and Diaphragm Myogenic Regulatory Factors**

David S. Hydock, Colin J. Quinn. *University of Northern Colorado, Greeley, CO.*  
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 (No relationships reported)

Doxorubicin (DOX) treatment may lead to toxicity in hindlimb and diaphragm muscle that contributes to cancer patient fatigue. DOX myotoxicity potentially involves a disruption in myogenic regulatory factors (MRFs) which are instrumental in maintaining skeletal muscle integrity and directing regeneration. Endurance exercise increases the expression of MRF proteins and thereby may mitigate DOX-induced disruption in MRFs. **PURPOSE:** To examine the effects of short-term endurance training and acute DOX treatment on MRF protein expression in the soleus, extensor digitorum longus, and diaphragm. **METHODS:** Male Sprague-Dawley rats were randomly assigned to the endurance exercise (EX) or sedentary (SED) group. EX performed treadmill training for two weeks and SED was restricted to normal cage activity for two weeks. EX and SED then received either a bolus i.p. DOX (15 mg/kg; EX+DOX and SED+DOX) or saline (SAL; EX+SAL and SED+SAL) injection. The soleus, extensor digitorum longus (EDL), and diaphragm were excised 24 hours post injection and Western blotting was performed to determine expression of the following MRFs: Myf5, MyoD, Mrf4, and myogenin. **RESULTS:** In the soleus, a significant Myf5 drug and activity effect (p<0.05) was observed with EX+DOX expressing higher Myf5 than SED+DOX (+43%, p<0.05). There was also a significant drug effect detected in soleus MyoD (p<0.05) and a significant activity effect detected in soleus Mrf4 (p<0.05). In the EDL, no main effects or interactions were observed for Myf5, MyoD, Mrf4, or myogenin (p>0.05). In the diaphragm, a significant activity effect (p<0.05) was observed for Myf5 and EX+DOX expressed higher Myf5 than SED+DOX (+40%, p<0.05). No main effects or interactions were observed for diaphragm MyoD, Mrf4, or myogenin expression (p>0.05). **CONCLUSION:** An increase in Myf5 and MyoD was observed in the soleus following DOX administration suggesting an upregulation of transcription factors directed toward muscle regeneration. Endurance exercise promoted an increased expression of Myf5 in the soleus and diaphragm with EX+DOX expressing more Myf5 than SED+DOX suggesting that endurance exercise enhances muscle regenerative signaling in the soleus and diaphragm following DOX treatment.

1363 Board #16 June 2, 9:00 AM - 10:30 AM  
**E0771 Adenocarcinoma Breast Cancer Tumors Induce Muscle Fatigue and Wasting in C57BL/6 Mice**

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 (No relationships reported)

**Severe muscle wasting and muscle dysfunction (cachexia) are considered incurable complications associated with a wide variety of chronic diseases. Cachexia significantly decreases the quality of life for cancer patients, leads to an overall poor prognosis for recovery and accounts for ~40-50% of cancer patient morbidity. Cachexia is classified by a severe loss of body weight due to loss of adipose and skeletal muscle mass, which can negatively impact muscle function. We tested the hypothesis that the E0771 murine adenocarcinoma cell line would induce cachexia, reflected in loss of skeletal muscle mass and greater muscle fatigability. PURPOSE:** To determine the time course and extent of E0771 tumor cell induced alterations in muscle mass and fatigue. **METHODS:** C57BL/6WT female mice were randomly assigned to three groups consisting of a non-tumor control group (CON; n=8), a 2 week post tumor

cell injection group (2WK; n=5) and a 4 week post tumor cell injection group (4WK; n=10). Isometric force and fatigue properties were determined in EDL and soleus muscles ex vivo. Gene expression for selected inflammatory and atrophic markers were determined in skeletal muscle by PCR.

**RESULTS:** The body weight of 4WK mice was 27% lower compared to CON and 2WK mice. The EDL muscle mass was 25% lower in 4WK mice and this was reflected in a 19% loss in maximum force generating capacity. The soleus muscle mass was 17% lower in 4WK mice and this was reflected in a 23% loss in maximum force generating capacity. The EDL muscles from 4WK mice displayed a significantly greater rate of fatigue compared to CON and 2WK; this was not observed in the soleus muscle. The presence of an ulcerated tumor exacerbated the loss in muscle mass and force in 4WK mice. Muscles from 4WK mice had greater expression levels of pro-inflammatory genes (IL-6, TNF- $\alpha$ ) and pro-atrophic genes (Atrogin, Murf1).

**CONCLUSIONS:** This study demonstrates that the EO771 tumor cell line induces cachexia, reflected in loss of muscle mass and greater muscle fatigue. These data also suggest that alterations in muscle mass and force production are independent from alterations in fatigue properties in oxidative muscles. This mouse model of breast cancer is a suitable model for the pre-clinical evaluation of therapies directed against cancer-induced cachexia.

1364 Board #17 June 2, 9:00 AM - 10:30 AM  
**Physical Activity, Strength, Body Composition, Muscle Quality, And Functionality In Breast Cancer Survivors**

Ashley Artese<sup>1</sup>, Emily Simonavice<sup>2</sup>, Takudzwa A. Madzima<sup>3</sup>, Pei-Yang Liu<sup>4</sup>, Jeong-Su Kim<sup>1</sup>, Michael J. Ormsbee<sup>1</sup>, Carla M. Prado<sup>5</sup>, Bahram H. Arjmandi<sup>1</sup>, Jasminka Z. Ilich<sup>1</sup>, Lynn B. Panton, FACSM<sup>1</sup>. <sup>1</sup>Florida State University, Tallahassee, FL. <sup>2</sup>Georgia College and State University, Milledgeville, GA. <sup>3</sup>Elon University, Elon, NC. <sup>4</sup>University of Akron, Akron, OH. <sup>5</sup>University of Alberta, Edmonton, AB, Canada.  
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 (No relationships reported)

**PURPOSE:** To evaluate physical activity (PA), strength, body composition, and muscle quality (MQ) with respect to functionality in breast cancer survivors (BCS). **METHODS:** Body composition (lean mass (LM); fat mass (FM); bone mineral density (BMD)) was assessed on 45 BCS (60±9 yrs) using dual-energy X-ray absorptiometry. Chest press and leg extension were measured by one repetition maximal (1RM) tests. MQ was calculated by dividing chest press and leg extension 1RMs by arm and leg LM, respectively. Pedometers measured PA. The Continuous-scale Physical Functional Performance (Cs-PFP) test assessed functionality. Data were analyzed using t-tests based on BCS who fell above or below the Cs-PFP functional independence threshold of 57 units (U). **RESULTS:** BCS were overweight (27.1±5.2 kg·m<sup>-2</sup>) with low PA (6623±3671 steps/day). Mean Cs-PFP score was 66.7±13.3U with 12 BCS falling below 57U (48.9±5.9U). Those below 57U had significantly lower step counts (<57U: 4850±2595 steps/day; >57U: 7356±3834 steps/day) and upper (<57U: 54.3±15.7 kg; >57U: 75.1±17.4 kg) and lower (<57U: 62.8±13.0 kg; >57U: 76.8±15.8 kg) body 1RMs. Arm MQ was higher in those above 57U (<57U: 13.6±3.5; >57U: 18.2±3.7). Leg MQ was approaching significance (<57U: 5.1±1.1; >57U: 5.9±1.3, p=.069). There were no differences in LM, FM, and BMD measures. **CONCLUSION:** Our findings suggest that higher PA and strength may serve as protective factors against loss of function and MQ in BCS independent of LM, FM, and BMD.

1365 Board #18 June 2, 9:00 AM - 10:30 AM  
**Effects of Resistance Training and Creatine Monohydrate on Doxorubicin-Induced Muscle Fatigue**

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Doxorubicin (DOX) is a powerful chemotherapy agent associated with a number of deleterious side effects, including skeletal muscle dysfunction. Our lab has shown that resistance training (RT) and creatine monohydrate (Cr) can independently protect against DOX-induced muscle fatigue. However, no investigation has examined the combined effects of RT and Cr on DOX-induced muscle fatigue. **PURPOSE:** To investigate the effects of RT and Cr on DOX-induced skeletal muscle fatigue. **METHODS:** Male Sprague-Dawley rats were randomly assigned to a RT or sedentary

group. RT was simulated using an elevated food model. After 6 weeks of training, the soleus (SOL) and extensor digitorum longus (EDL) were excised and placed in a tissue bath containing Krebs buffer (K) where initial twitch force was measured. Muscles were then incubated with either K or a K containing Cr (25 mM) for 30 minutes. The buffers were refreshed with either new K or K containing DOX (24  $\mu$ M) and incubated for 30 minutes. Muscles were then supplied with new K and subjected to a 100 sec fatigue protocol, where force production was recorded every 10 seconds. **RESULTS:** In this investigation, fatigue was defined as the point in time where force production was significantly lower than baseline. DOX-induced fatigue occurred at 50 seconds in both the SOL and EDL. RT delayed the onset of DOX-induced fatigue by 10 seconds in the SOL, but RT failed to delay DOX-induced fatigue in the EDL. Cr treatment delayed the onset of DOX-induced fatigue by 10 seconds in the EDL, but Cr failed to delay DOX-induced fatigue in the SOL. However, the combination of RT and Cr delayed the onset of DOX-induced fatigue by 50 seconds in the SOL and by 20 seconds in the EDL. **CONCLUSION:** This study showed that a combined treatment with RT and Cr can be effective at minimizing DOX-induced fatigue in the SOL and EDL.

## C-27 Free Communication/Poster - Cardiovascular II

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
Room: Exhibit Hall A/B

### 1366 Board #19 June 2, 8:00 AM - 9:30 AM Comparison of Differences in O<sub>2</sub> Pulse across Upper Body Resistance Exercises

Swapan Mookerjee, Sam Meske, Vincenzo G. Nocera.  
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(No relationships reported)

**Purpose:** To compare O<sub>2</sub> pulse (VO<sub>2</sub>/HR) between selected upper body resistance exercises, as well as sex differences. **Methods:** A total of 24 subjects (12 ♂, 12 ♀) mean age ( $\pm$ SD) 21.4 ( $\pm$ 1.3) years, performed a 3-set, 5-exercise, 10-repetition, upper body protocol (bench press, lat pulldown, military press, triceps press, biceps curl). Loads were set at 70% of their 1-repetition maximum using a lifting cadence of 15 reps·min<sup>-1</sup>. Subjects rested for 2 minutes between sets, and 3 minutes between exercises. Breath-by-breath data and heart rates were recorded via a portable, telemetry metabolic measurement system. **Results:** Two-way repeated measures ANOVA was used to analyze differences between exercises as well as genders. Data (mean  $\pm$ SD) are presented in the table below:

3-Set	Bench Press		Lat Pulls		Military Press		Tricep Press		Biceps Curl	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Mn	7.00*	5.07	7.36*	5.13	5.48*	3.77	5.54*	3.76	4.30	3.89
SD	3.94	3.03	4.32	2.56	3.07	2.35	2.78	1.85	2.94	1.99

\*Sign. Diff. (p<0.05) between exercises

Overall, group bench press and lat pulldown O<sub>2</sub> pulse values were significantly greater than the military press, triceps press and biceps curl. However, there were no significant O<sub>2</sub> pulse differences across exercises in the females. O<sub>2</sub> pulse was significantly greater in the males. **Conclusion:** Variations in O<sub>2</sub> pulse during exercise represent changes in stroke volume and arterial-mixed venous O<sub>2</sub> difference. The significantly higher O<sub>2</sub> pulse values recorded between the exercises were possibly due to the pressor response, transient ischemia, and increased sympathetic drive. Sex-differences in O<sub>2</sub> pulse during upper-body resistance exercise were probably partly due to varied ventilatory and muscle activation patterns.

### 1367 Board #20 June 2, 8:00 AM - 9:30 AM The Mechanoreflex Response to Static and Dynamic Passive Limb Movement

Allison Keller, Lucas Zornoza, Stephen J. Ives. Skidmore College, Saratoga Springs, NY. (Sponsor: Paul Arciero, FACSM)  
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During exercise, the exercise pressor reflex (EPR) activates to increase efferent sympathetic nervous activity, increasing blood pressure (BP) and heart rate (HR), and thus increasing perfusion pressure. One component of the EPR, the mechanoreflex, has only recently been studied in terms of its central and peripheral cardiovascular effects due to the difficulty in separating it from the other component of the EPR, the metaboreflex. Two methods have been used to experimentally activate the mechanoreflex, static stretch (SS) and dynamic passive limb movement (PLM), though no study has yet to directly compare them. **PURPOSE:** The purpose of the present

study was to compare the central and peripheral hemodynamic responses between these two methods (PLM and SS) of isolating the mechanoreflex. **METHODS:** Two minutes of PLM and SS were performed in 23 young healthy participants, in a counterbalanced fashion. Central hemodynamic responses (cardiac output [CO], stroke volume [SV], and HR), were measured using a Finometer, while peripheral hemodynamic responses were measured using a near-infrared spectrometer (NIRS) to assess microvascular responses via percent tissue oxygen saturation (StO<sub>2</sub>). **RESULTS:** No significant differences were observed between the central or peripheral baseline values obtained for PLM and SS (p>0.05). Both methods significantly increased HR and CO from baseline; however, PLM elicited significantly higher central cardiovascular than SS ( $\Delta$ HR: 15.0 $\pm$ 9.5 vs 8.6 $\pm$ 8.1 bpm,  $\Delta$ CO: 1.3 $\pm$  0.8 vs. 0.8 $\pm$ 0.7 L/min) (p<0.05). Peripherally, PLM elicited an increase in StO<sub>2</sub> from baseline (p<0.05), while SS had an opposite effect with a significant decrease in saturation from baseline ( $\Delta$ StO<sub>2</sub>: 2.80 $\pm$ 2.49 % vs -1.31 $\pm$ 1.1 %) (p<0.05). **CONCLUSION:** The results from this study call into question whether SS may be a clear isolation of the mechanoreflex, with the observed reduction in tissue oxygenation, and thus possible activation of the metaboreflex. Finally, static stretch and dynamic muscle movement appear to exhibit divergent responses, and this ought to be considered when designing or interpreting studies using these models of the mechanoreflex to explore health and disease.

### 1368 Board #21 June 2, 8:00 AM - 9:30 AM Heterogeneous Circulating Angiogenic Cell Responses to Maximal Exercise

Nathan T. Jenkins, Daniel D. Shill, Meagan P. Marshburn, Hannah K. Hempel, Kasey A. Lansford, Nathan T. Jenkins.  
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Data from human and animal studies indicate that the vascular effects of exercise are not uniform throughout the arterial tree. Whether this heterogeneity extends to human circulating vascular cells is not known.

**PURPOSE:** To examine the effect of maximal exercise on different circulating angiogenic cell (CAC) subpopulations and the potential influence of sex.

**METHODS:** Twenty-two individuals (11 men, 24  $\pm$  5yr) performed a graded treadmill exercise test until volitional fatigue. Blood was drawn before and immediately after exercise. Samples were analyzed via flow cytometry for concentrations of angiogenic monocytes (CD14+/CD31+), angiogenic endothelial cells (CD62E+), endothelial progenitor cells (CD34+/VEGFR2+), endothelial cells (CD31+), angiogenic T-cells (CD3+/CD31+), and T-cells (CD3+).

**RESULTS:** Maximal exercise induced 14% and 33% increases in CD14+/CD31+ and CD62E+ cells, respectively (both P < 0.05). Women demonstrated a 20% and 54% increase in CD14+/CD31+ and CD62E+ cells, respectively (both P < 0.05), while exercise did not affect these cell populations in men. Maximal exercise produced a 33% increase in CD34+/VEGFR2+ cells (P < 0.05). Exercise enhanced both lymphocytic and mono-lymphocytic CD31+ cells by 40% and 29%, respectively (both P < 0.05). Maximal exercise did not augment CD3+/CD31+ or CD3+ cells.

**CONCLUSIONS:** These findings indicate that the effects of maximal exercise are heterogeneous among different CAC populations, and also differ between men and women. Importantly, our data demonstrate an exercise-induced increase in CD31+ CAC subpopulations, a cell type recently demonstrated to have robust angiogenic potential in preclinical studies of cell-based therapies for cardiovascular diseases.

### 1369 Board #22 June 2, 8:00 AM - 9:30 AM Post Exercise Hypotension Response in Non-Hypertensive Adults Following a Self-Paced Trail Run

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(No relationships reported)

During dynamic exercise, a rise in blood pressure (BP) can be seen in response to the increase in cardiac output demands. Once exercise has concluded, BP has been shown to decrease beyond pre-exercise measurements in most hypertensive and some normotensive adults. This prolonged decline in resting blood pressure is known as post exercise hypotension (PEH). Studies have shown that reductions in BP are directly related to exercise intensity in controlled research environments. However, few studies have looked at the extent of PEH in an applied-setting, such as a trail run.

**PURPOSE:** To determine the magnitude of PEH in non-hypertensive adults after a 1-mile trail run at a self-selected pace.

**METHODS:** Twenty-seven male and female volunteers participated in this study (age=22 $\pm$ 6 yrs; height=172.1 $\pm$ 11.8 cm; mass=69.8 $\pm$ 14.7 kg). Participants provided

resting SBP and DBP measurements, ran one mile on a trail at a self-selected pace, and measures were obtained immediately after, 20-min post, 40-min post, and 60-min post exercise. All BP measurements were obtained using automated cuffs. The trail altitude was 5385 feet at onset with 56 feet rise in elevation, and environmental condition ranges included temperature: 79.2°-90.2° F, humidity: 4.5%-8.3%, and wind speed: 1.1-3.5 mph. Data were analyzed using a one-way ANOVA and significance at the  $p < 0.05$  level.

**RESULTS:** Both SBP and DBP immediately after exercise were significantly higher than all other BP values ( $p < 0.001$  and  $p < 0.01$ , respectively). Only 60-min post SBP values were significantly lower than resting ( $p = 0.004$ ), and 40-min post SBP was lower, but not significant ( $p = 0.057$ ). No significant changes were found in DBP after 20-, 40-, or 60-min post exercise.

**CONCLUSIONS:** Our results confirm that SBP can be positively affected an hour post exercise, even in non-hypertensive adults. Since SBP was significantly lower at the last time interval, additional field-based research of PEH should focus on changes in BP for time periods greater than 60 minutes post exercise.

1370 Board #23 June 2, 8:00 AM - 9:30 AM  
**Generalized Response of the Exercise Pressor Reflex**  
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 (No relationships reported)

Autonomic responsiveness to reflex stimuli varies considerably between individuals, with implications for predicting cardiovascular disease. **PURPOSE:** To standardize blood pressures to activation of the exercise pressor reflex using isometric handgrip exercise followed by post-exercise circulatory arrest (PECA). **METHODS:** Using specific search terms including “metaboreflex”, “ergoreflex”, “handgrip”, “reflex”, “static”, and “isometric”, we identified 151 studies that quantified the pressor response to handgrip exercise followed by PECA in healthy humans aged 19-44 years. We characterized these studies by exercise mode (static vs. dynamic), percentage of maximum voluntary contraction, blood pressure measurement technique, duration of exercise, duration of PECA, and method of data presentation (absolute values vs. changes from baseline). Preliminary analysis revealed distinct effects of exercise intensity and duration. We constrained further analysis to studies including healthy adults completing isometric handgrip exercise at 30-33% of maximum for 3 minutes and 2 or more minutes of PECA, with blood pressure measured from the wrist or finger of the resting arm (total of 4 studies). **RESULTS:** Using the reported means and variation we employed bootstrapping with weighted re-sampling ( $n = 10,000$ ) to create a statistically comparable normal distribution of responses. Based on these criteria, the average population mean arterial pressure response for the second minute of PECA is 19 mmHg. The first quartile response is 13 mmHg, and the third quartile is 26 mmHg. **CONCLUSIONS:** The autonomic response following ischemic handgrip varies considerably between individuals, even when experimental conditions are standardized. The possible foundation for these differences may be neural (e.g., afferent, central, or efferent) or extra-neural (e.g., genetic, muscle fiber type, or vascular).

1371 Board #24 June 2, 8:00 AM - 9:30 AM  
**Effects Of Dynamic And Isometric Vibration Exercises On Hemodynamics, Flexibility, And Stress Hormone Levels**  
 Brittany Esparza, Eunice De Leon, Azeneth Chevaili, Eneida Alonso, Margarita Gonzalez, Murat Karabulut. *University of Texas at Rio Grande Valley, Brownsville, TX.* (Sponsor: Michael G. Bembem, FACSM)  
 (No relationships reported)

**PURPOSE:** To investigate the acute effects of lower body dynamic (DYN) vs isometric (ISO) exercises on systolic blood pressure (SBP) and diastolic blood pressure (DBP), heart rate (HR), flexibility using the sit and reach, and cortisol (COR) and amylase (AMY) levels measured pre and post exercise with different variations of frequency and amplitude on a power plate in pre-hypertensive females. **METHODS:** Nine females (age:  $23.8 \pm 5.1$  yrs) performed the ISO and DYN control sessions with the power plate off and ISO and DYN exercises with a combination of low frequency/high amplitude (LF/HA) and high frequency/low amplitude (HF/LA). A 5-min warm-up at 3.0 mph on the treadmill occurred before testing. DYN exercises were performed from standing position to 120° for squat, 90° for lunge, and 90° for squat for a total of four sets for one-min with metronome set at 40 bpm. ISO exercises were performed at the knee angles mentioned previously. Subjects had a 30 sec rest in-between sets. Blood pressure (BP) and HR were recorded using an automated BP cuff pre, post, 15-min, and post 30-min. Flexibility was recorded after the warm-up and post testing. The passive drool collection method was used to collect saliva to observe the changes in COR and AMY for a total of 1mL for each session before the warm up and post-exercise. Vials were then placed in the freezer to await analysis.

**RESULTS:** There was a significant condition\*time interaction ( $p < .01$ ) and time main effect ( $p < .01$ ) for SBP in the LF/HA DYN condition; the decrease observed in SBP occurred from post-exercise to post 15-min. There was a significant time main effect ( $p < .01$ ) for HR from pre to post. A time main effect ( $p < .05$ ) was found for AMY from pre to post. There were no significant condition\*time interactions or time main effects for DBP, COR or flexibility.

**CONCLUSIONS:** The results indicate that conditions did not cause any significant changes in psychological or physical stress. The greatest decrease in SBP following DYN exercises with the LF/HA setting could be due to increased mechanoreceptor and/or metaboreceptor activity and/or higher nitric oxide release causing greater vasodilation. The data suggest that this combination of exercise and setting may help manage or improve BP. Since this was an acute study, future studies using this setting should examine the chronic effects on BP.

1372 Board #25 June 2, 8:00 AM - 9:30 AM  
**Physiological Responses To Double- And Single-Leg High Intensity Interval Cycling In Healthy Older Adults**  
 Nicole Gordon<sup>1</sup>, Chris Abbiss<sup>2</sup>, Andrew Maiorana<sup>3</sup>, Jeremiah Peiffer<sup>1</sup>. <sup>1</sup>*Murdoch University, Murdoch, Australia.* <sup>2</sup>*Edith Cowan University, Joondalup, Australia.* <sup>3</sup>*Curtin University, Bentley, Australia.*  
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 (No relationships reported)

**PURPOSE:** There is little data examining single-leg high intensity interval cycle training in older adults. The purpose of this study was to investigate the physiological responses of healthy older adults to a high intensity interval session using either single-leg (SL) or double-leg (DL) cycling.

**METHODS:** In a randomised crossover design, fifteen healthy older adults (age:  $55 \pm 8$  y, height:  $1.71 \pm 0.07$  m, body mass:  $77.2 \pm 11.9$  kg,  $\dot{V}O_{2max}$ :  $37.1 \pm 10.0$  mL.kg.min<sup>-1</sup>; mean  $\pm$  SD) completed two high intensity interval cycling sessions using either DL or SL cycling. Participants completed ten 30-sec DL intervals interspersed with 60 sec passive recovery and twenty (ten with each leg) 30-sec SL intervals interspersed with 60 sec passive recovery. Impedance cardiography, blood pressure, muscle oxygenation and total haemoglobin concentration (near-infrared spectroscopy), oxygen consumption (indirect calorimetry) and power output were measured throughout each trial.

**RESULTS:** Relative to lower limb muscle mass used in each trial (kg; dual energy xray absorptiometry), SL cycling resulted in greater oxygen consumption (DL:  $84 \pm 20.8$  mL.kg<sup>-1</sup>.min<sup>-1</sup> and SL:  $101 \pm 11.2$  mL.kg<sup>-1</sup>.min<sup>-1</sup>;  $p < 0.01$ ) compared with DL cycling while power output (DL:  $6.29 \pm 1.53$  W.kg<sup>-1</sup> and SL:  $6.01 \pm 1.48$  W.kg<sup>-1</sup>) was not different between trials. Total haemoglobin concentration (DL:  $9.75 \pm 10.75$   $\mu$ M.cm.s<sup>-1</sup> and SL:  $14.09 \pm 5.05$   $\mu$ M.cm.s<sup>-1</sup>) and tissue oxygenation index (DL:  $65.79 \pm 1.94\%$  and SL:  $66.72 \pm 5.44\%$ ) and were not different between DL and SL cycling. Additionally, cardiac output (DL:  $14.3 \pm 3.2$  L.min<sup>-1</sup> and SL:  $12.3 \pm 2.7$  L.min<sup>-1</sup>;  $p < 0.01$ ) was higher during DL compared with SL cycling while mean arterial pressure (DL:  $107 \pm 10$  mmHg and SL:  $103 \pm 9$  mmHg) was not different between trials.

**CONCLUSIONS:** For a similar muscle blood volume and oxygenation, SL cycling resulted in greater muscle oxygen consumption. However, this did not translate to greater mechanical power of the muscles. These results indicate age-related skeletal muscle alterations could affect the training responses to SL and DL high intensity interval cycling.

1373 Board #26 June 2, 8:00 AM - 9:30 AM  
**Energy and Cardiopulmonary Cost of Carrying Hydration Gear During Running**  
 Laura A. Zdziarski, Kyle Fallgatter, Trevor Leavitt, Wasser G. Joseph, Cong Chen, JoAnna I. McClelland, Kevin R. Vincent, FACSM, Daniel C. Herman, Marybeth Horordyski, Jason L. Zaremski, Heather K. Vincent, FACSM. *University of Florida, Gainesville, FL.* (Sponsor: Heather Vincent, FACSM)  
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 (No relationships reported)

**PURPOSE:** It is not yet clear how the use of different hydration gear impacts cardiopulmonary responses and energy cost in healthy runners. The purpose of this study was to determine comparative effects of carrying different hydration gear compared to no gear on cardiopulmonary responses and energy cost during level running.

**METHODS:** This was a crossover study design using healthy young runners ( $N = 33$ ;  $28.0 \pm 6.6$  yr, 1.73m, 68.4 kg, 56% men). Each participant completed four, 5-minute conditions on a level grade during one testing session at self-selected speed: 1) no gear, control (CON), 2) full-water bottle (FULL, 454g), 3) half-full-water bottle (HALF, 227g), and 4) belt (BELT, Amphipod RunLite, 676g) with two full water bottles. Condition testing order was randomized. A portable gas analyzer and heart rate monitor collected minute ventilation ( $\dot{V}_e$ ), rate of oxygen use ( $\dot{V}O_2$ ), non-protein respiratory quotient (RQ), energy cost and heart rate (HR).

**RESULTS:** The HALF condition generated the highest  $\dot{V}_e$  compared to CON (78.4±23.3 L/min vs 65.0±22.0 L/min;  $p=0.045$ ). Average HR values were highest in BELT condition compared to HALF, FULL and CON (157bpm vs 151bpm, 151bpm and 143bpm, respectively;  $p=0.029$ ). RQ values and energy cost were not significantly different among the four conditions.

**CONCLUSIONS:** Running with various hydration gear differentially increases the ventilatory or cardiac demand compared to CON. The findings suggest that runners may make adjustments to muscle activation patterns and movement strategies to maintain similar energy cost and fuel use among the four different conditions in the short-term. Additional studies using electromyographic techniques and motion analysis could be used to test these hypotheses.

1374 Board #27 June 2, 8:00 AM - 9:30 AM

**Valsalva Maneuver During Resistance Exercise Increases Intracranial Pressure and Imposes a Transient Stress On The Cerebral Circulation.**

Dean Palmer, Justin Lawley, Erin Howden, Tom Sarma, Bill Cornwell, Mitchel Samels, Braden Everding, Sheryl Livingston, Margot Morris, Michael Williams, Louis Whitworth, Benjamin Levine, FACSM. *IEEM, Dallas, TX.* (Sponsor: Dr. Benjamin D. Levine, FACSM)  
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Valsalva Maneuver During Resistance Exercise Increases Intracranial Pressure and Imposes a Transient Stress on the Cerebral Circulation.

Dean Palmer<sup>1</sup>, Justin Lawley<sup>1</sup>, Erin Howden<sup>1</sup>, Satyam Sarma<sup>1</sup>, William Cornwell III<sup>1</sup>, Mitchel Samels<sup>1</sup>, Braden Everding<sup>1</sup>, Sheryl Livingston<sup>1</sup>, Margot Morris<sup>1</sup>, Michael Williams<sup>2</sup>, Louis A Whitworth<sup>1</sup> and Benjamin D. Levine<sup>1</sup>, FACSM. Institute for Exercise and Environmental Medicine, Presbyterian Hospital and UT Southwestern Medical Center, Dallas, TX.

**PURPOSE:** To determine the effect of performing a Valsalva maneuver on the transmural pressure gradient across the cerebral arteries during lower body resistance exercise (RE).

**METHODS:** Volunteers were four healthy adults with implanted Ommaya reservoirs. Intracranial pressure (ICP) was obtained via fluid-filled pressure transduction. Arterial blood pressure (ABP) was measured continuously by the volume-clamp method (Nexfin). Stress on the cerebral arteries was assessed by calculating the cerebrovascular transmural pressure gradient (CVTMP; systolic sABP - ICP).

Participants were instructed to perform repetitive supine leg press RE (8 out of 10 Borg scale) under three conditions: 1) Self-paced breathing (SP), 2) performing a Valsalva maneuver (VM) and 3) performing a modified Mueller maneuver (MM). Breathing interventions were performed during the contraction phase only. Peak and averaged sABP and ICP were calculated throughout the entire set (5 - 10 repetitions, Figure).

**RESULTS:** When participants performed SP exercise, sABP decreased ( $\Delta-6\pm 6$  mmHg) and ICP ( $\Delta 5\pm 3$  mmHg) rose slightly. The VM caused sABP ( $\Delta 9\pm 15$  mmHg) and ICP ( $\Delta 12\pm 3$  mmHg) to increase, whereas the MM resulted in a small reduction in sABP ( $\Delta -8\pm 9$  mmHg) and minimal change in ICP ( $\Delta 3\pm 4$  mmHg). This resulted in an average reduction in CVTMP irrespective of breathing maneuver (SP,  $-10\pm 5$ ; VM,  $-8\pm 11$ ; MM,  $-10\pm 9$ ). However, the VM caused a dramatic peak increase in sABP ( $28\pm 10$ ), which was not counteracted by ICP ( $15\pm 10$ ) and caused a transient increase in CVTMP in 3 of the volunteers ( $13\pm 10$  mmHg).

**CONCLUSION:** This study demonstrates that lower body RE can be performed safely with minimal stress on the cerebral circulation when appropriate breathing patterns are employed. However a VM imposes a dramatic transient stress on the cerebral circulation, not completely offset by ICP.

1375 Board #28 June 2, 8:00 AM - 9:30 AM

**Impact of Stability Ball Sitting on Cardiorespiratory Parameters During Arm Ergometry**

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(No relationships reported)

**PURPOSE:** This is the first study to determine the contributions of heart rate (HR), stroke volume (SV), and oxygen content difference ( $\text{CdO}_2$ ) to the higher  $\dot{V}_{O_2}$  that past studies observed with stability ball (SB) sitting during arm ergometry. **METHODS:** Following IRB approval, twenty-nine healthy young female and male adults exercised twice on separate days—one day sitting on a SB and the other day sitting on a chair (C), randomized order. Open circuit-spirometry,  $\text{CO}_2$  rebreathing, and a heart rate monitor measured  $\dot{V}_{O_2}$ ,  $\text{VCO}_2$ , cardiac output (Q), and HR at rest and two stages of submaximal arm ergometry. SV and  $\text{CdO}_2$  were calculated from results:  $\text{SV} = \text{Q} / \text{HR}$ ,  $\text{CdO}_2 = \dot{V}_{O_2} / \text{Q}$ . Power output was set to elicit a 20 to 40 b/min increase in heart rate for each stage of exercise. Repeated measures ANOVAs were done with alpha set at 0.05. **RESULTS:** Compared to C, SB was found to be significantly higher by 4 to 12% for  $\dot{V}_{O_2}$  ( $p < 0.001$ ) and 2 to 4% for HR ( $p = 0.016$ ). In addition, significant

interactions were found between SB and C, with increasing differences at higher intensities: SB higher by 0.5% to 2.1% for SV ( $p < .001$ ) and 1 to 6% for  $\text{CdO}_2$  ( $p = 0.016$ ).

	$\dot{V}_{O_2}$ L/min	HR b/min	SV mL/b	$\text{CdO}_2$ mL/dL
Rest-SB	0.280 ± 0.069	91 ± 15	61.8 ± 19	5.2 ± 0.8
Rest-C	0.270 ± 0.063	89 ± 15	61.5 ± 19.1	5.2 ± 0.9
Stage 1-SB	0.725 ± 0.146	120 ± 15	74.2 ± 21.7	8.4 ± 1.0
Stage 1-C	0.685 ± 0.148	116 ± 15	73.4 ± 22.9	8.3 ± 1.0
Stage 2-SB	1.002 ± 0.227	144 ± 18	74.2 ± 20.7	9.6 ± 1.1
Stage 2-C	0.892 ± 0.219	137 ± 16	72.7 ± 20.6	9.1 ± 0.9

**CONCLUSION:** Replacing a chair with a stability ball can elevate cardiorespiratory parameters, with oxygen extraction the predominant supplier of the extra oxygen during the higher intensity exercise stage of stability ball sitting.

1376 Board #29 June 2, 8:00 AM - 9:30 AM

**Comparative Analysis of Blood Pressure Response to Isometric Handgrip Exercise - Mechanical vs. Computerized**

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(No relationships reported)

The American Heart Association recognizes isometric handgrip (IHG) training as a novel intervention to lower resting arterial blood pressure (BP). Computerized IHG devices that utilize dynamometer technology are predominantly used, however, due to the high cost of these devices, price may be a barrier to utilization. There is some evidence to suggest that training with a much less expensive mechanical IHG device may offer similar benefits. Despite this early support for the BP lowering effects of mechanical IHG devices, it is not clear how different the exercise stimulus is between the different IHG technologies. **PURPOSE:** to determine whether differences exist in BP response to an acute bout of IHG exercise between devices. **METHODS:** 8 young ( $26 \pm 6$  years), normotensive participants completed 4, 2 -minute unilateral IHG contractions using the non-dominant arm at 30% of their maximum voluntary contraction (MVC), with a 4 -minute rest period between contractions using either a computerized or mechanical IHG device. Resting BP was recorded in the dominant arm following 10 -minutes of seated rest using brachial artery oscillometry, and was recorded every minute throughout each bout. Bouts occurred in random order, with 30 -minutes of rest between bouts. BP response was quantified as the peak contraction BP minus resting BP and reported as BP change. Data were analyzed using a 2-way (device x contractions) ANOVA with repeated measures and are presented as means and (SD). **RESULTS:** A greater systolic BP response [ $28$  (21) mmHg] and diastolic BP response [ $24$  (9) mmHg] were observed using the mechanical IHG device versus the computerized IHG device [ $17$  (15) mmHg and  $17$  (12) mmHg for systolic and diastolic BP response, respectively] ( $p < 0.05$ ). No significant differences were observed between contractions for either systolic or diastolic BP within each bout ( $p > 0.05$ ). **CONCLUSION:** Preliminary findings suggest that a mechanical device provides a greater BP response to an acute bout of IHG exercise than a computerized device. The importance of this difference is not entirely clear, but it is encouraging that a less expensive IHG device resulted in a positive BP response compared to traditional IHG training. Further investigations appear warranted in multiple populations, acutely, and in response to training interventions.

1377 Board #30 June 2, 8:00 AM - 9:30 AM

**The Effects of Acute Resistance Exercise on Vascular and Cognitive Function**

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Arterial stiffness increases risk for cardiovascular and cerebrovascular diseases. Recent studies note that increased central artery stiffness with age affects cerebral perfusion, contributing to impairments in cognitive function. Acute resistance exercise increases central artery stiffness. **PURPOSE:** To examine if changes in central artery stiffness from acute resistance exercise negatively affects cognitive function. **METHODS:** Fourteen healthy young adults ( $24\pm 5$  years, Body Mass Index (BMI)  $26\pm 7$  kg·m<sup>-2</sup>; 9 female) completed a screening visit and two separate, randomized experimental visits. For experimental visits, all participants completed cognitive testing and underwent measures of arterial stiffness before and after a bout of intense upper body resistance exercise. For the control visit, participants engaged in 30 minutes of seated rest

(watching a movie). We estimated carotid to femoral pulse wave velocity (PWV) as a measure of aortic stiffness. Working memory and executive functions were assessed using an N-Back task and the Erikson flanker task, respectively. **RESULTS:** Aortic PWV increased after acute resistance exercise ( $5.2 \pm 0.5$  to  $5.6 \pm 0.6$  m/s,  $p < 0.05$ ), but did not change following the control condition ( $5.2 \pm 0.7$  to  $5.3 \pm 0.7$  m/s,  $p > 0.05$ ). There were no significant changes in the N-back percentage correct following acute resistance exercise ( $81.5 \pm 14.0$  to  $80.8 \pm 16.9\%$ ,  $p > 0.05$ ) or following the control condition ( $77.7 \pm 17.7$  to  $75.0 \pm 15.0\%$ ,  $p > 0.05$ ). There were also no significant changes in the Flanker percentage correct following acute resistance exercise ( $90.0 \pm 6.0$  to  $90.0 \pm 5.54\%$ ,  $p > 0.05$ ) or following the control condition ( $88.1 \pm 9.6$  to  $90.0 \pm 6.0\%$ ,  $p > 0.05$ ). **CONCLUSION:** Even though there was an increase in aortic stiffness after resistance exercise, there was no change in cognitive function. These findings suggest that unlike the central artery stiffening that occurs with aging, artery stiffening from acute resistance exercise does not have a negative effect on cognitive performance in young healthy adults.

1378 Board #31 June 2, 8:00 AM - 9:30 AM  
**Effects Of Age And Fitness Level On Cardiorespiratory And Perceptual Responses During Wii Zumba® AVG.**

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*(No relationships reported)*

**PURPOSE:** The Wii Zumba® active video game (AVG) has the potential to be an important form of exercise that could be conducted from the comfort of one's own home. The purposes of this study were to compare the cardiorespiratory, metabolic, and perceptual responses of interactive Wii Zumba® gaming to treadmill walking in younger and older as well as fit and unfit women.

**METHODS:** Thirty females (young = 18-35, older=36-54) volunteered for the study with 7 fit and 8 unfit subjects in each group. Subjects completed a preliminary session to assess cardiorespiratory fitness, an experimental session to determine cardiorespiratory and perceptual responses to a Wii Zumba® protocol, and an experimental session to assess and compare cardiorespiratory and perceptual responses to graded walking on a treadmill at the same metabolic rate as the Wii Zumba® session. Session (2) by Time (9) repeated measures ANOVAs were conducted to compare responses of heart rate (HR), oxygen consumption (VO<sub>2</sub>), affect, and arousal measurements. Group (4) by Time (9) repeated measures ANOVAs were conducted for HR, %HRmax, VO<sub>2</sub>, %VO<sub>2</sub>max, breathing frequency (fB), caloric expenditure rate (kcal/min), tidal volume (TV), respiratory exchange ratio (RER), minute ventilation (VE), RPE, arousal, and affect.

**RESULTS:** HR [ $F(1,57)=19.15$ ,  $p < 0.001$ ] and arousal scores [ $F(1,58)=36.58$ ,  $p < 0.001$ ] were significantly higher ( $p < 0.05$ ) during the Wii Zumba® AVG than the graded walking, while VO<sub>2</sub> and affect were not significantly different. For VO<sub>2</sub>, %VO<sub>2</sub>max, HR, %HRmax, RER, VE, kcal/min, TV, RPE, arousal, and affect, there were significant time effects ( $p < 0.05$ ) during the Wii Zumba® AVG for the 4 groups (young/fit, young/unfit, older/fit, older/unfit). %VO<sub>2</sub>max was significantly greater in the older/unfit group than the other 3 groups [ $F(2,26) = 7.19$ ,  $p = 0.001$ ].

**CONCLUSIONS:** The Wii Zumba® AVG was shown to be as effective as treadmill walking for producing optimal cardiorespiratory, metabolic, and perceptual responses in younger fit and unfit as well as older fit and unfit women, and therefore appears to be an effective modality for improving fitness in women.

1379 Board #32 June 2, 8:00 AM - 9:30 AM  
**Compression Socks Worn During Flight And Hemostatic Balance In Boston Marathon Runners On Oral Contraceptives**

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*(No relationships reported)*

Marathon running evokes acute parallel increases in markers of coagulation and fibrinolysis (i.e., hemostatic activation) such that hemostatic balance is maintained. However, other factors incident to marathon running (i.e., travel, oral contraceptive [OC] use) may disproportionately activate the coagulatory system, increasing blood clot risk in otherwise, healthy athletes. Compression socks are an established

preventive measure to reduce blood clot risk with air travel, but their effect on thrombotic factors in athletes who fly to and from competitions has not been established. **PURPOSE:** This study investigated the effect of compression socks on hemostatic activation in OC using endurance athletes flying cross-country and running the 2015 Boston Marathon. **METHODS:** OC using women ( $n=29$ ) traveling cross-country were divided into compression sock (SOCK;  $n=14$ ) and control (CONTROL;  $n=15$ ) groups in which SOCK participants wore compression socks during flights to (mean flight time  $5.8 \pm 1.5$ hr) and from (mean flight time  $6.1 \pm 1.3$ hr) the marathon. Venous blood samples were collected 24hr prior to flying cross-country to Boston, 1d before the marathon after flying, immediately after the marathon, and within 24hr following a return flight home. Samples were analyzed for coagulatory factor thrombin-antithrombin complex (TAT); fibrinolytic factor tissue plasminogen activator (t-PA); serum estradiol; and hematocrit. **RESULTS:** Baseline (pre-flight) TAT and t-PA did not differ between groups (all  $ps > 0.13$ ) and were not different from baseline after flying cross country to the marathon (all  $ps > 0.92$ ). T-PA increased after the marathon from baseline in CONTROL ( $+4.0 \pm 1.3$  ng/mL) and SOCK ( $+3.3 \pm 1.3$ ng/mL) with no difference between groups ( $p=0.17$ ). TAT was not different after the marathon from baseline ( $p=0.70$ ). T-PA decreased to baseline levels after the return flight home in CONTROL ( $-4.4 \pm 1.6$  ng/mL) and SOCK ( $-3.5 \pm 1.3$  ng/mL); this response did not differ between groups ( $p=0.12$ ). **CONCLUSION:** Compression socks worn during flight did not alter the balance of clot formation or breakdown at any individual time point in OC using women flying cross country before and after running a marathon. Future research is necessary to determine whether the timing of sock use influences their utility for blood clot risk reduction.

1380 Board #33 June 2, 8:00 AM - 9:30 AM  
**Effects Of Intensity On Post Exercise Cytokine And Oxidative Stress Levels**

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**PURPOSE:** To compare the effects of single bouts of intermittent vigorous and continuous moderate intensity walking exercise on markers of inflammation and oxidative stress in the 48 h post exercise period.

**METHODS:** Seventeen ( $n=17$ ) recreationally active male participants ( $22.6 \pm 4.6$  years;  $179.2 \pm 5.6$  cm;  $79 \pm 10.6$  kg;  $VO_{2max} 53.7 \pm 7.1$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) were recruited to participate in a randomised crossover study consisting of two trials: (1) intermittent vigorous walking exercise (3 x 5 minute bursts at 80% VO<sub>2</sub>max) and (2) continuous moderate walking exercise (60% VO<sub>2</sub>max for 30 minutes). Each trial was separated by 7 days. Venous blood samples were obtained at baseline and immediately, 2 h, 4 h, 24 h and 48 h post-exercise for determination of markers of inflammation (IL-6 and TNF- $\alpha$ ), lipid soluble antioxidants and oxidative stress (LOOH, H<sub>2</sub>O<sub>2</sub> and the ascorbyl radical).

**RESULTS:** Lycopene decreased 2 h post-exercise during the intermittent vigorous walking trial compared to baseline ( $P < 0.05$ ) and post-exercise ( $P < 0.05$ ). A main effect for time was detected for increases in  $\alpha$ -tocopherol ( $P < 0.05$ , Pooled data). Main effects for time were also observed for increases in IL-6 and TNF- $\alpha$  following exercise ( $P < 0.05$ , Pooled data, respectively). No changes were detected for LOOH, H<sub>2</sub>O<sub>2</sub> and the ascorbyl radical either between or within conditions ( $P > 0.05$ ).

**CONCLUSION:** Bouts of both vigorous intensity intermittent and moderate intensity continuous walking promote increases in cytokine concentrations (IL-6 and TNF- $\alpha$ ), but not indices of oxidative stress in the post exercise period, although lycopene decreased in the vigorous trial. Further investigation is required to assess how such changes may underpin some of the transient health benefits of exercise.

1381 Board #34 June 2, 8:00 AM - 9:30 AM  
**Reductions in Cardiovascular and Metabolic Demands During Work Rate Matched Eccentric Stepping Exercise**

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Eccentric (ECC) exercise training induces greater increases in muscle strength, hypertrophy and performance compared with work rate (WR) matched concentric (CON) exercise. During ECC WR-matched cycle ergometry there is also a reduction in cardiovascular (CV) and metabolic demands compared with CON. However, the magnitude of this reduction during ECC exercise, which more closely mirrors natural locomotion, is unknown. Similarly, it is unknown whether ECC stepping exercise performed at the same CON metabolic rate can be tolerated to allow a greater volume of work to be accumulated for the same CV and metabolic demand.

**PURPOSE:** To compare CV and metabolic responses during CON and ECC stepping exercise performed at the same mechanical and metabolic rates. **METHODS:** Eight

participants (5 m, 3 f), (mean  $\pm$  SD: 22  $\pm$  2 yr; 172  $\pm$  6 cm; 70  $\pm$  9 kg) performed a CON and ECC ramp incremental test to the limit of tolerance on a step ergometer (Eccentron; BTE, Hanover, MD, USA). CON and ECC constant WR tests were then performed for 15 min at the same mechanical (work) and metabolic (pulmonary oxygen uptake ( $\dot{V}O_2$ )) rate, set at 90% of the CON lactate threshold (i.e. moderate-intensity). All tests were undertaken > 48 hours apart. Breath-by-breath  $\dot{V}O_2$ , heart rate (HR), and blood pressure (BP) responses were measured throughout. **RESULTS:** During constant exercise at the same mechanical WR (36.2  $\pm$  6.2 W), in which a steady-state was attained, compared with CON, ECC  $\Delta\dot{V}O_2$  was 64  $\pm$  9 % lower (22  $\pm$  0.07 vs. 0.62  $\pm$  0.17 l.min<sup>-1</sup>;  $P < 0.05$ ),  $\Delta$ HR was 51  $\pm$  13 % lower (14.6  $\pm$  5.9 vs. 29.9  $\pm$  7.2 beats.min<sup>-1</sup>;  $P < 0.05$ ) and  $\Delta$  mean arterial pressure was 56  $\pm$  18 % lower (7  $\pm$  3 vs. 16  $\pm$  5 mmHg;  $P < 0.05$ ). The ECC WR predicted to match for metabolic rate ( $\dot{V}O_2$ , 1.2  $\pm$  0.1 l.min<sup>-1</sup>) was 66  $\pm$  19 % higher (60.0  $\pm$  13.2 vs. 36.2  $\pm$  6.2 W;  $P < 0.001$ ), and allowed a greater volume of work to be accumulated; however,  $\dot{V}O_2$  and HR continued to increase throughout the exercise. **CONCLUSION:** ECC stepping exercise at the same mechanical WR reduces the CV and metabolic demand of the exercise. Although ECC exercise at the same predicted  $\dot{V}O_2$  was tolerable, and allowed a greater volume of work to be accumulated,  $\dot{V}O_2$  and HR increased throughout the exercise, suggesting this was performed at a higher exercise intensity, which may be contraindicated in some populations.

1382 Board #35 June 2, 8:00 AM - 9:30 AM  
**Analysis Of The Upper Extremity Muscle Response During An Acute Bout Of Isometric Handgrip Exercise.**

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 (No relationships reported)

Isometric handgrip (IHG) training lowers blood pressure in several populations and is accepted by the American Heart Association as an alternate blood pressure lowering treatment. However, high costs associated with traditional computerized IHG devices may create an economic barrier for some people. Purpose: As a preliminary step in investigating less expensive options, the purpose of this study was to determine whether an inexpensive mechanical IHG device elicits similar upper extremity muscle response via electromyography (EMG) to the traditional computerized IHG device. Methods: Normotensive individuals (n = 8; age = 25.8 (6.0) y) recruited from the general population performed a standard IHG bout (4, 2 minute isometric contractions at 30% of maximum voluntary contraction (MVC) separated by a 4 minute recovery time between contractions) using the computerized and mechanical IHG device. Each bout occurred in random order, and was separated by 30 min of seated rest. Raw surface EMG data were collected at 20-500 Hz (full wave rectified, low pass filtered using a cutoff frequency of 2 Hz) during each bout in the brachioradialis (BR), flexor carpi ulnaris (FCU), extensor carpi ulnaris (ECU), biceps brachii (BB) and triceps brachii (TB). Raw EMG linear envelopes were normalized to the peak activity of MVC trials and averaged over time intervals (22 sec) representing 5 epochs during each bout. Data were analyzed by repeated measures ANOVA and presented as means (SD). Results: No statistically significant differences were found between the devices for the BB, TB and ECU ( $p > 0.05$ ). Greater EMG activity was observed in the BR [218 (161) %MVC computerized versus 135 (96) %MVC mechanical;  $p < 0.05$ ] and FCU [529 (328) %MVC computerized versus 165 (130) %MVC mechanical;  $p < 0.05$ ] when IHG was performed with the computerized IHG device than when using the mechanical IHG device. Conclusion: Preliminary findings suggest that muscle activation is similar in some, but not all, muscles of the upper limb when IHG exercise is performed on a computerized versus mechanical device. More research is needed to determine whether differences in muscle activation using a mechanical device elicit similar blood pressure lowering benefits as observed in traditional isometric handgrip exercise using a computerized IHG device.

1383 Board #36 June 2, 8:00 AM - 9:30 AM  
**The Effect Of The Different Type Of Exercise In The Pupillary Size And Response**

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Accommodation of body internal functions during exercise is mainly controlled by autonomic nerves, and many studies on exercise and cardiac autonomic function including skin blood flow and frequency analysis of R-R interval have been reported. As a different method, we focused on observation of pupils, which has been traditionally used in medical practice. Studies on the intensity of exercise and

autonomic of the eye are very rare. From the past reports, sympathetic nerves are known to control predominantly during intense exercise, so pupil diameters are expected to dilate during exercise. **PURPOSE:** To determine the effects of the different type of exercise in the pupillary size and response. **METHODS:** Subjects were healthy young male and female volunteers without any history of ocular diseases other than minor refractive error. (n=14 to 20, age range: 18-24 years old) After 10 minutes of dark adaptation, subjects were assigned to the different types of exercise. The difference in the pupillary diameter and unrest were noted at rest, during exercise and the recovery phase by the pupilometer. Types of exercise used: 1) Maximum effort pedaling with ergometer for 30 seconds with Powermax, 2) Isometric contraction of knee extension for 10 seconds, 3) Maximal cycling exercise. **RESULT:** 1) There was a significant difference in the pupillary size between resting state and during exercise with maximal effort of 30 seconds duration ( $P < 0.05$ ). 2) Isometric exercise of knee extension for 10 seconds caused statistically significant pupillary dilation and then pupillary constriction 3 minutes after exercise ( $P < 0.05$ ). 3) Maximum pupillary unrest was significantly noted at the end phase of the maximal exercise and pupil slowly becomes stable after 3 minutes of recovery phase. However, the pupillary diameter was decreased compared to its baseline ( $P < 0.05$ ). **CONCLUSION:** Temporal refractory mydriasis would be induced by abrupt and high-intensity exercise as in the same way as ciliospinal reaction, regardless of the type of exercise. Also, an increase in pupillary unrest was observed due to physical fatigue when subjects performed high-intensity exercise. These findings indicate there is a possibility to monitor the body internal function during exercise by observation of pupils.

1384 Board #37 June 2, 8:00 AM - 9:30 AM  
**Modelling Red Cell Population Dynamics and Iron Status in Elite Endurance Athletes**

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A novel mathematical model of red cell (RBC) population dynamics (RCPD; Higgins & Mahadevan, 2010), which estimates the maturation and clearance of RBC has distinguished patients with and without iron deficiency anaemia, before a clinical diagnosis using traditional RBC indices has been possible. **PURPOSE:** The aim of this study was to use RCPD to characterise the maturation and clearance of RBCs in elite endurance athletes. Given the differences in the physical and metabolic demands, we hypothesised that RCPD would be significantly different in rowers and runners. **METHODS:** Complete blood counts (CBC) were taken from 35 elite endurance athletes using flow cytometry (rowers n=7;  $O_{2max}$  63.0  $\pm$  3.6 ml.kg<sup>-1</sup>.min<sup>-1</sup>, sFer 39.7  $\pm$  21.7  $\mu$ g.L<sup>-1</sup> male runners n=17;  $O_{2max}$  78.3  $\pm$  2.6 ml.kg<sup>-1</sup>.min<sup>-1</sup>, sFer 64.1  $\pm$  26.3  $\mu$ g.L<sup>-1</sup> female runners n=11;  $O_{2max}$  70.7  $\pm$  3.7 ml.kg<sup>-1</sup>.min<sup>-1</sup>, sFer 74.0  $\pm$  22.7  $\mu$ g.L<sup>-1</sup>). Traditional RBC indices were derived from the CBC, along with the following RCPD variables modelled from the raw CBC data file: reticulocyte volume reduction ( $\beta_r$ ); reticulocyte haemoglobin (Hb) content reduction ( $\beta_h$ ); erythrocyte volume and Hb content reduction ( $\alpha$ ); magnitude of variation in the rate of volume and Hb reduction ( $D_v$  and  $D_h$ , respectively); critical volume for cell clearance ( $v_c$ ). **RESULTS:**  $D_v$  and  $v_c$  were significantly different between female runners and male rowers (0.182  $\pm$  0.002 vs. 0.021  $\pm$  0.003,  $p = 0.006$  & 0.780  $\pm$  0.006 vs. 0.773  $\pm$  0.006,  $p = 0.008$ , respectively). No further differences between sports for RCPD variables were identified. There were significant relationships between  $v_c$  and red cell distribution width (RDW) in male rowers (-.835,  $p = 0.020$ ), male runners (-.933,  $p = 0.001$ ) and a trend was observed in female runners (-.544,  $p = 0.084$ ). There were no significant relationships between any RCPD variables and sFer or serum iron (sFe) in either sport. **CONCLUSION:** Maturation rates and clearance thresholds of erythrocytes differ between sports and this is independent of sFer and sFe. The association between  $v_c$  and RDW found here has been observed in patients from clinical populations, where it is suggested that increased RBC lifespan indicates an adaptive response to mild anaemic states. As such RCPD may provide a new understanding of iron status and its relationship with the haematology of endurance athletes.

1385 Board #38 June 2, 8:00 AM - 9:30 AM  
**The Effect Of A Needle Stick On Resting Heart Rate Variability**  
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**PURPOSE:** The purpose of this study was to investigate alterations of cardiac autonomic control through heart rate variability (HRV) during and following a phlebotomy procedure among apparently healthy individuals.

**METHODS:** A total of 33 participants, nine males ( $23.1 \pm 3.0$  yrs) and 24 females ( $22.5 \pm 3.3$  yrs) underwent a phlebotomy procedure while undergoing short-term analysis of HRV. Testing procedure included a 10-minute analysis of HRV prior to the needle stick (PRE), a 1-minute phlebotomy procedure and an additional 10-minute analysis of HRV following the needle stick. The log transformation of the time domain Root Mean Squared of Successive Differences (lnRMSSD) was used to quantify vagal tone.

**RESULTS:** Repeated measures ANOVA revealed several significantly different time points following PRE values. The Stick time point was significantly lower than PRE ( $1.69 \pm 0.23$  ms<sup>2</sup> vs.  $1.63 \pm 0.26$  ms<sup>2</sup>;  $p < 0.05$ ), while time points 2-min ( $1.76 \pm 0.22$  ms<sup>2</sup>), 4-min ( $1.74 \pm 0.25$  ms<sup>2</sup>), 5-min ( $1.74 \pm 0.24$  ms<sup>2</sup>), 6-min ( $1.75 \pm 0.23$  ms<sup>2</sup>), 8-min ( $1.74 \pm 0.24$  ms<sup>2</sup>), and 9-min ( $1.74 \pm 0.24$  ms<sup>2</sup>) were significantly elevated from PRE ( $p < 0.05$ ). lnRMSSD returned to base line by 10-min and was not significantly different from PRE values ( $1.69 \pm 0.23$  ms<sup>2</sup> vs.  $1.72 \pm 0.24$  ms<sup>2</sup>;  $p = 0.214$ ).

**CONCLUSIONS:** This study shows that alterations in vagal tone occur as a result of a phlebotomy procedure. During the phlebotomy procedure a withdrawal of vagal tone occurs, followed by a subsequent vagal rebound, resulting in a temporary state of elevated HRV. It is recommended that investigators consider the timing of phlebotomy procedures when measuring HRV.

1386 Board #39 June 2, 8:00 AM - 9:30 AM  
**Acute Effect of Energy Drink Consumption on Heart Rate Variability**  
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**PURPOSE:** To investigate the acute influence of commercially-available, zero-kcal energy drink (ED) ingestion on resting measures of cardiovascular autonomic control as indicated by heart rate variability (HRV).

**METHODS:** Using a single-blind, repeated measures, counter-balanced crossover design, 14 (7 women) young (mean  $\pm$  SD;  $25 \pm 3$  y), healthy adults completed two testing sessions after an overnight fast. Participants were asked to avoid vigorous exercise and caffeine consumption the day prior testing. Each session was separated by at least 48 h. Baseline supine HRV measures were recorded prior to ingesting either an ED or control drink (CD) of equal volume. Following a 30-min digestion period, HRV monitoring resumed. The alternate drink treatment was implemented during the subsequent visit. The change in pre- to post-drink HRV recordings were calculated and analyzed.

**RESULTS:** Paired samples t-tests did not reveal differences for any HRV parameters (RMSSD: ED =  $0.71 \pm 2.34$  ms, CD =  $-0.29 \pm 1.27$  ms,  $p = 0.11$ ; LF nu: ED =  $1.43 \pm 13.10$ , CD =  $-5.14 \pm 17.49$ ,  $p = 0.34$ ; or HF nu: ED =  $-2.36 \pm 14.22$ , CD =  $5.36 \pm 16.66$ ,  $p = 0.24$ ).

**CONCLUSIONS:** According to these data, consumption of a commercially available ED does not alter cardiovascular autonomic control in young, healthy adults under resting conditions. Future studies should investigate the effects of ED consumption on autonomic control during exercise, post-exercise, and under orthostatic stress.

1387 Board #40 June 2, 8:00 AM - 9:30 AM  
**Exploring the Effect of a Maximal Exercise Test on Heart Rate Variability in Young Adults**  
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Heart rate variability (HRV) is a commonly used tool in biobehavioral and biomedical research and may represent a non-traditional marker of disease risk. Few data

exist investigating relationships between HRV and concurrent measurements of maximal exercise capacity, adiposity and heart rate recovery (HRR) in the general population. Additionally, HRV or vagal response to/and following an exercise task may independently be related to current and future health status. **PURPOSE:** To investigate the effects of a maximal exercise test on HRV and to explore associations between changes in HRV indices in response to exercise and fitness, adiposity and acute HRR. **METHODS:** As part of a larger longitudinal study, 27 young adults (Age=18-20 years, Female=48%) completed a graded maximal exercise test. HRV was assessed at two times (pre- and ~20 mins post-exercise) via an orthostatic challenge (5 min in each posture: supine, seated, standing). HRR at 2 and 4 min post-exercise was assessed as reduction in HR following exercise test cessation using the Polar RS800CX. Adiposity was measured by BodPod. HRV was processed using Kubios (v2.1, Finland). A two-way RM-ANOVA (posture\*time) was used to assess the effect of maximal exercise on HRV. Spearman correlations were performed to identify associations between baseline HRV and health variables. **RESULTS:** Significant interactions for posture x time were seen for RMSSD (time domain) ( $p < 0.001$ ), approximate entropy (ApEn) ( $p < 0.001$ ), and baseline HR ( $p < 0.001$ ). Both baseline ApEn and resting HR were negatively correlated with VO<sub>2</sub>max ( $-0.49$ ,  $p = 0.009$ ;  $-0.52$ ,  $p = 0.005$ , respectively) and HRR at 2 min ( $-0.49$ ,  $p = 0.009$ ;  $-0.68$ ,  $p < 0.001$ , respectively). Neither baseline HRV indices nor change in HRV were related to adiposity, but changes in several HRV indices were associated with HRR and VO<sub>2</sub>max. **CONCLUSION:** As anticipated, maximal exercise resulted in significant posture specific changes in HRV. Continued exploration into the time-course of HRV recovery is needed, particularly as it relates to the dynamics of HRR in the initial minutes post-exercise. To interpret the potential utility of HRV measures, further investigation should focus on the relationships between HRV and traditional disease risk biomarkers in a variety of contexts.

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1388 Board #41 June 2, 8:00 AM - 9:30 AM  
**Dynamic Modulation of Spontaneous Cardiac Baroreflex Sensitivity to Changes in Workloads in Humans**  
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 (No relationships reported)

The arterial baroreflex plays important role in cardiovascular regulations during exercise. Previous studies showed that the spontaneous sensitivity of the cardiac component of arterial baroreflex (SBRS) is progressively attenuated with increasing workloads of dynamic exercise. However, dynamic modulation of SBRS to changes in workloads is unknown.

**PURPOSE:** We aimed to investigate the amplitude response and phase response of SBRS during cycling exercise with sinusoidally-varying workload.

**METHODS:** We studied 8 healthy male volunteers. After 5 minutes of resting measurements, the subjects performed cycling exercise at 50 W for 5 minutes. Then the workload was changed in a sinusoidal pattern between 30 W to 70 W for 32 minutes. The periods of sinusoidal workload were set to 4, 8 and 16 minutes. Subjects performed each of those three sinusoidal load exercise on separate days in random order. SBRS was evaluated as the slopes of the linear relations between R-R interval and systolic arterial blood pressure (SAP) during spontaneous sequences of at least three consecutive beats when SAP and R-R interval changed in the same directions. SBRS for all sequences were superimposed every periods of sinusoidal load and fitted to a sine model using the least-squares error approach to calculate amplitude response and phase response.

**RESULTS:** During sinusoidal exercise, SBRS changed sinusoidally with the change of workload. The amplitude response of SBRS for 4, 8 and 16 minutes periods were  $1.4 \pm 0.3$ ,  $1.4 \pm 0.2$ , and  $1.2 \pm 0.3$  msec/mmHg, respectively and were not significantly different ( $p > 0.05$ ). The phase lag of the SBRS from the sinusoidally-varying workload for 4, 8 and 16 minutes periods were  $20.4 \pm 4.2$ ,  $17.4 \pm 4.3$ , and  $3.6 \pm 4.2$  degrees, respectively. The phase lag of the SBRS in 16 minutes period was significantly smaller compared to 4 minutes period ( $p < 0.05$ ).

**CONCLUSIONS:** We conclude that the arterial baroreflex control of heart periods is modulated continuously in response to changes in workload. When workload changes fast, the modulation of SBRS delays from the changes in workloads. However, SBRS is modulated with almost no delay in response to relatively slow changes in workloads. We suggest that the dynamic modulation of the SBRS is one of the mechanisms to regulate cardiovascular responses in accordance with changes in workloads.

1389 Board #42 June 2, 8:00 AM - 9:30 AM  
**The Impact of Physical Activity and Sleep on Blood Pressure in College Students**

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College is a time when many health habits, both physical and behavioral, start to form that will remain throughout one's adult life (Kemper & Welsh, 2010). Excessive sedentary behavior is common among college-age students and can negatively impact cardiovascular health (Lepp, Barkley, Sanders, Rebold, & Gates, 2013). PURPOSE: Data for this analysis came from the Albion College Health Study, the purpose of which was to examine a variety of physical and behavioral characteristics of college students to better understand ways in which interventions and programming could be better tailored to meet the needs of this population. METHODS: A total of 64 Albion College students (39 males, 25 females) participated in the study. Height, weight, physical activity patterns, sedentary behavior, knowledge of physical activity and nutrition guidelines, the amount of time spent sleeping, blood pressure, waist circumference, and smoking were measured. RESULTS: Only 51.6% of participants were physically active five or more days per week, while 54.7% were considered normal weight and 43.8% were categorized as overweight or obese by BMI. Only 33.8% of participants averaged eight or more hours of sleep per night. 23.4% of participants were pre-hypertensive. There was a significant interaction between physical activity and BMI on weekend sleep ( $p=0.042$ ) and total hours of sleep per week ( $p=0.022$ ). Additionally, there was a significant interaction between physical activity and sleep on systolic blood pressure ( $p=0.012$ ). CONCLUSIONS: Being physically active, getting the proper amount of sleep, and maintaining a healthy body mass index should be the focus of any interventions or educational programs aimed at improving the health of college students.

1390 Board #43 June 2, 8:00 AM - 9:30 AM  
**Hemostatic Adaptations to a High-Intensity Interval Training Intervention in Healthy Men**

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Most adverse cardiovascular events such as heart attack and stroke are caused by an occlusive thrombus. Regular exercise training is theorized to reduce cardiovascular risk, in part, by lowering coagulation potential. However, studies of coagulation adaptations following traditional, moderate intensity exercise programs have yielded inconsistent results. High intensity interval training (HIIT) causes several improvements related to cardiometabolic health, but the effect of HIIT on coagulation potential is unknown.

PURPOSE: The purpose of this study was to examine hemostatic adaptations in healthy men following four and eight weeks of HIIT.

METHODS: Twenty-one healthy, sedentary men (age:  $25 \pm 5$  yrs, BMI:  $26.7 \pm 6.2$  kg/m<sup>2</sup>) participated in HIIT three days/week for eight weeks. Training consisted of repeated, 30-second bouts of maximal intensity cycling (i.e. "Wingate" training) separated by 4.5 minutes of active rest. Training began with three bouts/day with one additional bout/day added every two weeks, progressing up to six bouts/day in the final two weeks. Activated partial thromboplastin time (APPT), prothrombin time (PT), and plasma concentration of fibrinogen were assessed at baseline, after four weeks, and eight weeks of training. Data were analyzed using repeated measures ANOVA, with a priori significance set to  $p < 0.05$ .

RESULTS: Fibrinogen concentration (baseline:  $282.1 \pm 71.95$  mg/dL; 4w:  $246.4 \pm 58.5$  mg/dL; 8w:  $291.3 \pm 83.9$  mg/dL) significantly decreased from baseline to four weeks ( $p < 0.05$ ) and significantly increased from four weeks to eight weeks ( $p < 0.05$ ). No significant changes were observed for APPT (baseline:  $43.0 \pm 5.4$  sec; 4w:  $42.7 \pm 5.1$  sec; 8w:  $44.2 \pm 6.2$  sec), or PT (baseline:  $13.0 \pm 0.9$  sec; 4w:  $12.9 \pm 0.6$  sec; 8w:  $13.1 \pm 0.8$  sec).

CONCLUSIONS: These results may indicate a dose response relationship whereby fibrinogen decreased during the first few weeks of training but then significantly increased during the last four weeks, when training volume was at its greatest. This response is similar to what has been reported in cases of overtraining. Fibrinogen is a key indicator of coagulation and inflammation, and is consistently associated with cardiovascular risk. Additional study is needed to further elucidate the inflammatory and coagulative adaptations to HIIT in this and other populations.

1391 Board #44 June 2, 8:00 AM - 9:30 AM  
**Effect of Differing Lower Body Warm-up Methods on Plasma Volume**

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 (No relationships reported)

Changes in plasma volume (as calculated by changes in hemoglobin and hematocrit) are important to document, since hemoconcentration of blood constituents, such as hormones, during or after movement, can drastically affect measurement results. Changes in plasma volume have not been noted after differing warm-up methods. PURPOSE: To measure changes in plasma volume in response to two different types of lower body warm-up. METHODS: Subjects were healthy males ( $n=5$ ) and females ( $n=5$ ), ages 19-47, mean height 175.2 cm, mean weight 71.3 kg, who were tested on four separate visits. Subjects performed either of two types of lower body warm-up (dynamic or static stretching) or two types of control warm-up (controlling for changes in body position without actual stretching). Immediately pre- and post- warm-up, middle fingers on the dominant hand were punctured for measurement of hemoglobin (Hgb - using Hemocue device, in quadruplicate) and hematocrit (Hct - using StatSpin centrifuge, in triplicate). All statistical analysis was done by repeated measures ANOVA. RESULTS:

	Hgb	Hct	% $\Delta$ plasma vol.
Static Control Pre (SC)	13.75 $\pm$ 1.79	41.9 $\pm$ 4.0	+0.54 $\pm$ 4.21
Static Control Post	13.50 $\pm$ 1.85	41.1 $\pm$ 4.0	
Static Pre (S)	13.70 $\pm$ 2.02	40.0 $\pm$ 3.7	-3.51 $\pm$ 6.66
Static Post	13.91 $\pm$ 1.76	40.1 $\pm$ 3.6	
Dynamic Control Pre (DC)	13.54 $\pm$ 1.61	41.0 $\pm$ 3.2	+0.17 $\pm$ 4.85
Dynamic Control Post	13.95 $\pm$ 1.86	40.9 $\pm$ 3.1	
Dynamic Pre (D)	13.45 $\pm$ 1.80	38.3 $\pm$ 5.3	-14.90 $\pm$ 3.17†
Dynamic Post	14.56 $\pm$ 1.64*	43.6 $\pm$ 4.1*	

Data presented as means  $\pm$  SD; Hgb = hemoglobin in mg/dL, Hct = hematocrit in %,  $\Delta$  plasma vol. = change in plasma volume from formula and corrected for trapped plasma, \* = sig. different from pre-test ( $p < 0.05$ ); † = sig. different from other lower body warm-up protocols ( $p < 0.05$ )

Subject urine specific gravity did not differ amongst visits (mean  $\pm$  SD; D - 1.011 $\pm$  0.006, DC - 1.010  $\pm$  0.004, S - 1.011  $\pm$  0.005, SC - 1.013  $\pm$  0.004,  $p > 0.40$ ), indicating no dehydration present.

CONCLUSIONS: A lower body dynamic warm-up method, commonly used amongst athletes, but not a static stretching warm-up method, resulted in significant changes in plasma volume.

1392 Board #45 June 2, 8:00 AM - 9:30 AM  
**Static Passive Stretching Negatively Affects Exercise Endurance Via Reducing Functional Sympatholysis.**

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Exercise results in an increase in metabolism and the favorable redistribution of blood flow to the active area, by locally attenuating the vasoconstriction caused by the global increase in muscle sympathetic nerve activity, a process known as "functional sympatholysis". The recent recognition that passive leg stretching (PLS) negatively affect exercise endurance by reducing mechanical efficiency and increasing accumulation metabolism byproducts, instigates the question does PLS affect functional sympatholysis?

Purpose: To evaluate the effect of PLS on exercise endurance and functional sympatholysis.

Methods: In 8 healthy subjects ( $25 \pm 3$  yr) femoral artery blood flow (FBF) was measured during a time to exhaustion (85% of maximal work rate) of a dynamic knee extension (KE) exercise. The measurement was repeated during the same exercise executed immediately after 5 min of passive leg stretching (KE+PLS).

Results: Time to limit during the KE was ( $19 \pm 3$  min), and significantly decreased during KE+PLS ( $14 \pm 3$ ;  $p < 0.01$ ). Steady-state FBF recorded during the 4th minute of KE was ( $5136 \pm 733$  ml/min), and significantly decreased during the 4th minute of KE+PLS ( $3798 \pm 441$  ml/min;  $p < 0.01$ ).

Conclusions: These data reveal that 5 minutes of passive leg stretching does result in an extensive reduction  $\sim 26\%$  in femoral blood flow. Interestingly, the time to limit was decreased by the same extend, implicating a possible association between the reduction of functional sympatholysis and the decrease of endurance performance. This PLS-

induced reduction in oxygen delivery to the exercising skeletal muscle was likely determined by mechanical, neuromuscular, and biochemical factors, but other studies are needed to extend these preliminary results.

1393 Board #46 June 2, 8:00 AM - 9:30 AM  
**Changes In Vascular Responses During And After Applications Of Cold And Heat Modalities**

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Applications of cold- or heat-therapy are commonly used to control vascular responses of musculoskeletal injuries.

**PURPOSE:** To assess the changes in skin temperature and vascular reaction of the posterior tibial artery (PTA) during and after applications of cold and heat modality.

**METHODS:** Fifteen healthy male subjects (age:  $21.3 \pm 2.5$  yrs) underwent one of three treatment sessions (cold: two ice packs, heat: two moist heat packs, or control: no treatment). After baseline measurements, each treatment was randomly applied to the medial and lateral malleoli on the right ankles, then removed after 25-min. Dependent measurements were skin temperature using a digital thermometer at the posterior border of medial malleolus; blood flow volume, blood flow velocity, and vessel diameter at the PTA (10 cm above the medial malleolus) using a Doppler ultrasound (imaging frequency: 4 MHz). Each measurement was recorded at baseline and every 3-min thereafter until the end of the protocol (total time: 45-min). To test treatment effects over time, 3x16 mixed model ANOVAs and post hoc tests (Tukey-Kramer pairwise comparisons) were performed ( $p < 0.05$ ).

**RESULTS:** Comparisons between the baseline values (0-min) and the average values of the skin temperatures during the heat and cold treatment (from 3-min until 24-min) resulted in a 5.5 °C increase and a 9.9 °C decrease, respectively ( $F_{30,658}=25.23$ ,  $p < 0.0001$ ). From the baseline values, peak blood flow volume increased nearly four times ( $F_{30,658}=1.48$ ,  $p < 0.0001$ ; 11.9 to 42.1 ml/min) during the heat treatment. Blood vessel diameter was peaked after 18-min post application of heat ( $F_{30,658}=1.97$ ,  $p < 0.0001$ ; 0.21 to 0.26 cm).

**CONCLUSIONS:** We observed: (1) increased vascular responses by superficial thermotherapy (2) no treatment effect after the removal of thermotherapy, and (3) no hunting response by cryotherapy.

1394 Board #47 June 2, 8:00 AM - 9:30 AM  
**The Effects of Blood Flow Restriction Training on Frontal Plane Isometric Ankle Strength**

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(No relationships reported)

**PURPOSE:** To view the effects of Blood Flow Restriction Training (BFRT) on frontal plane ankle strength.

**METHODS:** Participants ( $n=4$  [ $22.5 \pm 3.5$  years]), with no known cardiovascular or metabolic diseases, were recruited for this study. To assess ankle strength, participants sat on a treatment table with a load cell attached to the distal end of the foot. Participants were asked to perform eversion and inversion bilaterally. Each of these movements were performed for three sets, maintaining an isometric contraction for five seconds, followed by a 60-second rest. To place the restriction cuff on the thigh, participants were measured from the head of the femur to the top of the patella, with the proximal third being used for placement. At this location, the circumference of the thigh was assessed, which determined the pressure to which the cuff needed to be set for testing. Participants completed six training sessions over a two-week duration, where they were asked to perform three sets of ankle eversion to failure, with a 30-second rest between each of the sets. Paired-samples t-tests with a Bonferroni correction ( $p > .0125$ ) were used to evaluate the data.

**RESULTS:** There were non-significant increases ( $p > .0125$ ) in force production of the untrained ankle directions, with the non-dominant evertor muscles demonstrating a greater increase than that of the dominant evertors undergoing BFRT.

**CONCLUSIONS:** Non-significant increases were noted for strength in all movement directions, regardless of the limb and direction involved in BFRT implicating possible neural adaptations across limbs. The study was of a very short duration, limiting the potential neural and physiologic adaptations of BFRT that have been noted in previous studies to shown any significant data/results.

1395 Board #48 June 2, 8:00 AM - 9:30 AM

**Acute Effects of Core Rotation Exercises on Leg Hemodynamics**

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Core rotation exercise performed while standing on a platform is a novel whole-body exercise modality that provides a safe indoor alternative for older people and patients with lower leg disability. However, whether such exercise could improve leg blood flow and vascular stiffness is unknown. Purpose: We assessed the acute effects of core rotation exercises performed at a fast cadence (aerobic exercise-like) and a slow cadence (resistance exercise-like) on femoral blood flow, lower leg impedance and arterial stiffness. These effects were compared with those elicited by the traditional knee extension exercise. Methods: Thirty-two apparently healthy adults, including 16 young ( $22 \pm 1$  yrs) and 16 older adults ( $66 \pm 2$  yrs), underwent a single bout of seated knee extension exercise (80% 1RM, 12 rep/set for 3 sets), and core rotation exercise at a fast (150 rpm) and a slow (40 rpm) cadence for 30 min by using a counter-balance order. Each exercise was performed at least 24 hr apart. Blood pressure, brachial-ankle pulse wave velocity (baPWV), and femoral blood flow were measured before, 30 min and 60 min after exercise. Results: There were no changes in blood pressure in any of the conditions 30 and 60 min after exercise. Knee extension exercise produced lowest baPWV 30 min post exercise. Fast core rotation exercise and knee extension exercise increased femoral blood flow at 30 and 60 min post exercise. Fast core rotation exercise was also shown to elicit significant reduction in lower leg impedance 30 min post exercise. Conclusions: An acute bout of standing core rotation exercise performed at fast cadence may produce favorable changes in blood flow and impedance in lower legs.

1396 Board #49 June 2, 8:00 AM - 9:30 AM

**Dose-dependent Effects Of Uv-a Light On Nitric Oxide Bioavailability And Cardiometabolic Function In Humans**

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Exposing human skin to 20 J·cm<sup>2</sup> of ultraviolet-A (UV-A) light has been shown to release nitric oxide (NO) species from dermal storage forms and mildly reduce blood pressure (BP). The dose-response relationship of these effects, however, remains unknown. Purpose: To determine the effects of two different doses of UV-A light on NO metabolites, mean arterial pressure (MAP) and resting energy expenditure (REE). Methods: Eight healthy males (age:  $28 \pm 5$  yr, body mass:  $81 \pm 12$  kg) were exposed to three light conditions in a randomised counter-balanced order. Following at least 30 min of supine rest, participants were exposed to either (i) no light (CON) (ii) 10 J·cm<sup>2</sup> UV-A light (UVA10), or (iii) 20 J·cm<sup>2</sup> UV-A light (UVA20). UVA20 is comparable to 30 min of sunshine in southern Europe in summer. During the experiment oxygen consumption (VO<sub>2</sub>) and REE were monitored continuously using indirect calorimetry. Regular BP measurements were taken and samples of venous blood collected before and after light exposure. Plasma nitrate [NO<sub>3</sub><sup>-</sup>] and nitrite [NO<sub>2</sub><sup>-</sup>] were later analysed via HPLC ( $n=7$ ). Statistical differences are reported together with effect sizes (Cohen's  $d$ ) where appropriate. Results: There were no significant changes in plasma [NO<sub>3</sub><sup>-</sup>] or [NO<sub>2</sub><sup>-</sup>] between pre- and post-exposures in all conditions ( $P > 0.05$ ). Plasma [NO<sub>2</sub><sup>-</sup>] was moderately higher after UVA20 exposure compared to CON ( $\Delta 29\%$ ,  $178 \pm 299$  nM,  $d=0.58$ ,  $P=0.17$ ) but increased to only a small extent with UV10 ( $\Delta 9\%$ ,  $58 \pm 220$  nM,  $d=0.26$ ,  $P=0.51$ ). There were no differences in MAP between conditions or before and after exposure (both  $P > 0.50$ ). There was a marked decline in REE following UVA20 ( $\Delta 7\%$ ,  $112 \pm 143$  kcal/day,  $d=0.78$ ,  $P < 0.01$ ) and UV10 ( $\Delta 4\%$ ,  $134 \pm 159$  kcal/day,  $d=0.84$ ,  $P=0.07$ ) while no significant differences were observed in the CON group ( $P=1.0$ ). From pre- to post-light exposure, VO<sub>2</sub> declined with UVA20 ( $\Delta 6\%$ ,  $13 \pm 19$  ml/min,  $P=0.04$ ), but did not change with UVA10 ( $P=0.26$ ) or CON ( $P=0.44$ ).

**Conclusion:** The present data suggests that a 20 J·cm<sup>2</sup> dose of UV-A light increases [NO<sub>2</sub><sup>-</sup>] and decreases REE and VO<sub>2</sub> to a greater extent than 10 J·cm<sup>2</sup>. Although speculative, it is probable that reductions in REE and VO<sub>2</sub> were mediated by an increased NO availability. Neither dose of UV-A light resulted in a detectable change in BP although a larger sample is required before definitive conclusions can be made.

1397 Board #50 June 2, 8:00 AM - 9:30 AM  
**Parasympathetic Reactivation Is Improved After Maximal Cycling Exercise In Immersion As Compared To Dryland Condition**

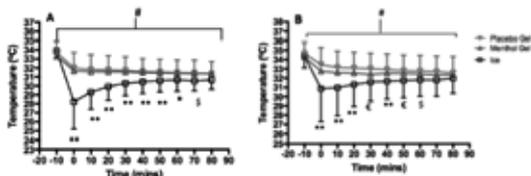
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**PURPOSE:** This aim of this study was to compare post-exercise parasympathetic reactivation after maximal incremental exercise performed at the same external power output (Pext) on dryland ergocycle (DE) vs. immersible ergocycle (IE). **METHODS:** Fifteen young healthy participants (30±7 years, 13 males and 2 females) performed in a random order an incremental maximal exercise tests on DE and another one on IE. On DE, the initial external power was 25 W and was increased by 25 W/min. On IE, initial external power was 40 rpm and was increased by 10 rpm until 70 rpm and thereafter by 5 rpm until exhaustion. Gas exchange and heart rate (HR) were measured continuously during exercise and 5-min recovery period. Parasympathetic reactivation parameters (ie: T30, τ, ΔHR from 10 to 300 sec) were compared during the IE and DE recovery. **RESULTS:** During the IE recovery, parasympathetic reactivation in the short-term phase was more predominant (ie: T30, HRR at Δ10, Δ20, Δ30, Δ60 sec, P<0.05), but similar in the long-term phase (HRR at Δ120, Δ180, Δ240 and Δ300 sec, P>0.05) as compared to the DE condition. **CONCLUSION:** Our study showed that recovery in immersion to the chest level following maximal exercise can accelerate parasympathetic reactivation during the short-term phase, as compared with recovery after maximal exercise on DE in healthy young participants.

1398 Board #51 June 2, 8:00 AM - 9:30 AM  
**The Effects of Topically Applied Menthol Cooling Gel on Intramuscular and Skin Temperatures**

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Cold therapy is routinely used to treat exercise induced soft tissue damage and injury by reducing intramuscular temperature. One mode of cold therapy is via topical application of menthol, which chemically triggers cold receptors and causes skin vasodilation; however, it is unclear whether intramuscular temperature declines as a result of redirecting blood flow from muscle to skin. **PURPOSE:** To establish tissue temperature and blood flow responses following application of menthol cooling gel to the anterior thigh. **METHODS:** Twenty (age: 21.4 ± 1.7) healthy males were treated on 3 separate days with ice, a menthol or placebo gel on one anterior thigh region while using the opposite leg as a control. Before and after treatment (for 80 mins) skin, core and intramuscular temperature (1 & 3cm deep), femoral arterial blood flow (duplex ultrasound) and cutaneous blood flow (laser Doppler) were measured. **RESULTS:** Ice and both gels significantly (p<0.0001) declined intramuscular temperature by 5.7 and 2.6 °C respectively, but were similar to each other by 80 mins (1.5-2 °C less than pre treatment)(Figure 1). Skin temperature mirrored the muscle temperature changes with 8.8 and 4.2°C respective decline for ice and gels. Menthol gel caused a significant (p<0.0001) increase of 0.3 ml/min in cutaneous blood flow compared to unaltered flow of the placebo gel and decline of 0.3ml/min by the ice. None of the treatments affected core temperature or arterial flow. **CONCLUSION:** This is the first study to objectively demonstrate the intramuscular cooling effect of menthol-based gel. However, the likely mode of action was from the water content of the gel despite menthol-derived increases in cutaneous blood flow. Supported by The Mentholatum Company #RH05071



**Figure 1.** Intramuscular temperatures for both legs (vastus lateralis) at depths of A: 1cm and B: 3cm for: both gels vs. ice. All treatments significantly declined over 80 minutes #p<0.01. Ice significantly less than the gels \*\*p<0.01; Menthol Gel and Placebo Gel significantly greater than ice € p<0.05 p<0.01 respectively; placebo gel significantly greater than ice \$ p<0.05

1399 Board #52 June 2, 8:00 AM - 9:30 AM  
**Acute Pain Elicits Changes in Pulse Wave Analysis and Pulse Wave Velocity**

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**Purpose:** To determine changes in central pulse wave analysis (PWA) and central pulse wave velocity (PWV) during and after a controlled experimental pain stimulus in healthy, asymptomatic subjects.

**Methods:** PWA was performed on 13 pain-free subjects (48 ± 7 years; 7 males, 6 females) before (resting), during, and 2 minutes after quantitative sensory testing, which includes a cold pressor task submerging their dominant hand in a cold water bath (7 °C) for 1 minute. PWV was performed before and 8-10 minutes after the pain stimulus. Both PWA and PWV were performed using SphygoCor XCEL (AtCor Medical) and the following variables were obtained: heart rate (HR), central systolic and diastolic pressure (CSP & CDP), ejection duration (ED), time to the first central pressure peak (T1), time to the second central pressure peak (T2), round trip travel time of the reflected pressure wave (ΔTp), central pressure at T1 (CP1), augmentation index (Aix), augmentation index normalized at a 75 bpm HR (Aix@75), and wasted left ventricular energy (LVEw=[(Π/4)\*(ED-ΔTp)\*(CSP-P1)\*1.333]).

**Results:**

Variable	Before	During	Post	p-value
HR (bpm)	75 ± 10	86 ± 29	74 ± 10	0.175
CSP (mm Hg)	119.1 ± 13.0	129.9 ± 11.6*	118.8 ± 11.0	0.001
CDP (mm Hg)	87.7 ± 11.0	97.0 ± 11.1*	88.7 ± 9.1	< 0.001
ED (ms)	288.0 ± 14.5	284.6 ± 54.1	296.7 ± 21.1	0.673
T1 (ms)	113.4 ± 6.6	109.9 ± 28.3	110.6 ± 11.6	0.875
T2 (ms)	199.2 ± 7.2	204.2 ± 35.1	208.7 ± 17.0	0.539
ΔTp (ms)	144.6 ± 8.4	140.5 ± 26.0	136.8 ± 27.2	0.683
CP1 (mm Hg)	114.0 ± 13.0	123.7 ± 11.3*	111.7 ± 8.7	0.001
Aix (%)	15.9 ± 10.8	20.1 ± 20.3	24.3 ± 27.4	0.447
Aix@75 (%)	15.8 ± 13.7	25.3 ± 13.7	23.8 ± 29.3	0.230
LVEw (dynes•s/cm <sup>2</sup> )	782 ± 327	1055 ± 894	1895 ± 3451	0.373
PWV (m/s)	6.7 ± 1.6	N/A	7.9 ± 2.1	0.089

\*: p<0.05 vs. Pre and Post

**Conclusions:** Overall, these results show that an acute pain stimulus increases central pressure without increasing reflective pressure waves from the peripheral arterial tree. Moreover, this central pressure increase is primarily attributed to increased ventricular contractility during early systole rather than the effect of reflective pressure waves, evidenced by an increase in CP1 without changes in Aix or Aix@75. Finally, the statistical trend observed on PWV suggests that the pain stimulus produced an acute aortic stiffness, which might contribute to the observed changes in PWA.

Supported by Charlotte Zietlow Endowment Women Faculty Research Grant, ISU

1400 Board #53 June 2, 8:00 AM - 9:30 AM  
**The Influence of ABO Blood Type on Hemostatic Activation Following A Marathon**

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 (No relationships reported)

Acute aerobic exercise such as marathon running stimulates an increase in both coagulation and fibrinolysis. Normally, this exercise-induced hemostatic activation is not detrimental as the balance between coagulation and fibrinolysis is maintained. However, recent evidence has established that certain risk factors (i.e., sustained

air travel, oral contraceptive use) may disproportionately activate the coagulation cascade without proportional compensation by fibrinolysis, therefore increasing the risk of deep vein thrombosis in otherwise healthy athletes. Individuals with nontype-O blood also have an increased risk of thrombotic events, but the influence of blood type on exercise-induced hemostatic activation has not been established. **PURPOSE:** This study investigated the influence of ABO blood type (O, n=19; Non-O, n=10) on hemostatic activation in 29 young (35.8±6.5 years), healthy (23.0±6.3 kg·m<sup>-2</sup>) female oral-contraceptive using runners flying to and competing in the 2015 Boston Marathon. **METHODS:** Venous blood samples were collected 24 hours before, immediately after, and 24 hours following the Boston Marathon. Samples were analyzed for thrombin-antithrombin complex (TAT), tissue plasminogen activator (t-PA), and ABO blood type. Repeated measures analysis of variance (RMANOVA) tested if the change in TAT and t-PA from baseline differed over time and by blood type. **RESULTS:** Baseline levels of TAT (p=0.82) and t-PA (p=0.33) did not differ among blood groups. TAT and t-PA (p<0.05) increased immediately following the marathon. By 24 hours post marathon, TAT levels returned to baseline (p=0.15) while t-PA levels remained slightly elevated from baseline (p=0.02). These changes were independent of blood type (p=0.43). **CONCLUSIONS:** Among female marathoners with potential risk factors for thrombosis, we found blood type did not further influence the hemostatic activation associated with acute prolonged endurance exercise. **SUPPORT:** This study was funded by the American College of Sports Medicine NASA Space Physiology Grant and the Connecticut Space Grant Consortium.

1401 Board #54 June 2, 8:00 AM - 9:30 AM

### Vascular Responses Following an Acute Bout of Resistance Exercise in Resistance-trained Individuals

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Evaluation of arterial stiffness and pulse wave reflection provide insight into vascular function to a greater degree than traditional measures such as blood pressure (BP). **PURPOSE:** To determine the effects of an acute bout of free-weight resistance exercise on arterial stiffness, peripheral and central BP, and pulse wave reflection in young, resistance trained individuals. **METHODS:** Fifteen young, healthy individuals (aged 23±3 yrs) with 9±3 yrs of resistance training volunteered for the study. Participants performed 2 counterbalanced sessions consisting of an acute bout of resistance exercise (ARE) using free-weights or a quiet control. The ARE consisted of 3 sets of 10 repetitions at 75% 1 repetition maximum for the squat, bench press, and deadlift with 2 minutes of rest between sets and exercises. The quiet control consisted of the participant lying supine for 30 minutes. Data were collected at rest and 10 minutes during recovery for each session. Arterial stiffness was assessed using carotid-femoral pulse wave velocity (cfPWV) while pulse wave reflection was evaluated using applanation tonometry. A repeated measures ANOVA was used to determine the effects of condition (ARE, control) across time (rest, recovery). **RESULTS:** There was a significant interaction for cfPWV (rest: 5.34±0.61; recovery: 5.86±0.74, p≤0.05) such that it was elevated during recovery from the ARE, but not the control. There were no significant interactions (p>0.05) for peripheral or central BP. However, there were significant interactions for the augmentation index (AIx)(rest: 115.8±8.7; recovery: 123.2±8.5, p=0.004), the AIx normalized at 75bpm (rest: 3.3±14.9; recovery: 27.3±13.1, p=0.0001), augmentation pressure (rest: 4.5±5.7; recovery: 10.4±5.7mmHg, p=0.003), time of the reflected wave (rest: 150.3±7.1ms; recovery: 145.5±5.6ms, p=0.003), and wasted left ventricular energy (rest: 641.6±684.2dynes s/cm<sup>2</sup>; recovery: 1785.3±920.6dynes s/cm<sup>2</sup>, p=0.013) such that they were altered during recovery from the ARE but not the control. **CONCLUSIONS:** These data demonstrate that an acute bout of free-weight resistance exercise does not alter peripheral or central BP, but does significantly increase arterial stiffness and measures of pulse wave reflection.

1402 Board #55 June 2, 8:00 AM - 9:30 AM

### Topical Menthol Application Augments Cutaneous Microvascular Blood Flow

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(No relationships reported)

Menthol, the active ingredient in several topical analgesic gels, activates transient receptor potential melastatin 8 (TRPM8) receptors on sensory nerves, eliciting a cold sensation and potentially vasoconstriction. Menthol can also act on vascular TRPM8 receptors inducing vasodilation. **Purpose:** We sought to characterize the cutaneous vascular effects of topical menthol application and to determine the mechanism(s) through which menthol may alter skin blood flow (SkBF). **Methods:** Three distinct protocols were conducted in three groups of 10 young (24±1 years), healthy subjects in a double blind placebo control design. Red cell flux was measured via laser speckle contrast imaging (Moor FLPI) in all protocols and normalized to cutaneous vascular conductance (CVC=flux\*mmHg<sup>-1</sup>). Protocol 1: Placebo and 4% menthol gels were

applied separately to 60cm<sup>2</sup> of skin without local thermal control and SkBF was continuously measured. Protocol 2: Seven concentrations of menthol gel (0.04%, 0.4%, 1%, 2%, 4%, 7%, 8%) were applied to the skin to model the dose-response relation. Protocol 3: Both with and without pretreatment with topical lidocaine, placebo and 4% menthol gels were applied to skin under local thermal control (33°C). Post-occlusive reactive hyperemia (PORH) and local heating (42°C) protocols were conducted to determine the contribution of endothelium derived hyperpolarizing factors (EDHFs) and nitric oxide, respectively. Data were expressed as CVC for all protocols. **Results:** Topical menthol application increased SkBF compared to placebo (3.4±0.3 v 1.1±0.2 CVC; p<0.001). During the dose response, SkBF increased with increasing doses of menthol (main effect, p<0.05) with an ED<sub>50</sub> of 1%. Similarly, SkBF was augmented with menthol application during PORH (3.6±0.3 v 2.5±0.2 CVC; p<0.001), but not local heating (3.0±0.2 v 2.9±0.3 CVC; p=0.44). Concurrent sensory nerve inhibition attenuated menthol-mediated dilation at thermoneutral baseline (1.3±0.2 CVC; p<0.001) and during PORH (2.8±0.3 CVC; p<0.001), but not during local heating (3.4±0.2 CVC; p=0.1). **Conclusion:** Topically applied menthol dose-dependently increases blood flow in the cutaneous microvasculature. This increase in blood flow is mediated, in-part by EDHFs and sensory nerves.

1403 Board #56 June 2, 8:00 AM - 9:30 AM  
**Association Between Maximal Oxygen Consumption And Blood Pressure Reactivity To The Cold Pressor Test**

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**PURPOSE:** The favorable influence of acute as well as regular moderate aerobic endurance exercise on blood pressure (BP) regulation is widely known. It is also well accepted that stress contributes to the development of arterial stiffness and increases the risk of cardiovascular events. In recent studies BP hyper-reactivity to the cold pressor test (CPT) has been suggested as a predictor of hypertension. Therefore we examined whether aerobic capacity, quantified by maximal oxygen consumption (VO<sub>2</sub>max) is associated with BP reactivity to the CPT.

**METHODS:** 27 recreationally active men completed a cardiopulmonary exercise testing on a bicycle ergometer. Peripheral and central BP were measured non-invasively at rest and at the end of a 2 minute CPT using an oscillometric device. Statistical testing about the relationship between VO<sub>2</sub>max and BP reactivity was performed by applying partial correlation analysis adjusted for age, body mass index and bodyweight.

**RESULTS:** After adjustment for covariates, VO<sub>2</sub>max showed negative correlations with systolic BP reactivity. This was true for both peripheral (r = -0.63, p = 0.001) and central (r = -0.55, p = 0.005), respectively. Regarding diastolic BP neither peripheral (r = -0.38, p = 0.067) nor central (r = -0.32, p = 0.125) BP-reactivity correlated significantly with VO<sub>2</sub>max.

**CONCLUSIONS:** The present study provides evidence for an inverse relationship between VO<sub>2</sub>max and systolic BP-reactivity to the cold stimulus. Higher physical conditioning status, indexed by VO<sub>2</sub>max seem to be associated with more favorable effects on arterial compliance during stress testing and might be beneficial on long-term BP regulation during stress.

1404 Board #57 June 2, 8:00 AM - 9:30 AM

### Acute Cheese Consumption Ameliorates Sodium-Induced Cutaneous Microvascular Dysfunction by Reducing Ascorbate-Sensitive Oxidants

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(No relationships reported)

In epidemiological studies, chronic dairy intake is associated with improved cardiovascular outcomes; conversely, high dietary sodium (Na) consumption impairs endothelial function through increased oxidative stress and reduced nitric oxide (NO)-dependent mechanisms. **PURPOSE:** To examine if the high Na in cheese has a less negative effect on microvascular dysfunction relative to equivalent Na from non-dairy sources due to the actions of milk-based macronutrients and proteins. We hypothesized that 1) acute dairy based cheese ingestion augments NO-dependent vasodilation (VD) compared to an equal amount of Na from non-dairy sources, and 2) the Na-induced decrease in NO-dependent VD is mediated by oxidant stress mechanisms. **METHODS:** On 5 separate visits, 14 subjects (61±2 yrs) consumed either 85 g cheddar cheese (560 mg Na), 85 g soy cheese (560 mg Na), 65 g pretzels (560 mg Na), 170 g cheddar cheese (1120 mg Na), or 130 g pretzels (1120 mg Na). Two intradermal microdialysis fibers were inserted in the forearm skin for local delivery of 1) lactated Ringer's solution (control site) and 2) ascorbate (antioxidant site). Red blood cell flux

was measured by laser-Doppler flowmetry (LDF) during local skin heating (42°C) to induce endothelial NO synthase-dependent VD. Once a plateau in cutaneous vascular conductance (CVC = LDF/MAP) occurred, 20 mM L-NAME was perfused at both sites to directly quantify NO-dependent VD. Data were expressed as a percentage of maximum (%CVC<sub>max</sub>; 28mM SNP). **RESULTS:** The total vasodilatory response was not different among the five dietary treatments. NO-dependent VD was higher following dairy cheese consumption compared to a Na-equivalent in soy cheese (59±5 vs. 44±6%; p=0.03) or pretzels (560 mg Na: 59±5 vs. 45±4%; p=0.03, 1120 mg Na: 57±4 vs. 46±5%; p=0.02). Local ascorbate administration abolished these differences (no main dietary treatment effect). **CONCLUSION:** Na ingestion in cheese was associated with a higher NO-dependent VD compared to an equal amount of non-dairy Na, a difference that was abolished with a local non-specific antioxidant. These data suggest that macronutrients in dairy based cheese may protect against acute Na-induced microvascular dysfunction through antioxidant mechanisms. Supported by Dairy Management Inc.

## C-28 Basic Science World Congress/Poster - Energy Balance: Pediatrics and Children

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
Room: Exhibit Hall A/B

### 1405 Board #59 June 2, 9:00 AM - 10:30 AM Objectively-Measured Physical Activity Predicts DXA-Measured Fat Mass from Age 5-17 Years: Iowa Bone Development Study

Kathleen F. Janz, FACSM<sup>1</sup>, Elena M. Letuchy<sup>1</sup>, Trudy L. Burns<sup>1</sup>, Soyang Kwon<sup>2</sup>, Julie M. Gilmore-Eichenberger<sup>1</sup>, James C. Torner<sup>1</sup>, Steven M. Levy<sup>1</sup>. <sup>1</sup>University of Iowa, Iowa City, IA. <sup>2</sup>Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, IL.  
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The high prevalence of childhood obesity supports the need to understand which dimensions of physical activity (PA) and sedentary time (SED) are most robustly associated with adiposity.

**Purpose:** This 12-yr longitudinal study examined associations among PA, SED, fat mass and visceral adipose tissue (VAT) from childhood through adolescence (ages 5 to 17 yr). We tested the premise that PA was more highly associated with fatness than SED. We also examined if specific intensities of PA (moderate-to-vigorous intensity PA (MVPA) and light PA) and a component of SED (TV viewing) have greater effects on adiposity than overall measures.

**Methods:** Participants in the Iowa Bone Development Study at ages 5, 8, 11, 13, 15 & 17 yr (n = 327, 398, 405, 399, 317, 285, respectively) were studied. MVPA (min/d), light PA (min/d), and SED (hr/d) were measured using accelerometry. TV viewing (TV) was measured via parent-proxy report (5 & 8 yr) and child-report (11, 13, 15, & 17 yr). Anthropometrics measured body size and somatic maturity. DXA measured fat mass and VAT. Gender-specific multi-level growth models were used to create fat mass and VAT growth curves for individual participants (level 1), and test the effect of PA, SED, & TV (level) after considering weight, height, linear age, non-linear age, and maturity. At each age, clinical significance was examined by calculating the differences in absolute fat mass and VAT between low (10th %ile) and high (90th %ile) active and SED participants.

**Results:** Due to non-normal distribution, fat mass, VAT, and MVPA were transformed. Growth models indicated that for boys and girls, high levels of MVPA were associated with low levels of fat mass and VAT (p<0.01); however, light PA and TV were positively associated with adiposity (p<0.05). On average, there was a difference in (absolute) fat mass of 18% between high MVPA/low TV boys compared to low MVPA/high TV boys. This difference was 12% in girls.

**Conclusions:** High levels of MVPA and low levels of TV independently and summatively contribute to low levels of adiposity. Unexpectedly, high levels of light activity are associated with high levels of adiposity. This study suggests that reducing the prevalence of childhood obesity may require focusing on specific dimensions of PA. It also supports current PA guidelines focusing on MVPA rather than SED.

### 1406 Board #59 June 2, 9:00 AM - 10:30 AM Energy Expenditure Associated With Froude Number And Traditional Speed Measures In Children And Adolescents.

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(No relationships reported)

Energy expenditure or metabolic cost of walking is related to speed of locomotion. Leg length normalized speed measures may improve the ability to predict the metabolic cost of walking across the developmental age range. Metrics that improve the strength of the relationship between subject size, walking speed and its metabolic cost may enhance the ability to provide universal recommendations of walking behavior that may serve to improve health.

**PURPOSE:** The purpose of this study was to compare the predictive value of speed in standard units (STD, m/s) to leg length (LL) normalized speed values: the Froude number (Fr) and Dimensionless Speed (DLS) on the metabolic cost of walking in persons 6-20 years of age. We hypothesize that Fr and DLS will improve the prediction of metabolic cost of bipedal transport in children and adolescents.

**METHODS:** 120 children and adolescents (50% female, 13.1 ± 4.2 years, height 155.6 ± 16.6 cm, mass 56.3 ± 22.3 kg, LL 74.1 ± 9.0 cm) participated in this study. O<sub>2</sub> consumption was measured by a K4 portable metabolic system (COSMED). Individuals completed an incremental treadmill protocol 0.22-2.23 m/s, in 0.22m/s increments. The square root of the metabolic data (ml\*kg<sup>-1</sup>\*min<sup>-1</sup>) were compared with all ambulatory speed measures: STD, Fr and DLS. The Akaike information criterion (AIC) was used to compare the linear and quadratic regression models of each gait measure and square root of metabolic cost of walking, best models were selected based on AIC weights.

**RESULTS:** AIC values indicated that quadratic model provided a better fit for all models of speed and the metabolic cost of walking. AIC weights indicated that DLS (AIC = -489.59) was 315 and 2.45 \* 106 times better than Fr (AIC = -478.08) and STD (AIC = -460.16), predicting the metabolic cost of locomotion.

**CONCLUSIONS:** The DLS method of scaling gait speed to leg length offers significant improvements in the ability to predict metabolic cost of locomotion in children and adolescents ages 6-20. Improving the ability to predict metabolic cost from gait parameters may enhance the ability to provide public health recommendations based on objectively measured gait parameters. Funded by Eunice Kennedy Shriver National Institute of Child Health and Human Development: 1R21HD073807-01A1

### 1407 Board #60 June 2, 9:00 AM - 10:30 AM Intensity and Bouts of Physical Activity and Physical Activity Level in Pre-adolescent Children

Keisuke Komura<sup>1</sup>, Satoshi Nakae<sup>2</sup>, Kazufumi Hirakawa<sup>3</sup>, Naoyuki Ebine<sup>1</sup>, Kazuhiro Suzuki<sup>4</sup>, Haruo Ozawa<sup>5</sup>, Yosuke Yamada<sup>2</sup>, Misaka Kimura<sup>3</sup>, Kojiro Ishii<sup>1</sup>. <sup>1</sup>Doshisha University, Kyoto, Japan. <sup>2</sup>National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. <sup>3</sup>Kyoto Gakuen University, Kyoto, Japan. <sup>4</sup>Yamagata University, Yamagata, Japan. <sup>5</sup>Tokai University, Kanagawa, Japan. (Sponsor: Susumu Sawada, FACSM)  
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Increasing pre-adolescent children's physical activity level (PAL) is an important way to prevent adolescent obesity. It is therefore necessary to investigate the types of physical activity of pre-adolescent children that are associated with PAL, with particular attention paid to the intensity and bouts of physical activity.

**PURPOSE:** The objective of this study was to elucidate the intensity and bouts of physical activity associated with PAL in pre-adolescent children. **METHODS:** This study was a cross-sectional study of 42 elementary school children aged 10 to 11 years old (26 boys, 16 girls). We defined PAL as the total energy expenditure as measured using the doubly labeled water (DLW) method, which is the gold standard for the measurement of field metabolic rate, divided by the basal metabolic rate. In order to measure the intensity and duration of physical activity performed during DLW measurement, we used uniaxial accelerometers to evaluate sedentary behavior (SED), light-intensity physical activity (LPA), and moderate- to vigorous-intensity physical activity (MVPA). MVPA was categorized by bouts of increasing duration: Sporadic (<4 min), short (≥4 and <10 min), and medium-to-long bouts (≥10 min). Partial correlation adjusted for sex and the accelerometer wearing time was used to analyze the association between PAL and the physical activity variables. **RESULTS:** SED showed a significant negative association with PAL (r=-0.409, p<0.01), and LPA showed a significant positive association with PAL (r=0.329, p<0.05). Although no significant association between total MVPA and PAL was observed, medium-to-long bouts of MVPA showed a significant positive association with PAL (r=0.322, p<0.05).

**CONCLUSION:** Although the correlations were not strong, these results suggest a negative relationship between SED and PAL, and also a positive relationship between LPA and medium-to-long bouts of MVPA and PAL among pre-adolescent children.

1408 Board #61 June 2, 9:00 AM - 10:30 AM  
**Compensatory Responses to Intermittent Physical Activity in Elementary School-Age Children**

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The ActivityStat hypothesis suggests that when physical activity (PA) is increased in schools in the form of physical education or recess, there will be a compensatory decrease in PA performed outside of school toward a homeostatic set-point to regulate physical activity energy expenditure (PAEE) over time. It is unclear whether children compensate in response to intermittent PA, a pattern of movement that resembles children's activity in free-living environments. **PURPOSE:** The purpose of this laboratory-based study was two-fold: (1) to determine the acute effect of intermittent activity breaks on PAEE in children and (2) to examine the effect of exercise intensity on PA compensation. **METHODS:** Thirty-nine children (18 males, 21 females; ages 7-11 years; 33% overweight/obese; 59% non-white) completed four experimental conditions in random order: (1) 8 hours of sitting interrupted with 2-minute light-intensity activity breaks performed at 25% maximal heart rate (HRmax) every 18 minutes; (2) 8 hours of sitting interrupted with 2-minute moderate-intensity activity breaks (50% HRmax); (3) 8 hours of sitting interrupted with 2-minute high-intensity activity breaks (75% HRmax); and (4) 8 hours of sitting interrupted with 2 minutes of sedentary screen time. PAEE was assessed via accelerometry for 7 pre-testing days to establish baseline PAEE and throughout the condition day (8 hours in-lab and the remainder of the condition day at home). **RESULTS:** Compared to baseline (293±19 kcal), PAEE was significantly lower on the sedentary condition day (212±22 kcal;  $p<0.05$ ) and significantly higher on the high-intensity condition day (415±26 kcal;  $p<0.05$ ). There were no significant differences in PAEE observed on the low- (259±22 kcal;  $p>0.05$ ) and moderate-intensity (305±24 kcal;  $p>0.05$ ) condition days compared to baseline. **CONCLUSION:** These data suggest PA compensation in response to intermittent activity breaks may be intensity-dependent. Children compensated to maintain baseline PAEE following low- and moderate-intensity activity breaks performed in the lab but expended an additional 121 kcal above baseline in response to high-intensity activity breaks. School-based interventions incorporating high-intensity intermittent physical activity may be an effective strategy to increase PAEE in children.

1409 Board #62 June 2, 9:00 AM - 10:30 AM  
**Pregnancy Family-based Nutrition and Exercise Lifestyle Intervention Program Re-introduced Postpartum Reduces Offspring Fatness at 1-year.**

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Babies born to overweight (OW; pre-pregnancy body mass index (BMI) 25.0 to 29.9 kg/m<sup>2</sup>) and obese (OB; pre-pregnancy BMI ≥30.0 kg/m<sup>2</sup>) women are at risk for obesity and co-morbidities. **PURPOSE:** To determine maternal weight retention and baby fatness at 2, 6 and 12 months post-delivery following a pre- and post-natal lifestyle intervention.

**METHODS:** OW and OB pregnant women were introduced to a Nutrition and Exercise Lifestyle Intervention Program (NELIP) at 16-20 weeks gestation, consisting of a controlled meal plan (daily 2000 kcal and 200g carbohydrate goals) combined with walking (25 mins, 3-4 times/week, adding 2 min/session/week until reaching 40 min) until delivery. Women (N=76) returned to the lab at 2, 6 and 12 months post-delivery for follow-up but with no post-partum intervention. A second group of OW/OB women followed the original NELIP plus a Family-based Behavioural Treatment (FBBT) plan (group sessions) (NELIP+FBBT; N=52). The intervention was re-initiated at 2 months post-delivery, included a group stroller walking program (25 min session, 3 times/week adding 5 min until reaching 45 min), and a similar nutrition program, including group sessions with family members (FBBT) and education regarding infant feeding practices. Women were followed until 1 year post-delivery. **RESULTS:** The two-pronged approach (NELIP+FBBT) appeared to be successful in reducing fatness in babies of OW and OB women, compared to our original NELIP with no postpartum intervention. Although the average BMI for the infants at 2, 6

and 12 months were not different, we found a significant reduction in body fatness at 6 months (NELIP+FBBT=2020±375 gm vs NELIP pregnancy only=2414±648 gm;  $p=0.03$ ), which continued to 1 year of age (2359±644 gm vs 2788±439 gm;  $p=0.05$ , respectively). This was reflected in a reduction in percent body fat in 1 year old infants (23.3±2.9% vs 25.6±2.5%;  $p=0.05$ , respectively). By one year post-delivery, maternal weight retention was 1.2±7.5 kg in the combined NELIP+FBBT group and 1.8±5.5 kg in the NELIP only group;  $p>0.05$ .

**CONCLUSIONS:** Preliminary results suggested that in OW and OB women a lifestyle intervention initiated during pregnancy should be re-introduced at 2 month postpartum to reduce baby fatness in the first year of life. Funding-CIHR and Rx&D HRF Canada

1410 Board #63 June 2, 9:00 AM - 10:30 AM  
**Effectiveness of Sedentary Behaviour Interventions on Body Mass Index in Children: Systematic Review and Meta-analysis**

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The evidence supporting the association between sedentary behaviour (SB) and obesity in children is conflicting. Nevertheless, interventions aiming to prevent or treat overweight in children have been targeting SB as an attempt to include a wider range of factors associated with energy balance.

**PURPOSE:** To summarize and compare the effect of interventions that target body mass index (BMI) in children. The secondary aim is to explore the impact of moderator variables (age, weight status, intervention type, duration, setting and study quality) on intervention effectiveness.

**METHODS:** English-language publications up to March 2015 were located through electronic and manual searches. Interventions targeting sedentary activities in children (0 to 17 years old) with a control group and objective measure of weight and height were included. Mean change in BMI or BMI z-score from baseline to post-intervention between intervention and control group was calculated and meta-analysis was performed using a random effects model.

**RESULTS:** Sixty-seven studies were included in the review. Sixteen studies were performed with pre-school children (0 to 5 years), 35 with children (5 to 11 years) and 16 with adolescents (12 to 17 years). Six studies targeted only SB, 10 studies targeted only SB and physical activity and 51 targeted SB and other behaviour(s). Nineteen studies reported a significant reduction in BMI or BMI z-score. Results from the meta-analysis revealed a small but significant effect on BMI and BMI z-score compared with controls (standardized mean difference (SMD) = -0.064, 95% confidence interval [CI] -0.091 to -0.038, I<sup>2</sup> = 75%). Interventions delivered in a non-educational setting (SMD = -0.161, CI: -0.218 to -0.105), to an overweight population (SMD = -0.159, CI: -0.229 to -0.089) and including SB and other behaviours (SMD = -0.074, CI: -0.108 to -0.041) appeared to improve effectiveness.

**CONCLUSIONS:** The effect of SB interventions on BMI is small and unlikely to be clinically relevant. Nonetheless the impact of the intervention appeared to improve when SB interventions were delivered to an overweight population, implemented in a non-educational settings and in addition to other behaviours, showing that adopting a broader contextual approach might be more efficacious in targeting childhood obesity.

1411 Board #64 June 2, 9:00 AM - 10:30 AM  
**Summertime Blues: A Critical Period for Childhood Weight Gain**

Layton Reesor<sup>1</sup>, Taylor Moree<sup>1</sup>, Jennette P. Moreno<sup>2</sup>, Craig Johnston<sup>1</sup>, Daphne C. Hernandez<sup>1</sup>. <sup>1</sup>University of Houston, Houston, TX. <sup>2</sup>Baylor College of Medicine, Houston, TX.

(No relationships reported)

Previous studies have found that school-aged children increase body mass index z-scores (zBMI) over the summer compared to the school year. Research on summer weight gain has not focused on whether the same pattern exists in children's percent body fat (%BF) and waist circumference (WC) or whether certain types of summer care are predictive of weight gain.

**PURPOSE:** To compare changes in zBMI, %BF, and WC during the school year versus over summer vacation among elementary school children and to identify if certain types of summer care (i.e. self-supervision) put children at increased risk for summer changes in body composition.

**METHODS:** Seventy-six school-aged children were recruited from a local elementary school. Height and weight were measured with a standard scale and stadiometer. BMI z-scores and classifications were calculated using age and gender normative data. A pediatric Tanita scale was used to calculate %BF and related classification. Paired sample t-tests were used to compare changes in zBMI and %BF during the school year compared to the summer.

**RESULTS:** On average [ $\bar{x}$ age = 7 years (SD 1.55); 54% female], 25% (n=19) of children were classified as overweight/obese, 72% (n=55) normal weight, and 3% (n=2) as underweight. Thirty-eight percent (n = 29) of children were classified as overfat/obese, 54% (n = 41) as healthy fat, and 8% (n = 6) were underfat. Overweight/obese children exhibited greater changes in zBMI over the summer compared to the school year ( $\bar{x}$ summer=.08 vs.  $\bar{x}$ school=-.04,  $p < .05$ ); this relationship was not observed among normal weight children ( $\bar{x}$ summer=.17 vs.  $\bar{x}$ school=.04,  $p = .17$ ). Overweight/obese children exhibited greater increases in %BF during the summer compared to the school year ( $\bar{x}$ summer=2.18 vs.  $\bar{x}$ school=0.12,  $p < .05$ ); normal weight children showed similar changes during the summer as the school year ( $\bar{x}$ summer = 0.72 vs.  $\bar{x}$ school = 0.88,  $p = .73$ ). During the school year 5% of children increased their BMI by 1 category, and 7% increased their %BF by 1 category. During the summer, 12% increased their BMI by 1 category, and 13% increased their %BF by 1 category. **CONCLUSIONS:** Summer may be a critical time for weight gain among overweight/obese children. Data on summer care information is currently being collected via parent survey. Results will be included in the ACSM poster presentation.

1412 Board #65 June 2, 9:00 AM - 10:30 AM  
**Assessment Of Impulsive Eating Behavior In Primary School Children**

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 (No relationships reported)

Pediatric obesity is one of the major health challenges of the 21st century. Prevalence rates among children in Europe range from 14.8 % to 23.3 %. Recent research indicates an association between deficits in self-control or an increased impulsivity in obese children. It is assumed that eating behavior mediates this association, however, there is a lack of culturally appropriate assessment tools for young children.

**Purpose** To create a parental questionnaire to measure impulsive eating behavior in children aged 5-9 years.

**Methods** Based on self-rating questionnaires for adolescents and adults and expert opinion we developed a short list of impulsive eating indicators. Parents of  $n = 1575$  children ( $7.06 \pm 0.62$  years; 50.1% boys) were asked to rate the final list on a four-point rating scale. Item, reliability and factor analyses were conducted. Group differences between weight groups (based on BMI) and children with Waist-to-Height-Ratio (WHtR) greater versus less than 0.5 were analyzed as well as gender differences.

**Results** The final parental questionnaire consisted of 17 items. Factor analysis confirmed four dimensions which were interpreted as emotional eating, overeating, irregular eating and externally induced eating; factor loadings varied between .45 and .81. Internal consistency ranged from  $\alpha = .66$  to .82. Differences between weight groups and WHtR groups could be found in the total score as well as in all subscales ( $\chi^2$  (3,  $N = 1422$ ) = 94.97,  $p < .001$ . and  $t$ (135) = 8.58,  $p < .05$ ). There were no significant gender differences.

**Conclusion** The questionnaire is an economic and practicable measure that can be used to detect an impulsive eating style, for example in the overweight prevention setting. However, further validation analyses are requested. To increase reliability the inclusion of more items or a more detailed rating scale should be considered.

C-29 Basic Science World Congress/Poster -  
**Energy Balance: Selective Populations**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
 Room: Exhibit Hall A/B

1413 Board #66 June 2, 9:00 AM - 10:30 AM  
**Task Description and Physiological Demand of Marine Special Operations Students during Amphibious Training**

Shawn Eagle<sup>1</sup>, Takashi Nagai<sup>1</sup>, John Abt, FACSM<sup>2</sup>, Nicholas Heebner<sup>2</sup>, Necia Williams<sup>3</sup>, Brad Lambert<sup>3</sup>, Joshua D. Winters<sup>2</sup>, Scott Royer<sup>2</sup>, Scott Lephart, FACSM<sup>2</sup>. <sup>1</sup>University of Pittsburgh, Pittsburgh, PA. <sup>2</sup>University of Kentucky, Lexington, KY. <sup>3</sup>Marine Special Operations Command, Sneads Ferry, NC. (Sponsor: John Abt, FACSM)  
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The amphibious operations skillset is crucial for Marines. For Marine Special Operations (MARSOC) students, this training includes small boat operation, open-water navigation, and beach reconnaissance. Training is highlighted by a daily 2000 meter swim with fins, and night-time navigation exercises in speed boats. Understanding the relevant tasks and physiological demand of this training

can help identify the necessary physical traits for this population's success in amphibious operations. **PURPOSE:** To investigate the physiological demands and mechanisms associated with injury risk in Marines during MARSOC amphibious training. **METHODS:** Ten male Marines (age=25.4±2.5 years, mass=87.1±5.0 kg, height=181.6±4.9 cm) participated in a two-day observation. Marines wore a GPS-watch during the swim to estimate energy expenditure. A Borg Scale was used to estimate their Rate of Perceived Exertion (RPE) immediately post-swim. A trained clinician documented potentially injurious mechanisms during each exercise and consulted on-site corpsmen about injury complaints. **RESULTS:** Swims were completed in 50.3±3.1 mins and students expended approximately 445±58.4 kcals. Swimming was an aerobic activity, completed at a RPE >8. Corpsmen reported the high intensity/repetitive nature of the swim led to complaints of hip flexor/peroneal tendonitis. Boat preparation was an anaerobic activity that occurred over several hours with short periods of lifting heavy objects, such as the fuel bladder, engine and boat itself. Thus, lumbar/thoracic spine injury from improper lifting technique is possible. Those seated in the front of the boat are susceptible to repetitive, rapid forward flexion of the neck/lower back, similar to a "whiplash" mechanism. **CONCLUSION:** Amphibious training has a high physiological demand. Several tasks were identified with injury risk, based on clinician observation and reports from corpsmen. Prior to training, increasing muscular strength/endurance of the hip flexors, peroneals, and lower back/neck musculature while emphasizing aquatic exercise with proper form could help prevent such injuries. Future research should investigate the effects of a preventative program aimed at improving these characteristics on MARSOC amphibious training injury rates.

Supported by: ONR: N00014-14-1-0022

1414 Board #67 June 2, 9:00 AM - 10:30 AM  
**Daily Caloric Intake and Energy Expenditure Among D1 Collegiate Female Soccer Players and Non-Athletes**

Bethany L. Noack<sup>1</sup>, Jorge Z. Granados<sup>1</sup>, Diana Nguyen<sup>2</sup>, Stephen F. Crouse, FACSM<sup>1</sup>. <sup>1</sup>Texas A&M University, College Station, TX. <sup>2</sup>North Carolina State University, Raleigh, NC.  
 (No relationships reported)

**PURPOSE:** Previous research has reported the diets of soccer players as inadequate to meet the high-energy demand of the sport. The aim of the present study was to examine dietary profiles of female collegiate soccer players during pre-season training relative to their measured daily energy expenditure (EE) and compared with the profiles of non-athletes. **METHODS:** Eleven NCAA Division 1 female soccer players (Age: 19.5±1.0 yrs; Height: 169.3±8.1 cm; Weight: 63.3±7.4 kg; Body fat percentage: 25.9±4.8%) and 11 non-athletes (Age: 20.4±1.6 yrs; Height: 165.6±7.5 cm; Weight: 58.9±8.7 kg; Body fat percentage: 26.2±6.1%) completed 7-day diet and physical activity records. Additionally, soccer players wore on-body activity monitors to measure EE concurrently with the diet records. **RESULTS:** Results showed no significant difference in the dietary profiles between groups; however, soccer players' reported caloric intake was significantly less than measured EE (mean energy balance: -1281±514 kcal/day). With the exception of carbohydrate (CHO), macronutrient consumption met current guidelines. Soccer player's failed to meet the higher CHO recommendation necessary for high-intensity activity (mean intake: 3.5 ± 1.0 g/kg/day). Intakes of calcium, iron, vitamin D, pantothenic acid, folate, magnesium, potassium, and water were also found to be marginal (<75% of DRI) in both groups. **CONCLUSION:** This study supported previous evidence that female soccer players are not meeting the necessary nutritional requirements to optimize training adaptations. The novel use of on-body activity monitors to measure EE and inclusion of a comparison group provided further evidence that sampled athletes are in a detrimental caloric deficit and fail to match dietary habits to their increased energy needs. Therefore, players should be educated on proper hydration and increasing caloric intake through CHO- and nutrient-rich foods.

1415 Board #68 June 2, 9:00 AM - 10:30 AM  
**Energy Cost Of Slow And Normal Gait Speed In Adults With And Without Lower-body Impairments**

Taylor W. Rowley<sup>1</sup>, Ann M. Swartz, FACSM<sup>1</sup>, John Staudenmayer<sup>2</sup>, Kevin Keenan<sup>1</sup>, Whitney A. Welch<sup>1</sup>, Chris Cho<sup>1</sup>, Scott Strath, FACSM<sup>1</sup>. <sup>1</sup>University of Wisconsin- Milwaukee, Milwaukee, WI. <sup>2</sup>University of Massachusetts Amherst, Amherst, MA. (Sponsor: Dr. Scott Strath, FACSM)  
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**Purpose:** The purpose of this study was to examine energy cost of slow and normal walking speeds among adults with and without lower body ambulatory limitations. **Methods:** Adults aged 20-90 years, able to walk at least ten feet unassisted, were recruited as part of a larger study. Subjects were placed into a low-functioning group (LFG) or a high-functioning group (HFG) based upon expected age and gender adjusted average gait speed determined by a 10-m functional walk test. Later, subjects completed two successive 3-minute walking bouts, progressing from slower than

normal (SWS) to normal walking speed (NWS). Total meters were recorded and averaged over each 3-minute bout to determine distance per minute. Energy cost was determined by a portable metabolic unit. Steady state was accounted for in the final minute of each bout. Energy cost per meter (ml/kg/m) was calculated by dividing energy cost by meters walked. Non-Parametric Wilcoxon Rank Sum tests were run on the median energy cost per meter scores, and compared between groups. Results: Sixty-three subjects completed the protocol. Forty subjects were categorized as low-functioning ([meanSD] age 60.912.5 yrs; mass 82.019.6 kg; ht 167.710.1 cm; 10-m gait speed 0.790.31), and twenty-three subjects were categorized as normal functioning (age 51.217.6 yrs; mass 73.415.7 kg; ht 168.110.2 cm; 10-m gait speed 1.200.13). SWS energy cost per meter (median [range]) was 28% higher in the LFG (0.248 [0.146-1.249] ml/kg/m) compared to the NFG (0.187 [0.152-0.274] ml/kg/m);  $p=0.0002$ . NWS energy cost per meter was 22% higher in the LFG (0.216 [0.136-0.908] ml/kg/m) compared to the NFG (0.173 [0.127-0.223] ml/kg/m);  $p=0.0005$ . Conclusion: Low-functioning adults rely on greater energy cost per meter of walking at both a slower and normal speed. The intersection between functionality and energy cost warrants future investigation as it has important implications to daily energy conservation. \*Work sponsored by funding from the NIH 1R21HD080828

1416 Board #69 June 2, 9:00 AM - 10:30 AM  
**Effects of Training for a 439 Mile Endurance Run on Performance and Energy Balance**

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Running for extreme distances or time has become increasingly popular, however, little is known about the training process needed to successfully complete an ultra-endurance event. PURPOSE: This case study examined 28 weeks of training on physical performance, training volume, and energy balance in a 51 year old firefighter preparing for an 11-day, 439 mile solo run across Texas. METHODS: A maximal treadmill exercise test and body fat assessment via plethysmography was conducted at baseline and 28 weeks later. Nutritional intake was recorded biweekly via food diary. Exercise training data were recorded via a heart rate/GPS monitor for all workouts. Resting heart rate and morning body weight was self-reported weekly. Training consisted of running, tire dragging, and stair repeats in the fire station. RESULTS: VO<sub>2</sub>max improved by 5.19% (52.0 vs 54.2 ml/kg/min; 4.17 vs 4.38 L/min (4.94%)), while percent body fat increased 2.54% (23.6 vs 24.2%) following 28 weeks of training. Subject consumed 13731±2578 kcals per week (~1962 kcals/day) and expended 2658±1518 kcals per week (~380 kcals/day) from exercise. At the end of training, the subject had lost 2.17 kg from baseline weight, however weight fluctuated throughout the 28 weeks (77.63-82.54 kg). There was no correlation between weekly weight change from baseline and calories consumed ( $r=0.264$ ,  $p=0.384$ ) or weekly exercise caloric expenditure ( $r=0.385$ ,  $p=0.748$ ). CONCLUSION: Twenty-eight weeks of training resulted in improved maximal aerobic capacity in this 51 year old ultra-endurance athlete. Energy balance is important for sustaining the high training levels required for ultra-endurance events. However, the athlete was not able to consume enough calories to remain in energy balance. Nutritional needs assessments during training and competition should be an integral part of the preparation for participation in an ultra-endurance event. Supported by Valdosta State University Faculty Research Seed Grant

1417 Board #70 June 2, 9:00 AM - 10:30 AM  
**Equestrian Rider's Cardiovascular But Not Metabolic Response During Walk, Trot, and Canter Is Variable**

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**PURPOSE:** The purpose of this case study was to quantify the cardiovascular and metabolic demands during 30 minute dressage rides (walk, trot, and canter) on 5 different horses and to describe differences in responses due to the horse's influence on the rider.  
**METHODS:** A 63kg, 1.6m female (21yr) USPC Level C1 rider (VO<sub>2</sub>max = 40ml.kg<sup>-1</sup>.min<sup>-1</sup>) rode 5 different horses in a dressage arena. Each ride consisted of 10 min walk, 10 min trot, 5 min break and 5 min canter. HR and VO<sub>2</sub> were measured via indirect calorimetry (Oxycon Mobile). Average HR and VO<sub>2</sub> was determined during each riding condition. Repeated measures ANOVA with LSD post hoc tests were performed to determine differences between riding conditions.  
**RESULTS:** Descriptive statistics and significant post hoc tests are displayed in Table 1. Statistically significant differences ( $p < .001$ ) were found between all 3 riding conditions for all CV variables. All CV responses of walking were significantly less than trotting; CV responses of walking and trotting were both significantly less than cantering.

**CONCLUSIONS:** This study confirms VO<sub>2</sub> is a moderate intensity activity that can promote fitness. However, there was more variance in HR response on different horses at trot and canter than in VO<sub>2</sub>. At trot, HR was 127±9, range 122-142 while VO<sub>2</sub> was 20±1, range 19-22 ml.kg<sup>-1</sup>.min<sup>-1</sup>. At canter, HR was 149±8, range 132-158 while VO<sub>2</sub> was 24±3, range 22-29 ml.kg<sup>-1</sup>.min<sup>-1</sup>. These differences in rider response suggest the characteristics of the horse (training level, as well as size and temperament) will influence the cardiovascular HR response in the rider even when the MET level is predictable. This has implications for the use of HR as an indicator of the overall metabolic response in equestrian activities.

Table	Average HR (beats/min)	Peak HR (beats/min)	Average VO <sub>2</sub> (ml/kg/min)	Average VO <sub>2</sub> (ml/kg/min)
Walk	93 ± 4.2b,c	114 ± 10.7b,c	10.4 ± 1.4b,c	18.4 ± 3.1b,c
Trot	127 ± 9.5a,c	143 ± 12.2a,c	20.3 ± 1.0a,c	25.1 ± 1.4a,c
Canter	149 ± 8.4a,b	160 ± 9.7a,b	24.3 ± 3.0a,b	29.0 ± 1.4a,b

Note: Values are displayed as mean ± SD.  
 a,b,c denotes significant difference ( $p<.05$ ) between walkinga, trottingb, or canteringc, respectively.

1418 Board #71 June 2, 9:00 AM - 10:30 AM  
**Energy Intake and Energy Expenditure of Pre-professional Female Contemporary Dancers**

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 (No relationships reported)

Dance is characterised as a moderate-high intensity, intermittent and highly skilled, activity. However dance is also an art and therefore dancers are often expected to maintain an aesthetic form whilst also achieving and maintaining optimal performance and recovery. Though dancers are at risk of energy imbalance, little is known about their eating and exercise behaviours. PURPOSE to determine the energy intake and energy expenditure of pre-professional contemporary dancers. METHODS Twenty-five female undergraduate contemporary dance students at a conservatoire completed the study. Over a 7-day period, including five week days (with scheduled training at the conservatoire) and two weekend days, energy intake (self-reported weighed food diary and 24 h dietary recall) and expenditure (tri-axial accelerometry) were recorded. RESULTS Mean daily energy intake and expenditure were different over the 7-day period (10.2 ± 0.4 vs 11.6 ± 0.5 MJ,  $p=0.014$ ) equating to an energy deficit of -1.5 ± 0.6 MJ. Energy expenditure was not different when comparing week and weekend days (11.4 ± 0.3 vs 11.0 ± 0.5 MJ,  $p=0.297$ ). However daily energy intake (9.6 ± 0.4 vs 11.5 ± 0.6 MJ,  $p=0.002$ ), energy availability (24.3 ± 2.0 vs 36.4 ± 4.2 kcal.kgFFM<sup>-1</sup>,  $p=0.003$ ), and energy balance (-1.8 ± 0.4 vs 0.5 ± 0.8 MJ,  $p=0.004$ ) were lower during the week compared to the weekend, where energy balance became positive. Macronutrient intakes also differed; with higher fat ( $p=0.022$ ) and alcohol ( $p=0.020$ ), and lower carbohydrate ( $p=0.001$ ) and a trend for lower protein ( $p=0.051$ ) intake at the weekend. CONCLUSIONS Energy balance and appropriate macronutrient intake are essential for maintaining the demands of training, performance and recovery. This research demonstrates that female contemporary dancers are at risk of energy deficiency, particularly during periods of scheduled training. Whilst aesthetics are important, as with many athletes in aesthetic or weight dependent sports, female contemporary dancers may be at risk of the numerous health and performance impairments associated with negative energy balance.

1419 Board #72 June 2, 9:00 AM - 10:30 AM  
**An Analysis of the Anthropometric Characteristics of Irish Apprentice Jockeys**

SarahJane Cullen<sup>1</sup>, Adrian McGoldrick<sup>2</sup>, Gillian O'Loughlin<sup>2</sup>, Giles Warrington, FACSM<sup>3</sup>. <sup>1</sup>*Waterford Institute of Technology, Waterford, Ireland.* <sup>2</sup>*Turf Club, The Curragh, Ireland.* <sup>3</sup>*University of Limerick, Limerick, Ireland.* (Sponsor: Giles Warrington, FACSM)  
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Horse racing jockeys are required to maintain a low body mass almost on a daily basis throughout the racing season which may last up to 10-12 months. In flat racing, the minimum racing weight is 116.2lb (52.7kg) which is inclusive of all racing equipment. To encourage the allocation of rides to the more inexperienced flat jockeys, apprentice jockeys are allocated a weight allowance ("claim"), which varies depending on

experience. **PURPOSE:** To evaluate anthropometric characteristics of apprentice jockeys at the various stages of their apprenticeship. **METHODS:** All male apprentice jockeys (n=46) in the 2014 racing season were recruited and categorised according to their specific racing "claim" (Group 1: "10lb claim" (n=21); Group 2: "7lb claim" (n=14); Group 3: "5lb claim" (n=5); Group 4: "3 lb claim" (n=6)). A dual energy X-ray absorptiometry (DXA) scan was completed for the assessment of body composition. The relative contributions of fat mass (FM) and lean mass (LM) were extrapolated from the results of the total body scan. Body mass index (BMI), fat mass index (FMI) and lean mass index (LMI) were calculated. **RESULTS:** Apprentice jockeys with a 10lb claim were significantly younger (3.3 years;  $p=0.004$ ) than those with a 3lb claim. Mean body mass for each jockey group were  $54.7 \pm 4.0$ kg for 10lb claim,  $55.8 \pm 4.1$ kg for 7lb claim,  $53.5 \pm 1.8$ kg for 5lb claim,  $56.6 \pm 1.1$ kg for 3lb claim. No significant differences were apparent between any jockey group for height ( $p=0.856$ ), body mass ( $p=0.440$ ), BMI ( $p=0.863$ ), LM ( $p=0.394$ ), LMI ( $p=0.522$ ), FM ( $p=0.818$ ), FMI ( $p=0.913$ ) or percentage bodyfat ( $p=0.963$ ). **CONCLUSION:** The reported mean body mass of each jockey group would suggest apprentice jockeys of all stages may experience difficulties meeting the required minimum riding weight in flat racing in Ireland. New apprentice jockeys are required to ride at lower stipulated competition weights than their more experienced apprentice counterparts, yet no differences exist in their anthropometric characteristics, despite being significantly younger in age. Results suggest many difficulties may arise for these new jockeys in attempting to attain the current minimum riding weight standards. Current scientific evidence would strongly suggest a need to revise upwards the minimum weight structure for jockeys to ensure optimal health, safety and well-being.

1420 Board #73 June 2, 9:00 AM - 10:30 AM  
**The Association of Race and the Female Athlete Triad**  
 Carolyn Cardona<sup>1</sup>, Nanna Meyer, FACSM<sup>1</sup>, Margaret Harris<sup>1</sup>, Nancy Di Marco, FACSM<sup>2</sup>, Anthony Duplanty<sup>3</sup>, Shawn Hueglin<sup>4</sup>, Emilia Ochoa<sup>5</sup>. <sup>1</sup>University of Colorado at Colorado Springs, Colorado Springs, CO. <sup>2</sup>Women's Texas University, Denton, TX. <sup>3</sup>Louisiana State University, New Orleans, LA. <sup>4</sup>United States Olympic Committee, Chula Vista, CA. <sup>5</sup>California State University, Fullerton, CA.  
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Race is a significant variable for individual components of the Triad in non-athletic females. Studies involving the Triad have mainly focused on females of Caucasian descent; therefore, it is unknown if race plays a role in the incidence and underlying etiology of the Triad, especially in athletes. **Purpose:** The purpose of this study was to investigate the association of race and sport on the Triad. **Methods:** A multi-center study was established to recruit enough African Americans. Participants were divided into four groups: Caucasian athletes (n=46; age:  $25.0 \pm 5.5$  years; height:  $167.0 \pm 7.2$  cm; weight:  $62.0 \pm 7.1$  kg), African American athletes (n=19; age:  $21.2 \pm 3.8$  years; height:  $168.1 \pm 5.7$  cm; weight:  $65.8 \pm 13.0$  kg), Caucasian controls (n=22; age:  $25.5 \pm 4.8$  years; height:  $164.1 \pm 5.8$  cm; weight:  $62.3 \pm 9.9$  kg) and African American controls (n=12; age:  $22.3 \pm 3.0$ ; height:  $164.9 \pm 7.2$ ; weight:  $62.3 \pm 8.8$  kg). Caucasian and African American athletes were further divided into low impact or high impact sport and weight sensitive or non-weight sensitive sport. EA was calculated using 3-day diet and exercise logs. DE and menstrual function were assessed by validated questionnaires. BMD was measured by DXA (iDXA, GE Lunar, Madison WI). **Results:** Low EA (<30 kcal/kg FFM/day) was significantly higher among athletes than controls (46.8% athletes vs. 12.1% controls;  $p < 0.01$ ). DE was significantly higher in Caucasian athletes than African American athletes (65.2% Caucasian athletes vs. 31.1% African American athletes;  $p < 0.01$ ). The prevalence of MD and low BMD was not significantly different among groups (Caucasian athletes: 41.3% and 41.3%; African American athletes: 15.8% and 42.1%; Caucasian controls: 36.4% and 31.8%; African American controls: 16.7% and 33.3%). **Conclusion:** African Americans are also at risk for the Triad components; however, the relationships among Triad components appear to be weaker for African American athletes than Caucasians, but not African American controls. Understanding if the prevalence and risk factors of the Triad components vary by race will provide useful insights to enhance the development of prevention and intervention programs that are ethnically diverse, ultimately promoting safe sport in all cultures.

## C-30 Exercise is Medicine®/Poster - Exercise and Various Health States

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
 Room: Exhibit Hall A/B

1421 Board #74 June 2, 8:00 AM - 9:30 AM  
**Effects of High Intensity Interval Training on Symptomatology and Physical Fitness in Neurological Patients**  
 Lars Donath, Daniel Hammes, Lukas Zahner, Oliver Faude.  
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 (No relationships reported)

High-intensity interval training seems beneficial in sports and clinical settings. Sprint interval training at lower training volumes has not yet been frequently applied to clinical populations. This is particularly true for neurological patient. **PURPOSE:** To present preliminary results on effects of different modes of high-intensity interval training on symptomatology, physical fitness and autonomous function. **METHODS:** We conduct two independent randomized controlled trials with now 15 patients suffering from migraine (age:  $30 \pm 9$  y; BMI:  $21 \pm 4$  kg/m<sup>2</sup>) and 10 patients with unipolar depressive disorder (age:  $35 \pm 9$  y; BMI:  $25 \pm 5$  kg/m<sup>2</sup>). Depressed patients were randomly assigned to either a high-intensity low volume (HILV) program ( $25 \times 30$ s at 90% of Pmax) or a continuous aerobic exercise (CAE) regime (20min at 60% Pmax). Migraine patients were either allocated to standard high-intensity interval training at higher volumes (HIIT:  $4 \times 4$ min at 90% of HRmax) or continuous aerobic training (CAT: 45min at 70% of HRmax). We examined symptoms of depression (BDI 2) and headache days, duration and intensity per month as primary outcomes. Submaximal and maximal physical fitness (VO2max, VT), pain thresholds and autonomous function were assessed as secondary outcomes. **RESULTS:** Depressive symptoms notably decreased in both groups (HILV:  $\downarrow 45\%$ ; Cohen's  $d=0.8$ ; CAE:  $\downarrow 30\%$ ; Cohen's  $d=1.3$ ). Headache frequency did not change significantly ( $p=0.45$ ). However, HIIT led to a decrease from 8 to 6 headache days a month ( $p=0.21$ ,  $d=0.5$ ). Maximal aerobic capacity did not change in both groups ( $0.4 < p < 0.7$ ,  $0.2 < d < 0.4$ ). However, submaximal fitness improved in both groups (Depression (VO2 at VT), pre:  $1.2 \pm 0.1$  vs. post:  $1.3 \pm 0.1$ ,  $p=0.04$ ; Migraine, (VO2 at VT), pre:  $1.6 \pm 0.3$  vs. post:  $1.8 \pm 0.3$ ,  $p=0.02$ ). Heart rate variability (HRV as SDNN) insignificantly increased ( $d=0.02$ ) in HILV and decreased ( $d=0.4$ ) in CAE (HILV, pre:  $150 \pm 48$ , post:  $161 \pm 84$ ; CAE, pre:  $205 \pm 85$ , post:  $170 \pm 83$ ). **CONCLUSION:** HIIT at different training volumes might improve symptomatology and submaximal aerobic fitness. Also HRV seems to benefit from intermittent short-interval training at low volumes in patients with depression. The latter is particularly interesting, since depressed patients show reduced HRV. However, more data and studies are further required.

1422 Board #75 June 2, 8:00 AM - 9:30 AM  
**Moderate and Unsupervised Mixed Exercise In Cancer Patients : A Long Term Follow Up Study**  
 Laura Stefani<sup>1</sup>, Francesca Mazzoni<sup>2</sup>, Michele Corezzi<sup>3</sup>, Davide Palmerini<sup>3</sup>, Marco Mandoli<sup>3</sup>, Giorgio Galanti<sup>3</sup>. <sup>1</sup>Sports Medicine Center-University of Florence, Florence, Italy. <sup>2</sup>Clinical Oncology, Florence, Italy. <sup>3</sup>Sports Medicine of Florence, Florence, Italy.  
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 (No relationships reported)

**Purpose :** Aerobic and resistance exercise have been recently promoted to improve global fitness , cardiovascular performance and quality of life of cancer patients. The most common exercise programs normally proposed are often in a " supervised way " , while no data are yet available about the eventual efficacy of a long term of an " unsupervised and individualized exercise program " .**Methods:** Among a large cohort of 145 cancer patients, free of disease, followed at Sports Medicine Center of the University of Florence, a subgroup composed of 37 subjects ( 7 male and 30 female,  $45 \pm 3$  yrs) and previously affected by colon and breast cancer and therefore submitted to a chemotherapy and eventual radiotherapy treatment , but in a stable clinical conditions , were enrolled for the long term Exercise as prescription program . Following the ACSM guidelines , an individualized level of aerobic and resistance exercise , at moderate intensity(60% of the maximal effort) , was established by the 6MWtest. A resistance exercise was determined on the basis of chair stand test and hand grip tests. At the first visit (T0), after six months(T6) and at the end of the year((T12), some antropometrics parameters as weight, body mass index (BMI), waist and hip circumferences, hydration status by Bio Impedance Analysis (BIA) were assessed. **Results :** from the data obtained there was a significant reduction of the weight ( T0: $72.5 \pm 16$  vs T12 :  $71,2 \pm 15$   $p < 0.005$ ); of the BMI( T0:  $26.5 \pm 5.5$

vs T12: 26.12±5.5 ; p<0.01):Waist circumference ( T0: 97.5 ±15 vs T12:85.8±13; p<0.01) diastolic blood pressure after 6MWT( T0 PAD 71±8 mmHg vs T12 : 70.8±8 mmHg ; P<0.01) distance at 6MWT ( T0: 525.8±7 mt vs T12 547.64±6; P<0.001). A very significant improvement ( p<0.001) has been observed also among the strength parameter for the upper and lower limbs. No significant variations of the myocardial parameters and therefore no impairment of the myocardial function estimated by echocardiographic exam, was observed . Conclusions: Mixed exercise maintains normal heart function in previous cancer patients, enhances strength , and it modifies substantially the body composition with a reduction of cardiovascular risk factors.

**1423 Board #76 June 2, 8:00 AM - 9:30 AM  
Physical Reconditioning Training “In Field” On A Group Of Solid Organ Transplant Recipients**

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**Background**

Regular physical exercise requires for solid organ transplant recipients (OTR) an acceptable health and a good physical condition as well as to remove cultural, psychological and organizational barriers. Despite the role of physical activity (PA) in OTR is often underestimated, a growing number of researches and scientific reviews confirm unequivocally the positive effects on the health, the lifestyle and the mood and on the graft survival too.

**Aim**

With the project “You can if you want, try!” we started by the idea of de-medicalize the PA for OTR, developing under the aegis of Local Health Trust and patient Associations a new model of cooperation between the medical transplantation doctors, cardiologists, sports physicians and exercise specialists. The medical group recruit and select the transplanted patients on the basis of their health status and physical conditions, the exercise specialists prescribe, implement and supervise the plan focused on involve, recondition and motivate the OTR.

**Methods**

The project involved 10 physically inactive subjects (8 males, 2 females; 51,2±17,8 yrs, 1 heart, 1 lung, 3 liver, 5 kidney, time from transplant 5,2±6,1 yrs) for a 6 months program of PA on a track and field facility 3 sessions/week, 2 supervised, 1 self administered. Health history, medical and nutritional examinations, cardiac and cardiopulmonary tests, sf-12 questionnaire were administered to all before the start of the on field program, consisting for the 70% of aerobic activities (regular and nordic walking), 10% flexibility and 20% neuromotor (proprioceptive and functional) exercises.

**Results**

Data showed at the end of 6 months of work an increase of aerobic power (1.35±0.3 vs 2.01±0.4 lmin-1 P<0.01) and maximum workload in the incremental cycling test, a significantly reduction of BMI and an improvement of SF-12 score and an increase of aerobic capacity evaluated on the basis of the working distance performed adjusted for perceived intensity of 154%±32%.

**Conclusions**

The preliminary results confirm the extremely positive effects of a on field tailored physical reconditioning training on our group of OTR, improving self confidence and motivation to involve themselves in regular exercise, removing the initial concerns, aware of the significance to maintain a good physical condition as long as they can.

**1424 Board #77 June 2, 8:00 AM - 9:30 AM  
The Egoscue Method’s Effect on Nonspecific Chronic Low Back Pain and Functional Disability**

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(No relationships reported)

Low Back Pain (LBP) is the leading cause of activity limitation and work absence throughout much of the world, with a prevalence of 70-85% in the US. “Exercise therapy is probably the most widely used type of conservative treatment worldwide.” The Egoscue Method is a form of therapeutic exercise designed to affect posture to reestablish the integrity of structural or postural muscles, which have been compromised due to injury or poor postural habits.

**PURPOSE:**

To compare the efficacy of the Egoscue Method (EM) to a patient specific typical physical therapy (PT) home exercise program with regard to pain and function in chronic nonspecific LBP patients.

**METHODS:**

Visit 1 - subjects filled out an IRB approved consent and were randomly assigned to a treatment. They were administered: The Modified Oswestry low back pain disability questionnaire (MODQ), the Functional Rating Index (FRI), and the visual analogue scale (VAS), for average pain at rest (R) and with movement (M) over the last week. They were given a compliance log.

Visit 2 - EM group met with an Egoscue postural assessment specialist and their posture was assessed. They received an Egoscue exercise menu specific to their needs. PT participants were evaluated by a licensed physical therapist and a therapeutic exercise program was developed for their needs. All subjects were instructed and critiqued on how to perform their exercises. They were asked to do their exercises for at least 6 days/wk for 4 wks.

Visits 3&4 - after doing their treatment programs for 2 wks all subjects were given the MODQ, FRI and VAS, this was repeated at Visit 4 after 4 wks of treatment.

**RESULTS:**

Decreases in VASM were found in both groups after 2 & 4 wks p<0.001. There was no difference between groups after 2 or 4 wks p=0.806, p=0.394 respectively. Decreases in VASR were found in both groups after both 2 (EM p=0.01 and PT p=0.03) and 4 p<0.001 wks of treatment. There was no difference between groups after 2 or 4 wks of treatment p=0.853, p=0.509 respectively. FRI and MODQ scores followed the same pattern with significant improvement p<0.001 after 2 and 4 wks but there were no differences between treatments.

**CONCLUSION:**

It appears individualized Egoscue exercise is as effective as patient specific typical physical therapy home exercises in reducing pain and improving function in patients with nonspecific chronic LBP.

**1425 Board #78 June 2, 8:00 AM - 9:30 AM  
Beneficial Effects Of Aerobic Exercise Training On Insulin Sensitivity And Signaling In Systemic Lupus Erythematosus**

Cintia Miyake, Hamilton Roschel, Bruno Gualano, Wagner Dantas, William Neves, Ana Lúcia de Sá Pinto, Fernanda Lima, Vanessa Zambelli, Maria Elizabeth Rossi, Eloisa Bonfá, Fabiana B. Benatti. *University of São paulo, São Paulo, Brazil.*  
(No relationships reported)

**Objective**

To investigate the effects of a three-month aerobic training program on insulin sensitivity and signaling in women with SLE.

**Methods**

Nineteen adult SLE patients (BMI: 26.3±3.4 Kg/m<sup>2</sup>) were randomly assigned into two groups: trained (T, n=9, 12-wk aerobic exercise program, 2x/wk) and non-trained (NT, n=10). Subjects were assessed at baseline (PRE) and after training (POST). A healthy control group matched for BMI, age and physical activity levels (assessed by accelerometry) (C, n=10) was also selected for baseline measurements. Main measurements included insulin sensitivity (assessed by meal test and HOMA index) and protein expression (assessed by Western Blotting) of total and membrane GLUT-4 and phosphorylated AMPK, IRS-1 and AS160 in a subsample of patients (n=3/ group). Muscle biopsies were performed after the meal test. Further measurements included body composition (assessed by DXA), and food intake (assessed by 3-day food records).

**Results**

All groups were similar at baseline with regard to physical activity levels, BMI, body composition and age (p>0.05, between-group comparisons). Food intake and body composition remained unchanged in both T and NT overtime (p>0.05, within- and between-group comparisons). Furthermore, no changes were observed in the triglyceridemic or glycemic responses to the MTT test in either SLE T or NT groups (p>0.05, within- and between-group comparisons). In contrast, only the SLE T group showed improved insulinemic and proinsulinemic responses to the meal test (T PRE: 8817±5638 µU/mL/min and 6495±2219 pmol/L/min, POST: 6678±4244 µU/mL/min and 5209±2518 pmol/L/min; p=0.06 and p=0.02, respectively, PRE vs. POST), HOMA IR (T PRE: 2.05±1.39, POST: 1.46±1.13; p=0.03, PRE vs. POST) and HOMA B (T PRE: 40.6±23.8, POST: 28.7±18.9; p=0.03, PRE vs. POST), which were similar to the responses observed in C. This was accompanied by an improvement in GLUT-4 translocation (membrane GLUT-4/total GLUT-4) and AMPK Thr 172 protein expression towards the levels observed in C.

**Conclusion**

Both insulin sensitivity and signaling were improved in response to a three-month aerobic training program in SLE patients. This suggests that they are responsive to these beneficial effects of exercise, further supporting its role in the management of SLE.

Supported by Fapesp (11/08302-0; 11/24093-2)

1426 Board #79 June 2, 8:00 AM - 9:30 AM  
**The Effects of Aquatic Exercise on Gait and Strength in Individuals with Multiple Sclerosis**

Allison M. Lange, Kelsea Smith, Ileana Hurtado, Mai Narasaki-Jara, Teri Todd, Konstantinos Vrongistinos, Taeyou Jung.  
*California State University Northridge, Northridge, CA.*  
 (No relationships reported)

Multiple Sclerosis (MS) is a progressive neurodegenerative disease which is associated with various physical impairments. These impairments can limit independence in activities of daily living and decrease the level of physical activity, which may lead to further deconditioning. Aquatic exercise can help people with MS improve their function and fitness in an accommodating environment.

**PURPOSE:** The purpose of this study was to investigate the effects of aquatic exercise on gait and strength outcomes in individuals with MS.

**METHODS:** A randomized controlled intervention study was used to compare gait and strength outcomes from a total of 20 participants with MS. Following recruitment and screening process, 10 participants were randomly assigned to aquatic intervention group and 10 to control group. The aquatic intervention group participated in 50-minute aquatic exercise, twice a week for 10 weeks while the control group was asked to continue their daily activities as usual. Each aquatic session included a warm-up, gait and strength training, and a cool-down. Data collection was conducted before and after the 10-week period. Spatiotemporal and kinematic gait outcomes were assessed by 3-D motion analysis system (VICON, Oxford, UK, 2010). Isometric strength of knee flexion and extension was measured by a computerized dynamometer (Biodex Medical System Inc, Shirley, NY, 2012).

**RESULTS:** 2x2 mixed model ANOVA showed significant groups-by-time interactions in quadriceps strength, cadence, stride length, walking speed, ankle excursion and ankle peak plantarflexion ( $p < .05$  for all). Within-group comparison demonstrated that aquatic group significantly increased muscle strength in quadriceps by 32.60% (from 66.03±14.93 to 87.59±15.27). Also, aquatic group showed significant increases in stride length by 14.03%, walking speed by 21.88% and peak ankle plantarflexion by 71.62% ( $p < .05$  for all).

**CONCLUSIONS:** The study suggests that aquatic exercise can be effective in improving muscle strength in the knee extensors and gait patterns in individuals with MS. In particular, our findings suggest that aquatic exercise can facilitate the proper use of ankle plantarflexion for walking.

1427 Board #80 June 2, 8:00 AM - 9:30 AM  
**Moderate-to-vigorous Physical Activity Is Related To Quality Of Life In People With Inflammatory Bowel Disease**

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 (No relationships reported)

Inflammatory Bowel Disease (IBD) is a common gastrointestinal disease in the US. IBD is characterized by a cyclical nature of remission and disease flare that often negatively affects quality of life (QOL). Little is known about the potential benefits of moderate-to-vigorous physical activity (MVPA) in people with IBD, particularly its effects on QOL. **PURPOSE:** To investigate the differences in physical and mental QOL across levels of MVPA in people with IBD. **METHODS:** 185 participants with IBD (81.6% female; 54.7% in remission; mean±SD: age 37.2±12.7 y; physical QOL 42.7±9.3; mental QOL 38.4±11.7) completed an online-survey consisting of the Short Form-36 (SF-36) and the International Physical Activity Questionnaire (IPAQ) to assess QOL and MVPA, respectively. One-way ANOVA with Bonferroni post-hoc analyses were conducted to detect differences in QOL across quartiles of MVPA. Independent sample t-tests were conducted to detect differences in QOL and MVPA during a disease flare and remission. **RESULTS:** Median time (±IQR) spent in MVPA was 60.0 (±120.0) min/week in this cohort of people with IBD. Quartiles for MVPA were created (1st quartile 0 min/week; 2nd quartile 1-60 min/week; 3rd quartile 61-120 min/week; 4th quartile >120 min/week). Physical QOL improved linearly across increasing quartiles of MVPA ( $p < .001$ ). Physical QOL was significantly lower in the 1st quartile of MVPA than all other quartiles (difference ranging from -4.96 to -8.77;  $p < .05$ ). There were significant differences in both physical ( $p < .001$ ) and mental QOL ( $p = .001$ ) during a flare and remission, with decreased levels of QOL during a disease flare. However, levels of MVPA were not significantly different between a disease flare and remission ( $p = .15$ ). **CONCLUSIONS:** We are the first to show that increased MVPA is related to increased physical QOL but not mental QOL in people with IBD. Furthermore, although QOL decreases during a disease flare, similar levels of MVPA are still maintained in comparison to remission. These findings suggest that MVPA may be beneficial to improving QOL in people with IBD. Future research should explore appropriate exercise interventions to understand the best mode of MVPA to increase QOL.

Funded by Gatorade Sports Science Institute (GSSI) Student Research Grant

1428 Board #81 June 2, 8:00 AM - 9:30 AM  
**Cardiac Response During Exercise in Adolescents with Chronic Fatigue**

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 (No relationships reported)

**PURPOSE:** To describe the cardiac response to exercise in order to elucidate pathophysiology of adolescent chronic fatigue. **METHODS:** We reviewed records of adolescents with minimum 6-month history (in accordance with 2015 Institute of Medicine diagnostic criteria for Systemic Exertion Intolerance Disease) of chronic fatigue who underwent maximal cardiopulmonary exercise between June 2012 and December 2014. Patients in whom fatigue was not the primary problem or those with another medical diagnosis were excluded. All patients performed an incremental exercise (1-minute steps) test on a cycle ergometer to voluntary exhaustion with breath-breath measurement of gas exchange to determine peak oxygen uptake ( $\dot{V}O_2$ ). Cardiac output (Q) was measured by acetylene rebreathing at rest plus at 1-3 levels of light-moderate exercise, and regressed against  $\dot{V}O_2$ . Stroke volume was normalized for body surface area to give stroke volume index (SVI). Patients were classified as unfit if their predicted peak  $\dot{V}O_2$  was <90% (Cooper et al., 1984), which cutoff eliminated height/weight differences between groups. **RESULTS:** Our study population comprised 312 subjects with mean (±SD) age 15.6±1.7 years (77% female); Hgb level 13.5±1.2, with lowest 10 g/dL; unfit 75% of males and 80% of females. Overall Q rose normally with a mean slope 6.06±2.29 L·min<sup>-1</sup> per L·min<sup>-1</sup>  $\dot{V}O_2$ . SVI of fit males (59 mL) was significantly higher than unfit males (47 mL) at 30-60 W ( $p = 0.018$ , *t*-test). There were no differences in Q- $\dot{V}O_2$  relationship or HR between fit and unfit males. In contrast, Q of an unfit female rose an average of 5.96 L·min<sup>-1</sup>, significantly higher than 5.26 L·min<sup>-1</sup> in a fit female, per L·min<sup>-1</sup>  $\dot{V}O_2$  ( $p = 0.012$ ). For a 1L·min<sup>-1</sup> rise in  $\dot{V}O_2$ , HR of an unfit female rose an average of 70 bpm vs 61 bpm for a fit female ( $p = 0.002$ , RM-ANOVA). There were no significant differences in SVI between fit and unfit females. **CONCLUSION:** Most males and females with chronic fatigue are deconditioned and show the classical cardiovascular features thereof. However, a subset of adolescent males achieves SVI in light exercise similar to that reported in healthy subjects. Findings suggest there may be muscle alterations or perceptual differences in chronic fatigue. Sex differences also exist in the cardiovascular response to exercise, perhaps related to Hgb levels or  $O_2$  extraction.

1429 Board #82 June 2, 8:00 AM - 9:30 AM  
**Circuit Resistance Training Increased Antioxidant Status In Adults With Chronic Spinal Cord Injury**

Ignacio Rosety, Maria T. Pery, Antonio J. Diaz, Sonia Elosegui, Francisco Brenes-Martin, Maria Lopez-Hernandez, Ismael Garcia-Campanario, Jesus Rosety, Maria A. Rodriguez-Pareja, Natalia Garcia, Francisco J. Ordoñez, Manuel Rosety-Rodriguez, Miguel A. Rosety. *University of Cadiz, Cadiz, Spain.*  
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 (No relationships reported)

**PURPOSE:** Recent studies have reported aerobic training may reduce both markers of oxidative damage and proinflammatory cytokines in adults with chronic spinal cord injury (SCI). However to date, the information regarding the utility of resistance training on this population is scarce. Therefore, the current study was conducted to assess the influence of a 12-week circuit resistance training programme on total antioxidant status (TAS) in adults with chronic SCI.

**METHODS:** Male adults (N=24) with complete SCI at or below T5 volunteered for this interventional study. Participants were randomly allocated to the intervention (n=12) or control group (n=12) using a concealed method.

The intervention consisted of a 12-week circuit resistance training programme, 3 sessions/week. Participants completed 1-3 sets of 6-8 repetitions for each station at 55-70 % of 1-RM. To simulate a "real-world" experience, subjects remained in their custom wheelchair at each station. Plasma levels of TAS was determined spectrophotometrically. Lastly, the current protocol was approved by an Institutional Ethics Committee.

**RESULTS:** When compared to baseline, resistance training significantly increased plasma levels TAS (0.40±0.07 vs 0.46±0.09 mmol/l;  $p = 0.015$ ) in the experimental group. No significant changes were found in the control group.

**CONCLUSION:** A 12-week circuit resistance training program increased antioxidant in adults with chronic SCI. While current results are promising, future studies are still required to consolidate this approach in clinical application.

1430 Board #83 June 2, 8:00 AM - 9:30 AM

**Association of Clinical Features with Objective Physical Activity Levels in Individuals with Knee Osteoarthritis**

Sean T. Hurley<sup>1</sup>, Sarah Kozey-Keadle<sup>2</sup>, William D. Stanish<sup>1</sup>, Cheryl L. Hubley-Kozey<sup>1</sup>. <sup>1</sup>Dalhousie University, Halifax, NS, Canada. <sup>2</sup>National Cancer Institute, Bethesda, MD. (Sponsor: Charles Matthew, FACSM)  
Email: sean.hurley@dal.ca  
(No relationships reported)

**PURPOSE**

Physical activity (PA) is recommended as the first-line treatment for conservative management of knee osteoarthritis (OA), but low PA has been reported for this clinical population. Age, gender, body size, disease and symptom severity are thought to influence PA. The purpose of this study was to determine if these clinically relevant factors were associated with objective PA measures in those with knee OA.

**METHODS**

68 individuals with physician-diagnosed moderate (conservatively managed) medial compartment knee OA participated in this study. Body-Mass Index (BMI) was measured. Standard anterior-posterior radiographs were graded using the Kellgren-Lawrence (KL) scale. Self-reported pain, stiffness, and function were assessed using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Participants wore a triaxial accelerometer for 7 days. Data were averaged over at least 4 days of >10 hours of valid wear and categorized into sedentary, light, moderate, and vigorous PA. Step counts and moderate-vigorous activity (MVPA) that occurred in bouts of 10-minutes or more were calculated.

Pearson's correlations determined associations between age, BMI, and WOMAC scores with PA outcomes. Two-sample t-tests examined gender differences and one-way ANOVA examined differences among radiographic severities (KL2-4) ( $\alpha = 0.05$ ).

**RESULTS**

The Moderate OA group averaged 6555 (2481) steps/day, 8.0 (12.0) minutes/day of bout-MVPA, and 23.4 (16.6) minutes/day of unbouted-MVPA. Age had a significant negative correlation with unbouted-moderate ( $r=-0.28$ ) and unbouted-MVPA ( $r=-0.29$ ) ( $p<0.05$ ). WOMAC-overall and WOMAC-function scores had a significant negative correlation with step counts ( $r=-0.23, -0.26$ ) ( $p<0.05$ ).

**CONCLUSION**

Worse subjective knee function and age were associated with lower PA measures, but there were no associations between PA and other clinically relevant factors. Thus future research will need to identify what factors are predictive of changes in PA over time in this clinical population. In conclusion, these findings suggest gender, body size, disease and symptom severity are not associated with low physical activity in individuals with moderate knee OA.

1431 Board #84 June 2, 8:00 AM - 9:30 AM

**Exercise and Lifestyle Therapy Improves Weight Maintenance in Young People with Psychosis: A Service Evaluation.**

Lisa A. Griffiths<sup>1</sup>, Justine Bold<sup>1</sup>, Jo Smith<sup>2</sup>, Eleanor Bradley<sup>1</sup>, Marie Band<sup>2</sup>, Rachael Hird-Smith<sup>2</sup>. <sup>1</sup>University of Worcester, Worcester, United Kingdom. <sup>2</sup>Worcestershire Health and Care NHS Trust, Worcester, United Kingdom.  
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(No relationships reported)

Compared to same age counterparts, young people with psychosis are more likely to smoke tobacco, misuse harmful substances and have a poor diet and sedentary lifestyle. These behaviors are linked to premature cardiovascular disease and metabolic disorders. When prescribed obnoxious antipsychotic medication, a weight gain of >12 kg within 2 yrs is typical. **PURPOSE:** To examine the benefits of a 12 wk exercise and lifestyle intervention entitled 'Supporting Health and Promoting Exercise' (SHAPE) for young people (18-24 yr) recently diagnosed with psychosis. **METHODS:** Participants ( $n=27$ ; 8 females) engaged in weekly 45' education sessions on healthy lifestyle behaviors (e.g. smoking cessation, healthy eating, substance misuse) followed by 45' exercise session (e.g., yoga, Tai Chi, circuit training). Anthropometric data were measured at baseline, 12 wk and 12 mo post-intervention. Lifestyle behaviors and clinical measurements, including pulse, blood pressure, total cholesterol, triglycerides, HbA1c and prolactin, were assessed at baseline and 12 mo as part of their routine care plan. **RESULTS:** Mean baseline data suggests participants were at an increased health risk due to elevated values in mean resting heart rate ( $92.7 \pm 20.3$  beats/min), triglycerides ( $2.4 \pm 1.5$  mg/dL), BMI ( $30.4 \pm 7.2$  kg/m<sup>2</sup>) and waist circumference ( $97.7 \pm 17.2$  cm). At 12 wk post-intervention, there were no changes in mean BMI ( $30.7 \pm 7.4$ ;  $p = 0.39$ ) or waist circumference ( $99.1 \pm 17.1$ ;  $p = 0.39$ ); 19 participants either maintained ( $\pm 2$  kg) or decreased (2-7 kg) weight; 8 participants increased weight (2.0-9.6 kg). At 12 mo post-intervention ( $n=8$ ), there was a 5.9 cm mean reduction in waist circumference ( $p = 0.04$ ); no change was observed in mean BMI ( $+0.7$  kg/m<sup>2</sup>), body mass ( $+1.9$  kg) or other clinical variables ( $p > 0.05$ ). Positive impacts on

lifestyle behaviors included 4 participants eating ~400g of fruit/vegetables daily, 2 ceased substance use, 1 ceased alcohol use and 3 were less sedentary. Findings compare favorably to the only similar published study on the 'Keeping Body in Mind' program specifically designed for early intervention psychosis. **CONCLUSION:** Findings suggest SHAPE supported young people with psychosis to make positive lifestyle behavior changes leading to sustained improvements in weight maintenance and physical health.

1432 Board #85 June 2, 8:00 AM - 9:30 AM

**Exercise And Internet-based Cognitive Behavioral Therapy For Depression (regassa): A Multi-center Randomized Controlled Trial With 12 Month Follow-up**

Mats Hallgren. Karolinska Institute, Solna, Sweden.  
(No relationships reported)

**Purpose:** To compare the long-term effectiveness of three treatments for depression: exercise, internet-based cognitive behavioral therapy (ICBT) and usual care by a physician.

**Methods:** Multicentre, three-group parallel, randomized controlled trial (RCT) with 3 month (post-treatment) and 12-month follow-up (primary end point). Outcome assessors were blind to group allocation. Computer-generated allocation was performed externally in blocks of 36. The ratio of participants per group was 1:1:1. The setting was primary health care centres located throughout Sweden. Participants included 945 adults with mild-to-moderate depression (Patient Health Questionnaire score >9), aged 18-71 years. Patients were randomly assigned to one of three 12 week interventions: supervised group exercise, clinician-supported ICBT, or usual care by a physician. The primary outcome was depression severity assessed by the Montgomery-Åsberg Depression Rating Scale (MADRS).

**Results:** Response rate at 12 months=84%. Depression severity reduced significantly in all three treatment groups in a quadratic trend over time. At the primary end point (12 months), improvements were significantly larger in the exercise group ( $\beta=-.34$ , CI  $-.55, -.14$ ,  $p<0.001$ ) and ICBT group ( $\beta=-.34$ , CI  $-.55, -.14$ ,  $p<0.001$ ) compared to usual care. Effect sizes for both interventions were small to moderate (Hedges  $g=0.24-0.66$ ). **Conclusions:** In this community-based RCT focused on long-term treatment effects, prescribed exercise and clinician-supported ICBT were at least equally effective treatments for mild-to-moderate depression in adults, compared to usual care by a physician.

**Trial registration:** The study is registered with the German Clinical Trials Register: DRKS00008745.

1433 Board #86 June 2, 8:00 AM - 9:30 AM

**Relationships between Pregnancy Physical Activity and Physical Activity Discussion with Prenatal Healthcare Providers**

Amanda K. McMahon<sup>1</sup>, Christopher P. Connolly<sup>1</sup>, Alison Ede<sup>2</sup>. <sup>1</sup>Washington State University, Pullman, WA. <sup>2</sup>Michigan State University, East Lansing, MI. (Sponsor: James M. Pivarnik, FACSM)  
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(No relationships reported)

Previous research has shown that pregnant women performing vigorous physical activity (PA) are more likely to have discussions about exercise with their health care providers (HCP), compared to those performing less intense PA. These relationships are in need of further exploration, particularly given specific exercise modalities have not been examined. **PURPOSE:** To 1) confirm the relationships between prenatal HCP PA discussion and both moderate and vigorous PA, as well as to 2) determine the relationships between PA discussion and participation in specific vigorous exercise modalities during pregnancy. **METHODS:** Pregnant women ( $N=498$ ) completed an online survey, answering questions on PA discussion with prenatal HCPs and PA behavior. Logistic regression analyses were conducted to examine relationships between PA discussion and 1) meeting the current PA guideline, 2) participating in any vigorous PA and 3) participating in specific vigorous exercise modalities. These included: intense jogging, intense cycling, intense swimming, Zumba/aerobic dance, and weight lifting. Meeting the current pregnancy PA guideline was defined as moderate or vigorous PA  $\geq 150$  min/wk. Participation was defined as PA > 0 min/wk. **RESULTS:** Over 70% of participants ( $n=351$ ) reported having discussed PA with their prenatal HCP. Discussion of PA was related to increased odds of vigorous PA participation ( $aOR=2.13$ , 95% CI: 1.12-3.77), but not for meeting the current PA guideline ( $aOR=1.51$ , 95% CI: 0.93-2.45). Women who discussed PA with their HCPs had significantly increased odds of participating in weight lifting exercises ( $aOR=1.98$ , 95% CI: 1.11-3.54), but not intense cycling, intense jogging, intense swimming, and Zumba/aerobic dance. Less than half ( $n=213$ ) of the total sample specifically discussed the current PA guideline with HCPs. However, this was related to increased odds of participating in any vigorous PA ( $aOR=2.37$ , 95% CI: 1.45-3.88) AND also meeting the current PA guideline ( $aOR=2.29$ , 95% CI: 1.49-3.52). **CONCLUSION:** PA

discussion between pregnant women and prenatal HCPs is related to vigorous LTPA participation and specifically to weight lifting. Incorporating the current pregnancy PA guideline into these discussions is related to pregnant women meeting that guideline.

### C-31 Free Communication/Poster - Fat Metabolism

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
Room: Exhibit Hall A/B

#### 1434 Board #87 June 2, 9:00 AM - 10:30 AM Postprandial Lipemia Following 24 Hours Of Overeating And A Single Treadmill Walk

Robert L. Hunt<sup>1</sup>, James L. Chapman<sup>1</sup>, Jenna P. Behnfeldt<sup>1</sup>, Lucas M. Harrison<sup>1</sup>, Jessica L. Luzar<sup>1</sup>, Megan E. Applegate<sup>1</sup>, Christa L. Cocumelli<sup>1</sup>, Michael W. Clevidence<sup>1</sup>, Rika Tanda<sup>1</sup>, Norio Hotta<sup>2</sup>, Michael R. Kushnick<sup>1</sup>. <sup>1</sup>Ohio University, Athens, OH. <sup>2</sup>Chubu University, Kasugai, Japan.  
(No relationships reported)

After eating a meal, there is an increase in the number of lipids in the blood known as postprandial lipemia (PPL). While an increase of triglycerides (TG) is expected, prolonged levels can have adverse effects on the cardiovascular system. Fortunately, it is well established that exercise attenuates PPL; however, limited published literature exists on the impact of differing energy states on acute exercise's ability to reduce PPL. **PURPOSE:** To determine if the energy state established over 24hrs affects PPL and other blood lipids the morning following an exercise bout. **METHODS:** Eight healthy men (24±5yrs) with average body composition (13.2±4.5%) and above average aerobic fitness (55.0±3.3ml/kg/min) were recruited and tested in three different trials. The trials composed of a balanced (45kcal/kg/FFM), caloric restricted (25 kcal/kg/FFM), and an overeat (65kcal/kg/FFM). To determine these values, the method of energy availability (EA) was used (EA=Dietary Energy Intake-Exercise Energy Expenditure). Each trial included a treadmill run to expend 10kcal/kg/FFM at approximately 65% of the participant's predetermined  $\dot{V}O_2$ max. The next morning, participants returned to the lab having fasted for at least 12hrs and completed a mixed meal challenge (20kcal/kg/FFM comprised as 50%/39%/11% of Carb/Fat/Protein respectively). Baseline blood was taken, and immediately following the mixed meal challenge, blood was collected at selected time points over the next three hours. All data was reported as mean±stdev; a 3X9 RM ANOVA was used with significance accepted at  $p \leq 0.05$ . An LSD was used for post hoc analyses where applicable. The iAUC (mg/dL in 3 hrs) was calculated for each blood lipid negating any value below baseline for that trial. **RESULTS:** While there were no significant interactions among baseline and postprandial lipids (Total cholesterol, LDL-C, and HDL-C) or in AUC, there were significant differences in TG-AUCs. Furthermore, the 65kcal/kg/FFM TG-AUC was higher (14840.4±3612.2) compared to 45kcal/kg/FFM and 25kcal/kg/FFM (9841.3±2011.2 and 6438.4±3880.3, respectively). **CONCLUSION:** These data suggests that in healthy men, overeating over 24hrs results in exaggerated PPL the morning following a single bout of exercise, as compared to being calorically restricted or in a balanced energy availability status.

#### 1435 Board #88 June 2, 9:00 AM - 10:30 AM Acute State Of Postprandial Lipemia Induces Changes In Heart Rate Variability In Healthy Adults: Clinical Pilot Study

Diana Lorena Camelo-Prieto<sup>1</sup>, Luis Andrés Téllez Tinjaca<sup>1</sup>, Katherine González-Ruiz<sup>2</sup>, Adalberto Palacios-López<sup>2</sup>, Jorge Enrique Correa-Bautista<sup>2</sup>, Robinson Ramírez-Vélez<sup>3</sup>. <sup>1</sup>Universidad Santo Tomas, Bogotá D.C, Colombia. <sup>2</sup>Universidad del Rosario, Bogotá D.C, Colombia. <sup>3</sup>Universidad Manuela Beltrán, Bogotá D.C, Colombia.  
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**PURPOSE:** Experimental evidence has shown the relationship between heart rate variability (HRV) and cardiac dysfunction. Nevertheless, it is unknown if changes in HRV can be modified after a high fat meal (HFM) intake. The hypothesis of this study was focused on demonstrating that an acute state of postprandial lipemia induces changes in HRV in healthy adults.

**METHODS:** Prospective interventional study in 14 apparently healthy adults of both sexes, (mean age: 30.71 ± 7.9 years; body weight: 71.53 ± 12.9 kg; BMI 26.2 ± 3.4 kg/m<sup>2</sup>), with no past medical history of cardiovascular or endocrine disease. The HFM consisted of a breakfast with a total weight of 141g and the following nutritional composition: 31 g fat, 69 g carbohydrate, 31 g protein, and a total of 1171 kcal. Pilot studies confirmed that in a rested state this meal produced a transient impairment in endothelial function. HRV was measured by the mean length of the RR interval

(ms), after 10-12h fast (0 min, baseline) and after 60 min, 120 min, 180 min and 240 min postprandial. ANOVA for repeated measures was performed for five times, with Bonferroni correction.

**RESULTS:** The basal value of mean RR was 925.2 ± 48.9 ms. It was identified that postprandial lipemia decreases the HRV in the first 60 min (826.9 ± 31.1 ms) by 10.6% ( $p < .261$  for all ANOVA measures). Nevertheless, it increases at 120 minute by 10% (909.8 ± 49.25 ms) regarding to min 60. This increase was maintained at 180 min (907.6 ± 55.4 ms increment 9.7% compared to min 60). Finally, another decrease was identified at 240 min postprandial (845.7 ± 81.1 ms decrease of 8.6%) regarding to baseline.

**CONCLUSIONS:** This study is the first experimental evidence that demonstrates that a high-fat intake changes HRV in healthy subjects. We recommend further studies with larger sample size in order to complement the results found on this study.

#### 1436 Board #89 June 2, 9:00 AM - 10:30 AM The Effects Of A High-fat Diet On Neuronal Inflammation

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(No relationships reported)

Diabetic neuropathy is a common and debilitating complication of diabetes. Overweight humans with dyslipidemia develop neuropathy before developing overt diabetes. In addition, recent evidence indicates a high-fat diet induces signs of neuropathy in rodents and may contribute to the development of neuropathy in pre-diabetic and/or diabetic humans, but mechanisms underlying high-fat diet induced neuropathy have not been elucidated.

**PURPOSE:** Identify neuronal inflammation as a potential mechanism underlying the pathogenesis of high-fat diet-induced neuropathy. This experiment tested the hypothesis that a HF diet induces neuronal inflammation.

**METHODS:** Male C57Bl/6 mice were randomized into two groups and fed a standard (Std,  $n = 11$ ) or high-fat diet (HF,  $n = 12$ ) for 8 wks. The lumbar dorsal root ganglia were harvested and inflammatory mediators (IL-1 $\alpha$ , IL-1 $\beta$ , IL-2, IL-3, IL-4, IL-5, IL-6, IL-10, IL-12p70, IL-17, MCP-1, IFN- $\gamma$ , TNF- $\alpha$ , MIP-1 $\alpha$ , GM-CSF, and RANTES) were analyzed using Multiplex ELISA. Neuropathy was characterized by the von Frey test for hindpaw mechanical sensitivity at baseline and every other week thereafter.

**RESULTS:** At end study, HF fed mice had greater bodyweight (33.3 ± 1.0 vs. 26.7 ± 0.5 g,  $p < 0.001$ ) and fasting blood glucose levels (160.3 ± 9.4 vs. 138.5 ± 3.4 mg/dl,  $p < 0.01$ ) compared to Std fed mice. Hindpaw mechanical sensitivity was not significantly different between groups at any time point. However, hindpaw mechanical sensitivity trended toward an increase from baseline to wk 8 in HF (baseline: 56.3 ± 0.05% vs. wk 8: 70.8 ± 0.06%,  $p = 0.055$ ) whereas there was no increase in Std (baseline: 56.9 ± 0.05% vs. wk 8: 61.4 ± 0.07%,  $p = 0.50$ ). MCP-1 was significantly higher in HF compared to Std (18.8 ± 3.8 vs. 10.5 ± 1.9 pg/mg,  $p < 0.05$ ). There were no other significant differences in inflammatory mediators between groups. **CONCLUSION:** Although hindpaw mechanical hypersensitivity is characteristic of HF feeding in mice, the mild increase in hindpaw mechanical sensitivity did not reach statistical significance in this cohort. HF fed mice exhibited elevated MCP-1 levels compared to Std fed mice which is suggestive of diet-induced inflammation. MCP-1 is understood to play a crucial role in recruitment of inflammatory factors, which suggests diet-induced inflammation may play a role in establishing neuropathy.

#### 1437 Board #90 June 2, 9:00 AM - 10:30 AM Predictors of Maximum Fat Oxidation during Progressive Cycling to Exhaustion in Active Men and Women

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The workload coincident with maximum fat oxidation (MFO) has been shown to widely vary across individuals (Venables et al. 2005). Determining MFO is paramount considering its relationship to weight status and metabolic health (Robinson et al.

2015). Significant predictors of MFO include fitness level measured by maximal oxygen uptake ( $\dot{V}O_2$ max), fat-free mass (FFM), and dietary fat intake. The majority of existing data were obtained in highly active populations performing progressive treadmill exercise to exhaustion and not cycle ergometry, which has been shown to elicit lower fat oxidation versus treadmill exercise (King et al. 2015). **PURPOSE:** To determine significant predictors of MFO during progressive cycling in recreationally-active men and women. **METHODS:** 49 men and women (age, body fat, and  $\dot{V}O_2$ max=23.7±4.9 yr, 16.2±6.6 %, and 40.6±5.5 mL/kg/min) performed a graded  $\dot{V}O_2$ max test after an overnight fast and abstinence from exercise for 36 h. Subjects cycled for 7 minutes at 30 or 40 Watt followed by a 20 Watt increase in work rate

every 3 min until respiratory exchange ratio (RER) = 1.0 for an entire stage, after which power output was increased by 20 Watt/min until fatigue. Oxygen uptake and carbon dioxide production were averaged from the last 90 s of each stage to determine fat and CHO oxidation using the Frayn (1983) equation. Demographic characteristics including body composition via 3-site skinfolds and anthropometry were also measured. **RESULTS:** Across participants, MFO was equal to  $0.30 \pm 0.08$  g/min and  $5.31 \pm 1.43$  mg/kg FFM $\cdot$ min $^{-1}$  and occurred at intensities equal to  $21.8 \pm 8.6\%$  Wmax,  $33.6 \pm 6.5\%$  VO $_2$ max, and  $57.6 \pm 6.6\%$  HRmax, respectively. Fat free mass, VO $_2$ max, RER during stage 1 of exercise, and waist circumference accounted for 81.5% of MFO ( $p < 0.05$ ). Bivariate correlation analyses showed that VO $_2$ max ( $r = 0.42$ ,  $p = 0.001$ ), FFM ( $r = 0.41$ ,  $p = 0.002$ ) and RER in stage 1 ( $r = -0.76$ ,  $p < 0.001$ ) were significant correlates of MFO. **Conclusion:** Data demonstrate that fitness level and body composition account for much of the variance in MFO. Clinicians should emphasize the need to improve cardiorespiratory fitness as it is related to capacity for fat oxidation and potentially metabolic health.

1438 Board #91 June 2, 9:00 AM - 10:30 AM

### Maximal Fat Oxidation Rate and Fatmax in Boys and Girls at Two Different Maturity Levels

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(No relationships reported)

Improving fat oxidation rate (FOR) may have positive implications for weight management. It has been suggested that exercise training at the intensity (Fatmax) that elicits maximal fat oxidation rate (MFO) can improve FOR in obese adults and adolescents. There have been relatively few Fatmax studies of children, and the effect of sex and maturation is not well-established.

**PURPOSE:** To investigate the effect of sex and pubertal maturation on MFO and Fatmax in children.

**METHODS:** Boys ( $n=13$ ) and girls ( $n=18$ ) volunteered for this study. Boys were pubertal stage 1-2 (YB,  $n=9$ ) and  $\geq 3$  (OB,  $n=4$ ) according to Tanner. Girls were premenarcheal (YG,  $n=12$ ) and menarcheal (OG,  $n=6$ ). Subjects performed a Fatmax test on a cycle ergometer followed by a maximal exercise test. FORs were calculated for each stage of the Fatmax test and were graphed against exercise intensity. A best-fit polynomial curve was applied to the data. MFO was interpolated as the peak of the curve, and the corresponding exercise intensity was deemed Fatmax. Effects of maturation and sex on Fatmax and MFO were evaluated, and specific group differences were isolated.

**RESULTS:** Absolute MFO was  $0.18 \pm 0.08$  g/min,  $0.15 \pm 0.04$  g/min,  $0.14 \pm 0.06$  g/min, and  $0.18 \pm 0.06$  g/min in the YB, YG, OB, and OG groups, respectively. MFO relative to body mass (BM) was  $5.6 \pm 2.7$  mg/kg/min,  $4.8 \pm 1.7$  mg/kg/min,  $2.7 \pm 1.0$  mg/kg/min, and  $3.3 \pm 1.1$  mg/kg/min in the YB, YG, OB, and OG groups, respectively. MFO relative to fat-free mass (FFM) was  $7.2 \pm 3.6$  mg/kgFFM/min,  $6.7 \pm 2.2$  mg/kgFFM/min,  $3.2 \pm 1.2$  mg/kgFFM/min, and  $4.9 \pm 1.6$  mg/kgFFM/min in the YB, YG, OB, and OG groups, respectively. Fatmax was  $45 \pm 11\%$ ,  $43 \pm 10\%$ ,  $36 \pm 6\%$ , and  $38 \pm 5\%$  of VO $_2$ max in the YB, YG, OB, and OG groups, respectively. There was no sex effect for any of the four metrics, or a maturation effect for absolute MFO. There was a significant maturation effect on MFO relative to BM and on MFO relative to FFM, and a maturation effect approached significance for Fatmax. The less-mature groups had significantly higher MFO relative to BM and FFM than had the more-mature groups, with a trend toward a higher Fatmax.

**CONCLUSIONS:** The results suggest that sex may not have an effect on MFO or Fatmax in children, but that there is likely a maturation influence. Funded by the Graduate Research Award from the Midwest Chapter of the American College of Sports Medicine.

1439 Board #92 June 2, 9:00 AM - 10:30 AM

### Functional Hepatic Sympathetic Innervation Determines Circulating Triglyceride-rich Lipoprotein Concentrations In Persons With Spinal Cord Injury

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The liver is innervated by the sympathetic nervous system (SNS) by projections from the celiac ganglion that originate from the 5th-12th thoracic vertebrae. Sympathetic stimulation increases hepatic secretion of very low density lipoprotein (VLDL) and triglyceride (TG) rich particles; pathological augmentation of SNS outflow may further enhance hepatic VLDL and TG secretion and peripheral levels. To date, as to whether interruption of physiological SNS hepatic innervation after spinal cord injury (SCI) influences circulating TG concentration and VLDL particle (VLDL-P) number has not been addressed.

**PURPOSE:** To determine the effect of SCI on TG concentration and VLDL-P number in those with functional compared to non-functional SNS hepatic innervation as a consequence of SCI.

**METHODS:** One hundred fifteen non-ambulatory persons with SCI (61 with  $\geq T4$ ; 54 with  $\leq T5$ ) and 62 able-bodied (AB) control subjects were studied. Fasting blood samples were obtained for determination of TG concentration and VLDL-P number by NMR spectroscopy.

**RESULTS:** Differences among the groups were found for age (y) and height (m), but not weight (AB:  $40 \pm 11$  y,  $1.72 \pm 0.08$  m;  $\geq T4$ :  $46 \pm 13$  y,  $1.78 \pm 0.08$  m;  $\leq T5$ :  $48 \pm 13$  y,  $1.76 \pm 0.09$  m). ANCOVA (age) revealed significant group main effects for TG and VLDL-P; post-hoc tests revealed that TG concentrations were significantly higher in  $\leq T5$  ( $141 \pm 9$  mg/dl) compared to AB ( $101.8 \pm 8$  mg/dl;  $p < 0.01$ ) and  $\geq T4$  ( $111 \pm 8$  mg/dl  $\pm$ ;  $p < 0.05$ ); VLDL-P number was significantly elevated in  $\leq T5$  ( $71 \pm 4$   $\mu$ mol/l) compared to AB ( $55 \pm 4$   $\mu$ mol/l;  $p < 0.05$ ) and  $\geq T4$  ( $55 \pm 4$   $\mu$ mol/l;  $p < 0.05$ ).

**CONCLUSIONS:** Functional SNS innervation to the liver appears to have a direct influence on circulating TG-rich lipoproteins. The cohort with SCI  $\leq T5$  had relatively higher TG and VLDL-P values compared to those with SCI  $\geq T4$  and the AB controls. The etiology of the adverse TG and VLDL-P profiles in persons with SCI is most likely due to insulin resistance, which is the consequence of physical inactivity and increased adiposity. Despite the probable presence of insulin resistance in both the SCI groups, the loss of functional hepatic SNS innervation in the higher cord injuries may be hypothesized to be "cardio-protective" with regard to the lipid profile compared to that of persons with SCI with functional hepatic SNS innervation.

1440 Board #93 June 2, 9:00 AM - 10:30 AM

### Metabolic Flexibility And Substrate Utilization Following Exercise In Hypertriglyceridemic Versus Normal Triglyceridemic Individuals

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**INTRODUCTION:** Hypertriglyceridemia (hyperTG) is a risk factor for metabolic disease. HyperTG and insulin sensitivity are known to be improved with moderate intensity exercise, but mechanisms of metabolic benefit from exercise may differ in individuals with hyperTG versus normal TG (normTG).

**PURPOSE:** Compare the response to a glycemic challenge and substrate utilization between individuals with hypertriglyceridemia and those without 18 h following a single bout of moderate intensity exercise.

**METHODS:** Overweight and obese men and women (ages 18-52 years) with fasting TG  $>$  (hyperTG) or  $<$  (normTG) 150 mg/dL completed, in randomized order, walking for 45 minutes at 65% VO $_2$ max (EX) and no exercise (CON). Energy intake was adjusted for the exercise matched across conditions for the day, and participants completed an oral glucose tolerance test (OGTT) the next morning with measurement of respiratory exchange ratio (RER), insulin, glucose, and C-peptide.

**RESULTS:** Fasting blood glucose and resting oxidation of fat for energy were greater ( $p < 0.05$ ) in normTG compared to hyperTG. The release of insulin, from the beta cells, as measured by C-peptide from 0 to 30 min, was faster ( $p < 0.05$ ) following EX compared to CON in both groups, but glucose and insulin responses did not differ. Metabolic flexibility (change in RER from 0 to 60 min) indicated by the shift to glucose oxidation during the OGTT was greater ( $p < 0.05$ ) after EX in normTG (mean  $\pm$  SEM  $0.10 \pm 0.02$  delta VCO $_2$ /VO $_2$ ) compared to hyperTG ( $0.04 \pm 0.02$  delta VCO $_2$ /VO $_2$ ).

**CONCLUSION:** Fat utilization for energy at rest was higher in normTG compared to hyperTG individuals, and moderate intensity exercise had a beneficial effect on metabolic flexibility in normTG but not hyperTG individuals. Thus, metabolic benefits of exercise were attenuated in hypertriglyceridemic overweight and obese individuals. Supported by the Mountain West Clinical Translational Research - Infrastructure Network under a grant from NIGMS of the NIH under Award Number 1U54GM104944.

1441 Board #94 June 2, 9:00 AM - 10:30 AM

### The Effect of a High Fat/High Sugar Diet on Physical Activity in Female Mice

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**BACKGROUND:** A growing body of literature suggests that dietary intake influences voluntary physical activity in both human and rodent models. It is known that caloric restriction leads to increases in activity; however, it is unknown if excessive caloric

intake affects daily activity. Determining whether excessive caloric and decreased physical activity are causally linked would be the first step towards identifying a mechanism through which diet influences activity.

**PURPOSE:** The overall purpose of this project was to determine the effect of diet type on voluntary wheel running in SENCAR female mice.

**METHODS:** All procedures were approved by TAMU IACUC. SENCAR breeder pairs (Charles River) and offspring at 3 weeks of age were group housed and randomly assigned to one of three diet types: 1) control ad-lib (AL; 10% fat) diet (n=2); 2) diet restricted (DR; 12% kcal reduction from AL fed mice) (n=8); or 3) high fat (HFHS; 45% fat/10% fructose drinking water) fed diet (n=7). At 4 weeks of age, these mice were then provided running wheel access and daily speed, distance, and duration of activity were recorded until their termination at 20 weeks of age. Weekly food weights were also calculated to determine average daily caloric (kcal) intake. A two way ANOVA was employed to determine the effect of diet on activity with factors of time and diet.

**RESULTS:** Overall, the HFHS mice consumed 18% more kcals per day than the control AL mice (25.9 ± 1.0 and 21.2 ± 1.3 kcals/day; p < 0.0001). Over the 17-week period, there was a significant difference in the distance (p = 0.01), duration (p = 0.01), and speed (p = 0.005) ran between the diet groups, with the HFHS fed mice displaying the lowest levels of daily running wheel activity. The HFHS mice ran 58% (± 4.2%) and 44.7% (± 5.2%) less distance than the AL and DR groups respectively, and this reduction was due to a decreased duration (p < 0.001) without a change in activity speed (p > 0.05).

**CONCLUSION:** Our data shows that excess caloric intake from HFHS feeding leads to a decrease in daily activity, with the decrease primarily caused by a reduced duration of activity.

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

1442 Board #95 June 2, 9:00 AM - 10:30 AM  
**Bold Does a High Fat Diet or Succinic Acid Treatment Affect Adipose Mitochondrial Function?**

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A high fat diet (HFD) is also known to induce mitochondrial dysfunction, which is thought to be linked to metabolic disease. Succinic acid (SA) is thought to improve mitochondrial function, and while we previously observed an effect of SA on adiposity, SAs effects on adipose tissue are unknown. **PURPOSE:** To determine the effect of a HFD and SA treatment on mitochondrial function in visceral adipose tissue (VAT). It was hypothesized that the SA treatment would improve mitochondrial respiration in fat through improved oxidative phosphorylation and might rescue any negative effects of a high fat diet. **METHODS:** Visceral fat tissues were analyzed from 20 mice fed a HFD (n=10) or standard diet (n=10) with half of each group (n=5/group) were treated with succinic acid (0.75mg/ml drinking water), using the permeabilized (saponin) tissue technique to measure oxygen consumption via a Clark electrode (Oxytherm) system. A substrate inhibitor protocol was used to activate the mitochondria, specifically, glutamate+malate (G+M) to stimulate complex I (CI, Leak), followed by ADP (CI, oxidative phosphorylation, OXPHOS), succinate (CI+II OXPHOS) and ascorbate + TMPD as an electron donor to complex IV. **RESULTS:** There was no significant diet effect between LFD and HFD mice in terms of leak (G+M, CI: 0.78 ± 0.4 v. 0.90 ± 1.0 pmol/mg/s), Complex I OXPHOS (G+M and ADP: 1.12 ± 0.25 v. 0.98 ± 0.64 pmol/mg/s), complex I+II driven respiration (G+M, ADP, and Succinate) (1.61 ± 0.58 v. 0.98 ± 0.642, pmol/mg/s) or CIV driven respiration (Asc+TMPD: 4.10 ± 0.61, 2.92 ± 2.42, pmol/mg/s), LFD vs. HFD, respectively, p > 0.05. SA had no effect on the HFD group in CI+II driven respiration (1.58 ± 0.974 v. 3.44 ± 2.86, HFSA vs. HFDV, p > 0.05) or in the LFD group complex I+II driven respiration (1.61 ± 0.83, 1.61 ± 0.58, p > 0.05) as values were unchanged. Finally, there were also no significant difference between LFDSA and HFDSA in leak, CI driven OXPHOS, or CI+II driven OXPHOS (1.61 ± 0.83 v. 1.58 ± 0.97, p > 0.05) or in CIV driven respiration (Asc+TMPD: 3.85 ± 1.50, 3.44 ± 2.86, p > 0.05). **CONCLUSION:** The current study reveals, no deleterious or positive effect of a HFD on mitochondrial function, and SA treatment offered no beneficial effect in terms of altering visceral adipose tissue in mice fed a standard or high fat diet.

1443 Board #96 June 2, 9:00 AM - 10:30 AM  
**The Effect of Meal and Exercise Timing on Postprandial Lipemia**

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**PURPOSE:** Since relatively little research is available to assess how strategies that differentially time meal consumption relative to exercise influence the degree of postprandial lipemia (PPL), the goal of this study was to compare postprandial responses to a standardized high fat meal consumed alone (M) versus the same meal consumed in conjunction with exercise (60% of VO<sub>2</sub>max for 50 min) performed either immediately prior to (EM) or two hours after (ME) meal ingestion.

**METHODS:** Twelve young, healthy male volunteers performed the three trials in random order. Blood samples were drawn after fasting and 1, 3, 5 and 7 hours after the test meal to determine plasma concentrations of triglycerides (TG), glucose and insulin. Blood was also obtained after exercise for the EM trial.

**RESULTS:** The area under the curve (AUC) for TG was 33% lower (p < 0.05) for the EM trial in comparison to M, but no difference was detected between ME and M. The glucose AUC for M was significantly (p < 0.05) higher for M than both ME and EM. No differences in AUC were detected among trials for insulin responses.

**CONCLUSIONS:** These data suggest that exercise performed prior to a meal is more effective in reducing PPL than exercise performed 2 hours after the meal and that exercise either immediately before or 2 hours after exercise can diminish overall glucose responses. Strategies that optimally influence PPL should be explored to allow for the most beneficial management of triglyceride metabolism.

1444 Board #97 June 2, 9:00 AM - 10:30 AM  
**The Effects Of A High Fat Diet On Oxidative Stress In The Hindbrain: Pilot Study**

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Diets high in fat have been reported to increase inflammation and oxidative stress (OS), both systemically and in the brain. Recent data suggest that chronic consumption of a high fat diet may impair normal brain function, cognition, and memory. The standard "western diet" contains large amounts of saturated fats (meat, dairy), but their evaluation on brain function is limited. **PURPOSE:** To determine the extent to which a high fat butter-rich diet (34% of calories) affects markers of oxidative stress in the hindbrain of mice. **METHODS:** Male, C57BL/6 mice, six weeks of age, were assigned to either a high fat butter-rich diet (34% of calories) (HFD) (n=4) or a normal diet (10% calories from soybean oil) (NFD) (n=4) with free access to food for 16 weeks. Body weight was measured each week. Mice were sacrificed and brain regions were collected and immediately stored at -80°C until further analysis. Total glutathione (TGSH) and both the reduced (GSH) and oxidized (GSSG) forms were measured by high pressure liquid chromatography (HPLC) with electrochemical detection. The GSSG/TGSH ratio was calculated using the HPLC LC software. Protein carbonyls (PC) were measured using the DNPH assay method. Data were analyzed by one-way ANOVA via SPSS 21.0. **RESULTS:** A high fat butter-rich diet increased body weight by 30% in the HFD group compared to the NFD group over 16 weeks (P < 0.05). Measures of glutathione, GSH (NFD=41.9±6.0 vs. HFD=43.6±14.0uM/mg tissue), GSSG (NFD=0.4±0.0 vs. HFD=0.5±0.0uM/mg tissue), and TGSH (NFD=42.8±6.0 vs. HFD=44.6±14.0uM/mg tissue) increased in the HFD group, but were not statistically significant (P > 0.05). Markers of OS, PC and GSSG/TGSH were not statistically different between groups (P > 0.05). **CONCLUSION:** Consumption of a high fat butter-rich diet for 16 weeks significantly increased body weight, but not markers of oxidative stress within the hindbrain of mice. However, our lab has shown significantly elevated concentrations of F2-isoprostane in the midbrain. Future research should include use of a greater sample size and multiple brain regions.

- 1445 Board #98 June 2, 9:00 AM - 10:30 AM  
**Skeletal Muscle Gene Expression In Elite Ultra-endurance Athletes Habitually Consuming Very Low-carbohydrate or High-carbohydrate Diets**  
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A growing number of elite-level ultra-endurance athletes have switched from a high-carbohydrate (HCD) to a very low-carbohydrate/high-fat diet (LCD). LCD athletes exhibit greater than two-fold higher rates of peak fat oxidation compared to their high-carbohydrate counterparts. PURPOSE: In order to determine if the fat-adapted metabolic phenotype was associated with differences in skeletal muscle gene expression, we performed genome wide transcriptomic analysis in athletes who had been habitually consuming a LCD for a minimum of six months. METHODS: 20 elite ultra-endurance athletes (men, age 33.5 ± 6.4 yr, BMI 22.6 ± 3.3 kg/m<sup>2</sup>, VO<sub>2</sub>max 64.5 ± 4.9 mL/kg/min) habitually consuming a HCD (n=10; 58% CHO, 15% PRO, 28% FAT) or a LCD (n=10; 11% CHO, 19% PRO, 71% FAT) were matched for age, competition events, and performance. Muscle biopsies from the vastus lateralis were obtained in a fasted state. cDNA library was prepared from total RNA and sequenced for transcriptome expression using the Illumina HiSeq2500. Reads per kilobase of transcripts per million analysis was used to compare gene expression between groups (p ≤ 0.01) and with absolute fold changes (±2). RESULTS: Fat-adapted athletes had an average of 20 months (range 9-36 mo) on a LCD. Of the 25,262 total genes sequenced, 633 showed dietary differences (p ≤ 0.01). Sixty genes had greater than a 2-fold magnitude change including 47 upregulated (p ≤ 0.01) and 13 downregulated (p ≤ 0.01) genes. In the LCD athletes, two of the most significant upregulated genes coded for protein phosphatase 1 regulatory subunit 1A (+2.2 fold), an inhibitor of glycogen metabolism, and 3-hydroxy-3-methylglutaryl-CoA synthase 2 (+19.6 fold), an enzyme in ketogenesis. The most significant downregulated gene coded for cAMP-specific 3',5'-cyclic phosphodiesterase 4C, a key regulator of cAMP. CONCLUSION: Athletes habitually following a ketogenic diet showed distinct gene expression patterns that may give insight into the molecular mechanisms that mediate the fat-adapted phenotype.

- 1446 Board #99 June 2, 9:00 AM - 10:30 AM  
**Time Course Of Changes In Skeletal Muscle Mitochondrial Proteins After Cessation Of High-fat Diet Feeding**  
 Xi Li<sup>1</sup>, Kazuhiko Higashida<sup>2</sup>, Mitsuru Higuchi, FACSM<sup>1</sup>. <sup>1</sup>Waseda University, Saitama, Japan. <sup>2</sup>University of Shiga Prefecture, Shiga, Japan. (Sponsor: Mitsuru Higuchi, FACSM)  
 (No relationships reported)

High fat diet (HFD) feeding induces an increase in mitochondrial biogenesis in skeletal muscle. However, time course of changes in the increased mitochondrial proteins by HFD feeding to the baseline level after cessation of HFD feeding are not known. PURPOSE: To investigate the time course changes of skeletal muscle mitochondrial proteins after cessation of HFD feeding. METHODS: Five-week-old male C57BL/6 mice (n=32) were divided into control diet (CON, n=8) and high-fat diet (HFD, n=24) groups. HFD group was fed a HFD for 4 weeks, and then divided into three subgroups, HFD+0, HFD+3, HFD+7. Mice in HFD+0 group were sacrificed immediately after HFD intervention, whereas HFD+3 and HFD+7 groups were killed after switching from HFD to control diet 3 and 7 days, respectively. Gastrocnemius muscles were dissected out for measurement of electron transport chain proteins (COX I, COX V) as well as long chain acyl CoA dehydrogenase (LCAD). Plantaris muscles were used for the mitochondrial DNA copy number measurement. RESULTS: The protein expression of COX I and COX V were significantly higher in HFD+0 group compared to CON group (P=0.038, P=0.037), whereas those of HFD+3 and HFD+7 group were not different from CON group. In contrast to electron transport chain proteins, the LCAD protein expression in HFD+0 and HFD+3 groups showed significant increases compared to CON group (P=0.046, P=0.005). Mitochondrial DNA copy numbers in all HFD groups were significantly increased (P=0.000, P=0.000, P=0.002), but did not return to CON even 7 days after cessation of HFD. CONCLUSION: These results suggested that the electron transport chain proteins decline rapidly, whereas enzyme involved in β-oxidation returns slowly after cessation of HFD feeding. Furthermore, elevated mitochondrial DNA copy number persists at least 1 week after cessation of HFD feeding.

- C-32 Free Communication/Poster - Gender  
**Differences - Skeletal Muscle, Connective Tissue and Bone**  
 Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
 Room: Exhibit Hall A/B

- 1447 Board #100 June 2, 8:00 AM - 9:30 AM  
**Sex Differences In Hamstrings To Quadriceps Muscle Volume Ratio**  
 Fearghal Behan, Tom M. Maden-Wilkinson, Matt T.G. Pain, Jonathan P. Folland, FACSM. Loughborough University, Loughborough, United Kingdom.  
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 (No relationships reported)

Sex differences in hamstrings (H) to quadriceps (Q) maximum voluntary force ratio have been proposed as a factor for increased ACL injury risk in females. It has been suggested that the lower ratio in females may in part be due to a smaller H muscle size relative to Q muscle size. However, this has not been thoroughly investigated. Purpose: To investigate sex differences in H/Q muscle volume ratio. Methods: Following ethical approval, muscle volume of the H and Q muscles were determined from the dominant leg of 66 untrained participants (32 males mean ± SD: age, 20.6 ± 2.5 y; height, 178.8 ± 7.0 cm; mass, 71.8 ± 7.2 kg; and 34 females: age, 20.9 ± 1.7 y; height, 168.3 ± 0.1 cm; mass, 62.9 ± 7.2 kg). T1 weighted axial plane images were acquired from the anterior superior iliac spine to the knee joint space using a 1.5 T Magnetic Resonance Imaging scanner (Signa HDxt, GE, CT, USA) and processed with Osirix software (version 4.0, Pixmeo, Geneva, Switzerland). The ratio of H/Q muscle volume was determined. Sex differences were measured using independent samples t-tests.

Results: Males had 53% greater H muscle volume (940.5 ± 125.6 cm<sup>3</sup> vs 616.6 ± 127.7 cm<sup>3</sup>, P < 0.001) and 43% greater Q muscle volume (1940.9 ± 263.7 cm<sup>3</sup> vs 1354.8 ± 254.2 cm<sup>3</sup>, P < 0.001), compared to females.

H/Q values for males and females were 0.49 ± 0.05, and 0.46 ± 0.07 respectively, showing a significantly higher ratio in males compared to females (P < 0.05, Cohen's D = 0.57).

Conclusion: In agreement with our hypothesis the H/Q ratio displayed a significantly higher value in males with a moderate effect size. Sex differences in H/Q muscle volume may contribute to the increased ACL injury risk in females. Further investigations of neuromuscular factors including muscle morphology further explaining this increased ACL risk in females are warranted.

Research funded by the Arthritis Research UK Centre for Sport, Exercise and Osteoarthritis.

- 1448 Board #101 June 2, 8:00 AM - 9:30 AM  
**Sex-specific Molecular And Cellular Functional Adaptations To Resistance Training In Inactive Older Adults**  
 Mark S. Miller<sup>1</sup>, Damien M. Callahan<sup>2</sup>, James R. Slauterbeck<sup>2</sup>, Patrick D. Savage<sup>2</sup>, David W. Maughan<sup>2</sup>, Philip A. Ades<sup>2</sup>, Bruce D. Beynon<sup>2</sup>, Michael J. Toth<sup>2</sup>. <sup>1</sup>University of Massachusetts, Amherst, MA. <sup>2</sup>University of Vermont, Burlington, VT. (Sponsor: Jane Kent, FACSM)  
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 (No relationships reported)

Resistance training improves whole muscle performance in inactive older adults. However, the intrinsic muscle functional adaptations underlying these improvements are not well-understood, nor is it clear that men and women derive the same functional benefits. PURPOSE: We measured the skeletal muscle functional response at the whole body, tissue, cellular and molecular levels in inactive older men (M: n=7, 69±2 yrs) and women (W: n=10, 70±2 yrs) to a 14 week moderate-intensity resistance training program. METHODS: Whole muscle performance (one repetition maximum, isometric and isokinetic knee extensor torque) and size (computed tomography), cellular contractile properties (force-velocity curves) and myosin-actin cross-bridge mechanics and kinetics (sinusoidal analysis) were measured pre- and post-training. RESULTS: Resistance training increased whole muscle size (6-7%, p<0.05), one repetition maximum (48-71%, p<0.001) and isometric torque (6-15%, p<0.01) similarly in men and women, while isokinetic function was unchanged. In myosin heavy chain (MHC) I fibers, isometric tension (force per cross-sectional area) was increased in men and decreased in women with training (M: 7%, W: -9%, p=0.05), causing power output to be greater in men and lower in women at higher tensions (M: 12-44%, W: -28% to -61%). The differences in cellular function were explained at the molecular level by alterations in the number of strongly bound myosin heads (M: 21%, W: -9%, p<0.05) which, in turn, were due to sex differences in changes

in myosin attachment time (M: 13%, W: -2%,  $p=0.06$ ). In contrast to MHC I fibers, isometric tension was decreased in men and increased in women with training (M: -11%, F: 6%,  $p=0.06$ ) in MHC IIA fibers and these differences were explained by increases in myofibrillar force transmissibility in women compared to men (M: -12%, W: 6%,  $p<0.05$ ). **CONCLUSION:** Resistance training improves whole muscle function in inactive older men and women, but there are sex differences in their fiber type response and the fundamental molecular adaptations that bring about the cellular phenotypes. These results indicate that exercise prescriptions may need to be sex-specific to maximize cellular and molecular performance, leading to optimal whole muscle function.

Supported by NIH Grants AG-033547 and AG-031303.

1449 Board #102 June 2, 8:00 AM - 9:30 AM  
**Sex Differences In Relative Contribution Of Lean Mass And Fat Mass On Bone Mineral Density**

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(No relationships reported)

There is inconsistent evidence regarding the association between lean body mass, fat mass, and bone mineral density (BMD) between sexes and across various populations. This inconsistency in scientific evidence on these variables presents challenges when applying current evidence on lean body mass, and BMD in clinical scenarios. Purpose: The purpose of this study was to further determine the impact of fat mass, lean mass on BMD in both men and women. Methods: Sixty participants (males:  $n=24$ , age:  $30.5\pm 14.8$ ; females:  $n=36$ , age:  $26.3\pm 14.8$ ) participated in the study. Investigators examined BMD and body composition measurements using dual-energy X-ray absorptiometry (DXA). Results: Overall, BMD and lean mass were positively correlated ( $p < 0.01$ ,  $r^2=0.6$ ). When comparing groups, a statistically significant correlation between lean mass and BMD ( $p < 0.05$ ,  $r^2=0.4$ ) was found in women, but not in men. There were no significant correlations found between fat mass and BMD for the total sample or by sex. Conclusions: Higher lean mass is positively associated with greater bone mineral density in women. Future investigations should examine the correlation of fat mass, lean mass distribution and BMD at different sites within the skeletal system.

1450 Board #103 June 2, 8:00 AM - 9:30 AM  
**Sex Differences In The Bone-muscle Relationship In Young Adults**

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(No relationships reported)

Geometric characteristics associated with hip fractures such as the femoral neck axis length (FNAL), the femoral neck width (FNW), and the neck shaft angle (NSA) have been identified. However, research conducted on the influence or relationship of skeletal muscle on bone geometry is still sparse.

**PURPOSE:** The purpose of this study was to analyze associations between lean soft tissue (LST), a surrogate of skeletal muscle mass, and bone geometry at the proximal femur, one of the most affected regions by osteoporotic related fractures.

**METHODS:** Participants were 83 adults, 49 females (age:  $23.7\pm 3.5$  yrs) and 34 males (age:  $24.5\pm 3.4$  yrs). Leg LST was assessed by dual energy X-ray absorptiometry (DXA). Geometric measures of proximal femur were derived from a left hip DXA scan and included the FNAL, the FNW, the NSA, and a robustness index expressed by FNW:FNAL. Physical activity was evaluated by accelerometry.

**RESULTS:** In males, regression analysis adjusted for body height and body mass showed that variance of geometric measures of proximal femur explained by leg LST was 17.4% in FNAL ( $\beta=0.667$ ,  $p<0.001$ ) and 15% in FNW ( $\beta=0.620$ ;  $p=0.015$ ). In females, leg LST explained 8.8% of the variance in FNAL ( $\beta=0.499$ ,  $p=0.020$ ). Additional adjustment for vigorous physical activity revealed persistence of these associations in males (FNW:  $\beta=0.669$ ,  $p=0.019$ ; FNAL:  $\beta=0.628$ ;  $p=0.001$ ) but not in females (FNAL:  $\beta=0.356$ ;  $p=0.128$ ). Leg LST did not explain NSA or FNW:FNAL variance in both sexes.

**CONCLUSIONS:** Leg LST appears to contribute for the variation of geometric measures of proximal femur, particularly in males and independently of vigorous physical activity; in females associations of leg LST and FNAL seems to be mediated by vigorous physical activity. These results suggest that sex differences in the bone-muscle relationship need to be considered to develop specific strategies for improving bone strength.

This work was funded by Portuguese Science and Technology Foundation (PTDC/DES/115607/2009) and PhD Scholarship (SFRH/BD/79828/2011).

1451 Board #104 June 2, 8:00 AM - 9:30 AM  
**The Acute Transverse Strain Response of the Patellar Tendon to Quadriceps Exercise: A Gender-based Comparative Study.**

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(No relationships reported)

**Introduction:** Tendons are highly adaptive to changes in loading forces put on them always from walking, running, jumping and in other sporting activities. There are few studies involving the Patellar tendon (Wearing et al., 2013, Pearson et al., 2014), reported a studies on the Acute Transverse Strain response of the Patellar Tendon to quadriceps exercises, a response similar to the Achilles and other tendon studies reported. Resistive exercises are therefore shown to significantly alter the sonographic measures of the patellar tendon structure; the strain, entropy and echogenicity.

**Method:** Ten adult males and ten adult females, with no previous ankle or knee pathology, between 22 and 55 years of age, an average age of  $38.5\pm 15$  years; height of 1.60 to 1.80 m and weight of 60 to 90 kg, were recruited.

A 5- to 10- MHz linear array transducer was used to obtain standardized sagittal sonograms (Fredberg et al., 2008), of the patellar tendon immediately before and after 50 repetitions of leg extensions exercise, 20 mm distal to the inferior pole of the patellar. The transverse strain  $\epsilon$ , (Hencky strain) was calculated as a percentage ratio of the post- to pre-exercise tendon thickness and the result statistically analysed (Wearing et al., 2013).

**Result:**

There was immediate decrease in patellar tendon thickness ( $P < 0.05$ ), after the quadriceps exercise in both groups. A transverse strain of  $-13.8\% \pm 7.8\%$  occurred in the males and the females had a transverse strain of  $-9.6\% \pm 3.5\%$ . There were echotexture changes; increased tendon echogenicity ( $P < 0.05$ ), decrease in entropy ( $P < 0.05$ ) in both groups.

The patellar tendon echogenicity was higher for all participants post exercise while the entropy dropped in the post exercise measurement in all participants. There was also a significant difference in the magnitude of transverse strain response ( $P < 0.05$ ) between males and females;  $-13.8\%$  for males against  $-9.6\%$  for females a difference of 30%.

**Conclusion:**

This is a pilot study comparing the male and female acute strain response of the patellar tendon to quadriceps exercise and the consistency of the response in females. This strain response is consistent in both males and females but with a lower magnitude of response in females.

**KEY WORDS:** TENDONS, EXERCISE, IMAGING, STRUCTURE, PHYSIOLOGY, PATELLA, STRAIN, STRESS

**C-33 Free Communication/Poster - Hockey**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM

Room: Exhibit Hall A/B

1452 Board #105 June 2, 9:00 AM - 10:30 AM  
**Comparing Dual Energy X-ray Absorptiometry And Air-Displacement-Plethysmography Body Composition Evaluations in Male Collegiate Hockey Players**

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(No relationships reported)

Accurate assessment of body fat percentage has been a major goal of body composition research over the past 50 years. Body composition is a health and performance variable that coaches and athletes deem important for optimal performance. Two popular laboratory methods used for assessing an athlete's body composition include air displacement plethysmography (BODPOD), and dual energy x-ray absorptiometry (DXA). **PURPOSE:** Compare the results of the BODPOD® with the known gold-standard measure of body composition, the DXA.

**METHODS:** Twenty-nine elite male Canadian collegiate hockey players, (Age =  $24.07\pm 1.49$ , BMI =  $26.5\pm 2.74$ ) participated in this study at the mid-point of their regular season. All participants underwent one BODPOD and one DXA evaluation on the same day. Paired t-tests were performed to compare differences in fat mass, fat percentage, and fat-free mass between DXA and BODPOD.

**RESULTS:** Average fat percentage reported by the DXA and BODPOD® was  $15.34\pm 3.53$  and  $11.66\pm 4.82$  respectively, resulting in a bias score of  $3.78\pm 2.33$  kg ( $t(28) = 8.71$ ,  $p \leq .001$ ). Average fat mass reported by the DXA and BODPOD® was  $13.42\pm 3.59$  and  $10.15\pm 4.54$  kg respectively, resulting in a bias score of  $3.27\pm 1.92$  kg ( $t(28)$

= 9.18,  $p \leq .001$ . Average fat-free mass reported by the DXA and BODPOD® was 73.31 ± 5.30 and 76.25 ± 5.74 kg respectively, resulting in a bias score of -2.93 ± 2.06 kg ( $t(28) = -7.66, p \leq .001$ ).

**CONCLUSIONS:** There is a difference in fat percentage, fat mass, and fat-free mass reported between the BODPOD® and DXA. This may have important implications for training programming and meal planning for elite athletes. Our findings may help sport scientists better interpret and make comparisons between studies that use different types of body composition methodologies amongst athletic populations.

1453 Board #106 June 2, 9:00 AM - 10:30 AM

**Effects of Recovery Posture on Performance and Ventilation for a Simulated Hockey Sprinting Task**

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(No relationships reported)

Simultaneous postural and respiratory functions may cause respiratory muscle fatigue (RMF) during high intensity exercise. RMF is associated with a sympathetic metaboreflex that limits blood flow to working muscles and hinders subsequent performance. Unloading respiratory muscles to prevent RMF may improve performance. In hockey players, a supported forward posture during seated recovery may reduce postural work of respiratory muscles and decrease RMF.

**PURPOSE:** To investigate the effects of an elbows-on-knees (EK) and upright (UP) passive recovery posture on repeated sprint ability (RSA), lactate, and ventilation for a simulated hockey sprint task on a slide board.

**METHOD:** Using a repeated measures design, 10 male hockey players completed 6 simulated slide board shifts of 40 sec separated by 90 sec of passive recovery in either the EK or UP recovery postures. Each 40 sec shift consisted of two 15-sec sprints separated by 10 sec standing rest. RSA was measured by slide board stride frequency and recovery was measured by changes in minute ventilation ( $V_E$ ), tidal volume ( $V_T$ ), breathing frequency ( $f_b$ ), respiratory equivalent of carbon dioxide ( $V_E/VCO_2$ ), oxygen consumption ( $VO_2$ ), and heart rate (HR) at 0 sec, 30 sec, 60 sec, and 90 sec throughout the rest intervals. An RM ANOVA was used to analyze RSA and a RM MANOVA was used to analyze ventilation.

**RESULTS:** A significant ( $p < .05$ ) posture x shift interaction existed for stride frequency with subjects in EK posture performing more strides over the first 3 shifts than in the UP posture. Subjects performed more strides in sprint 1 than sprint 2 of each shift (21.11 vs. 20.47;  $p < .05$ ). Though not statistically significant ( $p > .05$ ), meaningful posture x recovery time interaction ( $\eta^2 = .34$ ) trends may suggest more efficient ventilation in the EK posture with lower  $V_E/VCO_2$  ( $\eta^2 = .22$ ), faster HR recovery ( $\eta^2 = .21$ ), lower  $f_b$  ( $\eta^2 = .16$ ), and higher  $V_T$  ( $\eta^2 = .15$ ) throughout the recovery intervals.

**CONCLUSION:** The EK posture was not more effective than the UP posture in optimizing performance or ventilation during recovery from the simulated hockey sprinting task, but more research is needed with larger sample sizes and a longer protocol to confirm these results.

1454 Board #107 June 2, 9:00 AM - 10:30 AM

**Relationship of Physiological Fitness Tests and Early Career Hockey Success in Elite Ice Hockey Players**

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Talent identification in professional sport is an important component for building a successful team. In an effort to improve athlete identification, physiological fitness assessments are included in a number of leagues, and attempts have been made to quantify the predictive ability of individual tests. In the National Hockey League (NHL), physiological fitness measures have been shown to correlate with draft selection order, but less subjective rankings of success have previously not been considered. **PURPOSE:** To determine the predictive ability of draft-age physiological fitness test outcomes to forecast the cumulative total games played within the player's first 3 consecutive NHL seasons. Games played are an accepted indicator of success at the professional level. **METHODS:** Multiple linear regression modeling was used with NHL Combine data (1998-2007) for a total of 451 players, who played ≥1 game per year during their first 3 NHL seasons. Separate models were developed for forwards and defense, given the differing physiological profiles and positional demands.

**RESULTS:** For defensemen, the variables of vertical jump (VJ), push-ups, bench press, and body index were included in the final model ( $p=0.001, r^2=0.15$ ). The regression equation to predict number of games played by defensemen over 3yr was: total games= 177 -0.979 (VJ) + 4.068(max push up) -3.87(max bench press) +9.5 (Body index). The

only predictive variable for forward players was push up repetitions ( $p=0.01, r^2=0.04$ ); total games =193.1 -2.3(max push-up). **CONCLUSION:** NHL Combine data was useful for explaining approximately 4% (forward) and 15% (defense) of the variance in games played amongst players who played ≥3yr in the league, suggesting a modest predictive ability. Upper body strength proved an important predictor for both models, while leg power was identified as a predictor only in defensemen. Homogeneity in performance amongst such elite athletes may explain the absence of more traditional measures of physiological fitness (VO2max, anaerobic power) within the predictive models, as a high level of these physiological traits is obligatory for all players who remained in the league at least three years.

1455 Board #108 June 2, 9:00 AM - 10:30 AM

**Effects Of Sleep-wake Patterns On Field Testing In Female High School Field Hockey Players**

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Sleep times and patterns are related to sport performance. Research has determined sleep patterns contribute to differences in laboratory maximal effort treadmill tests, but little research has been done on maximal effort testing in the field. Further, research is lacking on whether sprint and acceleration times are correlated to sleep patterns.

**PURPOSE:** The purpose of this study is to determine if a relationship exists between field performance testing and sleep patterns in female high school field hockey players.

**METHODS:** Within the first week of pre-season training female high school field hockey players ( $n=15, \text{age}=15.47 \pm 1.06$ ) completed a demographic survey, Pittsburgh Sleepiness Quality Index (PSQI) scale, and a seven day sleep-wake journal using an online survey platform (Qualtrics, Provo, UT). Sleep latency, overall sleep quality, and duration of sleep were three PSQI measures chosen for analysis. The onset of sleep time and concentration were two measures used from the sleep-wake journal for analysis. A beep test and six 40m sprints with 10m splits were conducted within the first week of pre-season training, with 48 hours between each test. Beep test was a 20m multistage test that involved running in accordance to a pre-recording of beeps. Field tests were conducted on a level grass field under research supervision. An average of six 40m sprints and 10m splits were taken for analysis.

**RESULTS:** PSQI revealed no subjects suffered from sleep disorders. A Pearson correlation was conducted between performance and sleep pattern variables. A positive strong correlation exists between 40m average sprint time and 10m average sprint time ( $r = 0.896, p \leq 0.05$ ). A negative correlation exists between onset of sleep and total sleep time ( $r = -0.598, p \leq 0.01$ ). There were no correlations between performance and sleep pattern variables.

**CONCLUSIONS:** These results indicate maximal effort field testing does not correlate with sleep patterns in female high school field hockey players. Supported by a Research and Faculty Development grant.

1456 Board #109 June 2, 9:00 AM - 10:30 AM

**Evaluation of College Ice Hockey Practices and Games via Heart Rate Monitoring and Direct Observation**

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Heart Rate (HR) monitoring via telemetry is used to assess sport training intensity, but its validity has not been assessed in collegiate ice hockey. Direct observation is a tool used to assess physical activity intensity and is used as a criterion for validating physical activity measures. **PURPOSE:** We compared assessment of on-ice practice intensity via HR monitoring with direct observation. HR monitoring was then used to compare practice and game intensities. **METHODS:** On-ice practices consisted of high intensity drills, tactical discussions, and game simulations. HR was divided into five intensity zones (<60%, 60-69%, 70-79%, 80-89%, and 90-100% of maximal HR) for analysis. Maximal HR was determined using a treadmill graded exercise test. The Children's Activity Rating Scale (CARS) was modified and used to classify hockey intensity into four observation zones (2-5): 2=sitting, standing; 3=one pair of limbs moving, gliding; 4=both pairs of limbs moving, skating backwards; 5=vigorous skating. Percentage of time spent in each HR and direct observation zone was computed for weekly practices on 12 players. Percentage of time spent in each HR zone was also computed for 3 games for athletes playing regular shifts. **RESULTS:** HR telemetry showed 30% of practices were spent at <60% of HR max, 23% at 60-69%, 22% at 70-79%, 22% at 80-89%, and 3% at 90-100%. Direct observation showed 60% of practice time was spent at an intensity level of 2, 29% at 3, 12% at 4, and 1% at 5. Players observed during competition showed 27% of games were spent at

<60% of HR max, 32% at 60-69%, 18% at 70-79%, 16% at 80-89%, and 7% at 90-100%. CONCLUSION: Agreement between the two measurement methods suggests that percentages of time spent at the various intensity levels were similar. These pilot results indicate that HR monitoring appears to be a reasonably valid indicator of hockey practice intensity, when compared to direct observation. HR data indicate that practice intensity is similar to game intensity for players playing regular shifts. Future research will focus on acquiring data from a larger sample size of players and using direct observation to assess game intensity.

1457 Board #110 June 2, 9:00 AM - 10:30 AM

**Off-Ice Testing Predictive Capabilities of On-Ice Performance Attributes in Men's Varsity Hockey Players**

Jonathan Bonneau, Lymperis P. Koziris, Patrick Delisle-Houde, Ryan E R. Reid, Ross E. Andersen, FACSM. *McGill University, Montreal, QC, Canada.* (Sponsor: Ross E. Andersen, FACSM) Email: jonathan.bonneau@mail.mcgill.ca

(No relationships reported)

Ice hockey is a physically demanding contact sport that requires players to perform repeated bouts of high-energy output with shifts lasting from 30 to 80 seconds. Predicting on-ice performance during a game is difficult. Physical and anthropometric testing has been commonly used in hockey to predict and evaluate fitness attributes (i.e. strength, agility, flexibility), which the hockey community believes are advantageous to several sport-specific tasks in hockey, such as the player's skating speed and balance.

**PURPOSE.** To explore the relationship between NHL combine testing results and on-ice testing assessments among elite varsity hockey players.

**METHODS.** Twenty-five Men's Varsity Hockey players from McGill University (age: 22.8 ±1.43, height: 1.81 ±0.06, weight: 87.13, ±6.73, %BF: 16.21 ±4.03) participated in the study. Participants performed the 2015 standard NHL combine tests. On-ice testing was conducted using advanced timing equipment to control for errors. Tests completed by the players were the 30-m forward and backward sprints, transition agility test, weave agility test, and pro-agility test. Six NHL teams currently use this battery of on-ice tests, to replicate game like situations.

**RESULTS.** See attached table for results.

**CONCLUSION.** It can be concluded that most of the NHL combine tests were not correlated with the on-ice measures of performance obtained. Improving the sport-specific nature of dryland testing represents a priority for sport scientists working with elite hockey players.

**Table 1.** Correlations of NHL 2015 combine tests to novel on-ice testing protocol.

	On-Ice Forward 30-m Sprint	On-Ice Forward 30-m Sprint with Puck	On-Ice Backward 30-m Sprint with Puck	On-Ice Transition Agility Test	On-Ice Weave Agility Test	On-Ice Pro-Agility Test Left Start	On-Ice Pro-Agility Test Right Start
Standing Long Jump	-.454*	-0.449	-.566*	-0.087	-.479*	-0.428	-0.343
Pro-Agility Left Start	.509*	.560*	.664**	0.146	0.252	.473*	0.079
Pro-Agility Right Start	0.22	0.152	-0.251	-.479*	0.061	-0.022	-0.017
Wingate (W/kg)	-.624**	-.550**	-.552**	-0.012	-.472*	-.554**	-0.231
DXA %Fat	0.325	0.234	.552**	0.229	.429*	0.175	.440*
Jump Mat Impulse	-.601**	-0.426	-.602**	-0.205	-.504*	-.531*	-0.374
Jump Mat Flight Time	-0.438	-0.34	-.643**	-0.373	-0.316	-.445*	-0.283

\*. Correlation is significant at the 0.05 level (2-tailed).  
 \*\*. Correlation is significant at the 0.01 level (2-tailed).

1458 Board #111 June 2, 9:00 AM - 10:30 AM

**Relationship Amongst Off-Ice and On-Ice Speed and Agility Measures in Men and Women Division III Ice Hockey Players**

andrew D. Curro, John Rosene, Heath Pierce, Paul Visich. *University of New England, Biddeford, ME.* Email: acurro1@une.edu

(No relationships reported)

Depending on the sport, there is a demand on different physiological systems (aerobic capacity, strength and power and anaerobic capacity), with typically one being more recruited than the others. Ice hockey is a team sport that requires players to perform at high intensity for a short duration (~ 30 to 45 seconds), thereby necessitating anaerobic conditioning. Off-ice testing procedures have long been used for ice hockey players however their usefulness has been debated due to potential differences in muscle recruitment, metabolic cost, level of anaerobic conditioning, etc. **PURPOSE:** The purpose of this investigation was to determine if a relationship exists between off-ice and on-ice testing for sprint and agility tests in men and women Division III ice hockey players.

**METHODS:** 51 Division III ice hockey players (m = 32; w = 19) performed four tests for the measurement of sprint and agility performance (2 sprints; 2 agility). The tests were the 20 and 40 yard sprints, the pro agility, and the M test. Fastest times were recorded for the 20 and 40 yard sprint tests, and the average time of two trials in each direction was recorded for the pro agility and M test.

**RESULTS:** See Table

All values presented in seconds, \* p<.00, significant r values for 20y, 40y and M test in males (0.54, 0.62, and 0.56, respectively)

**CONCLUSIONS:** Men's performance measures were transferrable from off-ice performance to on-ice performance in straight ahead speed measures and agility measures that do not require a hard stop. The lack of a relationship between off- and on-ice testing in the women is not clearly understood and maybe related to differences in skating stride and efficiency between men and women ice hockey players at the Division III level.

		Results						
	20y Off-Ice	20y On-Ice	40y Off-Ice	40y On-Ice	Pro Agility Off-Ice	Pro Agility On-Ice	M Test Off-Ice	M Test On-Ice
M	3.11 +/- 0.21	3.1 +/- 0.12*	5.21 +/- 0.2	5.13 +/- 0.15*	4.39 +/- 0.17	4.76 +/- 0.18	11.56 +/- 0.34	10.76 +/- 0.62*
F	3.65 +/- 0.19	3.46 +/- 0.18	6.29 +/- 0.34	5.97 +/- 0.38	5.01 +/- 0.2	5.42 +/- 0.4	13.22 +/- 0.43	12.74 +/- 1.12

1459 Board #112 June 2, 9:00 AM - 10:30 AM

**Effect of Mouthguard and Stick Use on Aerobic Capacity High School Field Hockey Athletes**

Alexandra H. Roberts, Amy J. Walden, Kathleen A. Carter, T. Brock Symons. *University of Louisville, Louisville, KY.* (Sponsor: Ann M. Swank, FACSM)

(No relationships reported)

Many sports require the use of a mouthguard (MG) and the constraint of carrying a stick during play. Previous research has shown that these two conditions individually cause decrements to athletic performance; however, no research has been conducted on the effect of the combination of these conditions. **PURPOSE:** To determine effects of chronic MG and stick use during field hockey (FH) specific training on aerobic capacity; and to determine effects of acute use of MG and stick on aerobic capacity regardless of training group.

**METHODS:** 38 healthy female FH players (15+2 yrs.) from a local competitive high school team completed the study. Participants were placed into one of two groups: experimental (completing all conditioning with MG and stick) or control (completing all conditioning without MG and stick) by stratified random sampling matched for team level (Freshman, Junior Varsity or Varsity) and initial beep test performance. The beep test is a 20m multistage test that involves running in time with pre-recorded beeps. FH-specific training was performed as prescribed by coaching staff, with testing performed at baseline (start of preseason), 6 weeks (end of preseason) and 12 weeks (end of competition). Participants performed two beep tests, one with a MG and stick (MG-STK) and one without a MG and stick (WOMG-STK) during each testing block (baseline, 6 weeks, 12 weeks). Tests were performed >48 hours apart and the effects of MG and stick use were analyzed using a 3-way ANOVA.

**RESULTS:** No difference was found in aerobic capacity between the experimental and control groups (p>0.05). It was determined that performing a beep test with MG and stick resulted in reduced aerobic performance (WOMG-STK: 37.41±6.65 ml·kg<sup>-1</sup>·min<sup>-1</sup> vs. MG-STK: 33.16±5.02 ml·kg<sup>-1</sup>·min<sup>-1</sup>; p<0.01). Further, it was found

that FH-specific training altered aerobic performance across the 12 weeks ( $p < 0.01$ ). Aerobic performance increased from baseline to midpoint ( $p < 0.05$ ) (PRE:  $33.37 \pm 4.29$  ml·kg<sup>-1</sup>·min<sup>-1</sup>; MID:  $37.52 \pm 6.81$  ml·kg<sup>-1</sup>·min<sup>-1</sup>; POST:  $34.94 \pm 6.65$  ml·kg<sup>-1</sup>·min<sup>-1</sup>). **CONCLUSIONS:** Aerobic capacity was not affected by chronic use of MG and stick during standard FH-specific training. The use of MG and stick during the performance of a beep test diminished aerobic capacity across the study period.

1460 Board #113 June 2, 9:00 AM - 10:30 AM  
**Relationship Between Laboratory Measures And On-ice Performance Metrics Among NCAA DIII Collegiate Hockey Players**  
 Stephen J. McGregor<sup>1</sup>, Adam Coughlin<sup>2</sup>, Anthony Rossi<sup>3</sup>, Andrea Workman<sup>1</sup>, Chris Herman<sup>1</sup>. <sup>1</sup>Eastern Michigan University, Ypsilanti, MI. <sup>2</sup>Saginaw Valley State University, University Center, MI. <sup>3</sup>Adrian College, Adrian, MI.  
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 (No relationships reported)

**Purpose:** Traditionally, laboratory measures have been used to assess fitness and physiological capacity in hockey players. It is not clear how relevant these laboratory measures are to on-ice performance. Therefore, the purpose of this study was to compare on-ice performance metrics collected using wearable sensors with laboratory measures to determine their relevance to fitness assessment in collegiate hockey players.

**Methods:** 8 NCAA Div III Varsity hockey players (4 F/4D) consented to procedures approved by the Adrian College Institutional Review Board. Subjects performed laboratory testing including Wingate (absolute and relative mean and peak power, WabMP, WrelMP, WabPP, WrelPP, respectively) and fatigue index (WFI), absolute, relative and time limit of VO<sub>2</sub>max (VO<sub>2</sub>maxAB, VO<sub>2</sub>maxREL, VO<sub>2</sub>tot, respectively) and lactate threshold (LT) determination on two separate occasions, each, separated by 6 weeks. Between pre and post testing, players wore Zephyr Bioharness sensors (Zephyr, MD) for all practice and game on-ice sessions. Omnisense software (Zephyr, MD) was used to gather physiological data (HR, HRvariability, Ventilation, Core Temp, physiological load (PL), physiological intensity (PI)) and movement data (mechanical load (ML), mechanical intensity (MI)). Correlations and stepwise regressions between laboratory tests and on-ice metrics were determined using SPSS 22 (IBM, NY).

**Results:** Between laboratory sessions, subjects each participated in 9 games and 19 practices. For games, numerous correlations were observed, the strongest of which were HR variability and WrelPP, WabMP, WrelMP, WabPP ( $r = 0.76, 0.34, 0.52, 0.74$ , respectively;  $p < 0.05$ ). Stepwise regressions performed on game data showed MI predicted by WFI, VO<sub>2</sub>tot and V2Lac ( $r = 0.7, p < 0.05$ ). ML was predicted by WFI and WrelPP ( $r = 0.7, p < 0.05$ ). Practices exhibited similar relationships between HR variability and Wingate variables. Predictions were not as strong as for games, with the strongest being MI predicted by WFI, VO<sub>2</sub>tot, VO<sub>2</sub>max and WabMP ( $r = 0.6, p < 0.05$ ). **Conclusion:** Laboratory tests are relevant to on-ice performance, but are more indicative of game performance than practice performance, in general, in this population of collegiate hockey players.

### C-34 Free Communication/Poster - Immunology/Endocrinology

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
 Room: Exhibit Hall A/B

1461 Board #114 June 2, 8:00 AM - 9:30 AM  
**Monocyte Recruitment Following High-intensity And High-volume Resistance Exercise**  
 Adam J. Wells<sup>1</sup>, Jay R. Hoffman, FACSM<sup>2</sup>, Adam R. Jajtner<sup>2</sup>, Alyssa N. Varanoske<sup>2</sup>, David D. Church<sup>2</sup>, Adam M. Gonzalez<sup>3</sup>, Jeremy R. Townsend<sup>2</sup>, Carleigh H. Boone<sup>2</sup>, Kayla M. Baker<sup>2</sup>, Kyle S. Beyer<sup>2</sup>, Gerald T. Mangine<sup>4</sup>, Leonardo P. Oliveira<sup>2</sup>, David H. Fukuda<sup>2</sup>, Jeffrey R. Stout<sup>2</sup>. <sup>1</sup>Georgia Southern University, Statesboro, GA. <sup>2</sup>University of Central Florida, Orlando, FL. <sup>3</sup>Hofstra University, Hempstead, NY. <sup>4</sup>Kennesaw State University, Kennesaw, GA.  
 (No relationships reported)

Monocyte infiltration to damaged muscle is essential for optimal recovery. **PURPOSE:** The purpose of this study was to compare changes in markers of monocyte recruitment following an acute bout of high-intensity (HVY), versus high-volume (VOL) lower-body resistance exercise. A secondary purpose was to examine the relationship between circulating cortisol concentrations and C-C chemokine receptor-2 (CCR2) expression. **METHODS:** Ten resistance-trained men ( $24.7 \pm 3.4$  y;  $90.1 \pm 11.3$  kg;

$176.0 \pm 4.9$  cm) performed each resistance exercise protocol in a randomized, counterbalanced order. Blood samples were taken at baseline, immediately (IP), 30-minutes (30P), 1-hour (1H), 2-hours (2H), and 5-hours (5H) post-exercise. Plasma concentrations of myoglobin, lactate, monocyte chemoattractant protein 1 (MCP-1), tumor necrosis factor alpha (TNF $\alpha$ ), and cortisol were measured via assay. Tumor necrosis factor receptor-1 (TNFR1), macrophage-1 antigen (CD11b), CCR2, and glucocorticoid receptor (GCR) expression was measured using flow cytometry. TNFR1 and CD11b were assessed on CD14+CD16- monocytes, CCR2 on CD14+ monocytes, and GCR on CD14+CCR2+ monocytes. The research protocol was approved by the New England Institutional Review Board. **RESULTS:** A significant interaction between trials was observed for plasma myoglobin and lactate concentrations. Plasma lactate concentrations were significantly greater following VOL compared to HVY, while plasma myoglobin concentrations were significantly greater following HVY compared to VOL ( $p < 0.05$ ). With both trials combined, TNF $\alpha$  was significantly increased at IP, 30P, 1H and 2H, while MCP-1 was significantly elevated at all post-exercise time-points ( $p < 0.05$ ). CCR2 expression was significantly lower at IP, 1H, 2H and 5H ( $p < 0.05$ ). CD11b expression was significantly greater at IP ( $p = 0.014$ ), and 1H ( $p = 0.009$ ). TNFR1 and GCR expression did not differ from baseline at any time-point. Plasma cortisol concentrations did not appear to be related to CCR2 expression. **CONCLUSION:** Results indicate that both HVY and VOL protocols stimulate a robust pro-inflammatory response. However, no differences were noted between resistance exercise training paradigms.

1462 Board #115 June 2, 8:00 AM - 9:30 AM  
**Effects Of A Three-day Period Of Intense, Intermittent Exercise On Oxidative Stress And Inflammation.**  
 Camilla R. Holland<sup>1</sup>, Michael G. Roberts<sup>1</sup>, Justin D. Roberts<sup>2</sup>.  
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 (No relationships reported)

It is documented that strenuous and prolonged exercise induces oxidative stress and inflammation, with the associated muscle damage and fatigue compromising performance. Little is known about the oxidant effects of intense, intermittent exercise, as performed daily by elite athletes competing in team sports. **PURPOSE:** To assess the short-term effects of a 3-day period of intense, intermittent exercise on biomarkers of oxidative stress and inflammation in trained athletes. **METHODS:** Ten trained athletes (age:  $32.11 \pm 1.91$  yrs; mass:  $66.33 \pm 1.95$  kg; maximal oxygen uptake (VO<sub>2max</sub>):  $51.44 \pm 1.59$  mL·kg<sup>-1</sup>·min<sup>-1</sup>) completed a high-intensity, intermittent exercise protocol (90-minute intermittent treadmill run, ~70% VO<sub>2max</sub>) on three consecutive days and were compared to a control group (N=10). Blood samples were collected immediately pre (T1) and post (T2) the 3-day exercise protocol, then 21h- (T3) and 42h-post-exercise (T4); and assayed for Total Antioxidant Status (TAS), Thiobarbituric Acid Reactive Substances (TBARS), Interleukins (IL-6, IL-8 and IL-10), C-Reactive Protein (C-RP) and Lactate Dehydrogenase (LDH). Data were corrected for plasma volume change; results presented as M $\pm$ SE. **RESULTS:** No significant differences were observed between the exercise and control group at T1 (TAS:  $1.20 \pm 0.14$  mmol·L<sup>-1</sup> vs.  $1.18 \pm 0.11$  mmol·L<sup>-1</sup>; LDH:  $302.14 \pm 16.24$  U·L<sup>-1</sup> vs.  $295.27 \pm 31.26$  U·L<sup>-1</sup>; TBARS:  $6.21 \pm 1.09$   $\mu$ M vs.  $5.88 \pm 1.00$   $\mu$ M; and IL-6:  $0.67 \pm 0.70$  pg/ml vs.  $1.12 \pm 0.28$  pg/ml). The 3-day exercise period caused a significant increase in LDH ( $413.24 \pm 35.27$  U·L<sup>-1</sup>,  $P = 0.029$ ), IL-6 ( $2.54 \pm 0.35$  pg/ml,  $P = 0.037$ ) and TBARS ( $7.00 \pm 0.61$   $\mu$ M,  $P = 0.042$ ) at T2, with the effects of TBARS remaining above baseline at T4 ( $6.43 \pm 0.79$   $\mu$ M,  $P = 0.043$ ). TAS increased post-exercise with a significant difference observed between groups at T2 ( $1.86 \pm 0.21$  mmol·L<sup>-1</sup> vs.  $1.20 \pm 0.13$  mmol·L<sup>-1</sup>,  $P = 0.006$ ), T3 ( $1.86 \pm 0.28$  mmol·L<sup>-1</sup> vs.  $1.30 \pm 0.14$  mmol·L<sup>-1</sup>,  $P = 0.010$ ) and T4 ( $1.71 \pm 0.22$  mmol·L<sup>-1</sup> vs.  $1.17 \pm 0.13$  mmol·L<sup>-1</sup>,  $P = 0.014$ ). IL-8, IL-10, and C-RP did not differ between groups. **CONCLUSIONS:** A 3-day period of intense, intermittent exercise increased oxidative stress and upregulated antioxidants in trained athletes, confirming the current model that exercise-induced oxidants play an important role in intracellular signaling pathways of endogenous antioxidants.

1463 Board #116 June 2, 8:00 AM - 9:30 AM  
**Effects Of A Natural Combination Medicine On Exercise-induced Muscle Soreness**  
 Christian Pilat, Kerstin Muders, Vanessa Deuster, Torsten Frech, Karsten Krüger, Jörn Pons-Kühnemann, Christine Scheibelhut, Frank-Christoph Mooren. Justus-Liebig-University of Giessen, Giessen, Germany.  
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 (No relationships reported)

Muscle soreness is a common effect of eccentric exercise which is accompanied by an inflammatory response in muscle tissue. The preparation Traumeel (Tr14) is composed of 14 diluted biological and mineral components and indicated immunomodulatory effects in various recent studies.

**PURPOSE:** The present investigation examined potential effects of Tr14 on exercise-induced muscle soreness. **METHODS:** A total of  $n = 96$  (Tr14:  $n=48$ , placebo:  $n=48$ ) healthy, untrained male volunteers were enrolled in this double-blind, randomized, placebo-controlled clinical trial. The subjects performed a 45 minute, intensive downhill run on a treadmill (10% decline) at 80% of  $VO_{2max}$ . All analyses (subjective pain score, muscle damage markers, antigenstimulated cytokines and lymphocyte activation markers) were performed preexercise and at several time points thereafter (immediately post, 3 hours, 24 hours, 48 hours and 72 hours post). The area under the curve with respect to the increase ( $AUC_c$ ) of the subjective pain score and the muscle damage marker creatine kinase (CK) were defined as primary outcome measures. **RESULTS:** The muscle damage markers CK and LDH were lower in the Tr14 group ( $1.5 \pm 1.5 \times 10^6$  vs.  $1.6 \pm 2.1 \times 10^6$ ,  $p=0.05$  and  $6.6 \pm 9.8 \times 10^4$  vs.  $9.9 \pm 9.1 \times 10^4$ ,  $p=0.06$  respectively). Similarly, there was a lower ICAM1 expression ( $3.0 \pm 30.9 \times 10^3$  vs.  $1.1 \pm 1.9 \times 10^4$ ,  $p<0.05$ ) and a less pronounced lymphopenia ( $9.3 \pm 16.3 \times 10^3$  vs.  $-1.6 \pm 1.8 \times 10^4$ ,  $p<0.05$ ) in the Tr14 group. Furthermore, CD69 and IL-18 showed the same trend as above ( $4.2 \pm 26.9$  vs.  $5.2 \pm 39.8$  and  $1.0 \pm 3.2 \times 10^5$  vs.  $1.7 \pm 2.4 \times 10^5$  respectively, both  $p<0.1$ ). Neutrophil granulocytes and IL-12p70 showed a lower ( $2.2 \pm 2.0 \times 10^3$  vs.  $2.7 \pm 2.9 \times 10^3$ ,  $p<0.1$  and  $-2.8 \pm 47.0 \times 10^3$  vs.  $-9.7 \pm 43.6 \times 10^4$ ,  $p<0.05$  respectively) and GM-CSF a higher AUC score in the Tr14 group ( $13.0 \pm 5.9 \times 10^2$  vs.  $4.2 \pm 34.9 \times 10^4$ ,  $p<0.1$ ). Additionally, a lower expression of BDNF was found in the Tr14 group ( $-9.5 \pm 115.0 \times 10^2$  vs.  $4.1 \pm 7.7 \times 10^3$ ,  $p<0.05$ ). **CONCLUSION:** Tr14 affected muscle damage markers and selected immune system parameters after eccentric exercise. However, the evaluation of the subjective pain score showed no differences between the verum and placebo group. **FUNDING:** This investigator initiated clinical trial was financially supported by Biologische Heilmittel Heel GmbH (Baden-Baden, Germany).

1464 Board #117 June 2, 8:00 AM - 9:30 AM  
**Profiling Kynurenine (KYN) As A Potential Immunological Marker For Overtraining Syndrome (OTS) In Elite Rowers**

Uwe Schumann, Martina Zügel, Gunnar Treff, Marion Schneider, Dietmar Abendroth, Jürgen M. Steinacker, FACSM. *Ulm University, Ulm, Germany.* (Sponsor: Jürgen M Steinacker, FACSM)  
*(No relationships reported)*

OTS is characterized by a disturbed stress-recovery balance with long lasting loss of performance, elevated susceptibility to infections, chronic fatigue and mental depression in the absence of clinically defined diseases.

Immune system hyperactivity is a common feature of both functional overreaching (FO) in response to high exercise loads followed by tissue remodeling, and non-functional overreaching (nFO) leading eventually to severe OTS. The tryptophan catabolite KYN acts as an immune regulator in an attempt to resume immune homeostasis by activating Treg cells. Adversely such a stimulated KYN pathway generates neurotoxic substances impairing mental health. A correlation of high KYN and low tryptophan has been demonstrated in several disease phenotypes related to increased plasmacytoid dendritic cells (pDC), the most important cell type to induce Treg cells.

**PURPOSE:** We showed earlier that KYN in OTS-patients (PTS) is elevated compared to healthy recreational athletes (HRA). Here we aimed to elucidate the context of KYN with various markers of immune status and results of questionnaires during a world cup season of elite rowers (ER).

**METHODS:** Venous serum was drawn from 11 ER in between two world cup races and at off-season while KYN in PTS and HRA served as controls. Neopterin, Ferritin, TNF $\alpha$ , IL-1 $\beta$ , IL-2R, IL-6, HMGB1, and IL-10 of ER were measured using commercial immunoassay systems and relevant markers for pDC, and Treg cells (CD25+/CD4+, sCD25, HLA-DR on monocytes and CD123 on pDC) were determined by flow cytometry. KYN was defined using a non-commercial colorimetric assay, and EBF76 was applied to monitor stress and recovery balance.

**RESULTS:** Average KYN in PTS was increased by 33.6% compared with HRA (3.18 nmol/ml, SD 0.45 vs. 2.38 nmol/ml, SD 0.48,  $p<0.0001$ ) and 31.4% respectively 20.9% with ER in off- or high season (2.42 nmol/ml, SD 0.5,  $p<0.01$ ; 2.63 nmol/ml, SD 0.7,  $p<0.05$ ). Proinflammatory and EBF-stress markers significantly increased during high season while anti-inflammatory and recovery markers augmented during off-season.

**CONCLUSIONS:** While intense ongoing exercise loads challenge the immune system comprehensively, these triggers hardly affect the KYN pathway in successfully competing rowers, probably because the immune homeostasis can be regained, which is different to OTS-patients.

1465 Board #118 June 2, 8:00 AM - 9:30 AM  
**Interaction Between Vascular Inflammation Markers and Exercise-induced Stress Hormones in Obese Males**

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*(No relationships reported)*

**PURPOSE:** To examine the interaction between exercise-induced stress hormones [epinephrine (E), norepinephrine (NE) and cortisol (COR)] and vascular inflammation markers [soluble intercellular adhesion molecule-1 (sICAM-1), soluble vascular cell adhesion molecule-1 (sVCAM-1), and soluble E-selectin (sE-selectin)] following different intensities of exercise in obese men.

**METHODS:** As a cross-over design, 15 physically inactive (physical activity < 2 days per week) obese (BMI > 30 kg/m<sup>2</sup>) men between the ages of 18-30 years participated in the study. Participants performed a single bout of cycling exercise (average energy expenditure ~ 300 kcal) at two different intensities in random order (low: 50% and high: 80% of maximal heart rate). Overnight fasting blood samples were collected at baseline, immediate post-exercise (IPE), 1-hr PE, and 24-hr PE. All data were analyzed by an analysis of variance with repeated measures along with the Bonferroni multiple comparisons. The linear regression analysis was used to examine the interaction between exercise-induced hormones and vascular inflammation markers ( $p < .05$ ).

**RESULTS:** sICAM-1, sVCAM-1, E or NE did not change, while sE-selectin at 1-hr PE ( $10.25 \pm 1.07$  ng/mL) significantly decreased ( $p = .045$ ) from baseline ( $12.22 \pm 1.39$  ng/mL). COR at IPE ( $262.12 \pm 31.09$  ng/ml) was significantly higher ( $p = .001$ ) than 1-hr PE ( $189.35 \pm 31.11$  ng/ml) during high-intensity exercise. In contrast, COR at IPE ( $187.52 \pm 31.09$  ng/ml,  $p = .009$ ) and 1-hr PE ( $156.24 \pm 31.11$  ng/ml,  $p = .001$ ) were significantly lower than baseline ( $259.75 \pm 23.07$  ng/ml) during low-intensity exercise. COR and sICAM-1 had a negative relationship at 1-hr PE during low-intensity exercise ( $r^2 = .34$ ,  $p = .02$ ), whereas COR and sVCAM-1 had a positive relationship at IPE during high-intensity exercise ( $r^2 = .36$ ,  $p = .02$ ).

**CONCLUSION:** sE-selectin was favorably reduced following exercise, and changes in cortisol were exercise-intensity dependent. Although sICAM-1 and sVCAM-1 did not significantly change following exercise, a significant interaction between cortisol and these cell adhesion molecules suggests that cortisol is one of the responsible exercise-induced hormones that may be associated with cell adhesion molecule metabolism.

1466 Board #119 June 2, 8:00 AM - 9:30 AM  
**Salivary Biomarkers in Response to an Acute Bout of Exercise Before and After Training Program**

Shlomit Radom-Aizik<sup>1</sup>, Fadia Haddad<sup>1</sup>, Martin Perlstejn<sup>1</sup>, Ronen Bar-Yoseph<sup>1</sup>, Douglas A. Granger<sup>2</sup>, Dan M. Cooper<sup>1</sup>. <sup>1</sup>*Pediatric Exercise & Genomics Research Center (PERC), UC Irvine, Irvine, CA.* <sup>2</sup>*Institute for Interdisciplinary Salivary Bioscience Research, Arizona State University, Tempe, AZ.*  
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*(No relationships reported)*

There is increasing interest in the mechanisms and biomarkers through which physical activity influence health across the lifespan. Studies that require phlebotomy are challenging for investigations involving children. Not surprisingly, there is growing interest in the use of saliva in pediatrics for exercise-related biomarker discovery. Very little is known about the relationship of key potential salivary biomarkers (SaBs) and exercise during childhood.

**PURPOSE:** To evaluate the effect of acute intense bout of exercise and a training program on 3 SaBs known to be related to stress/inflammation: 1) salivary cortisol-marker of HPA axis activity; 2) salivary  $\alpha$ -amylase (sAA)-a surrogate marker for autonomic activity; and 3) salivary uric acid (sUA) which recently has been suggested to be an indicator of the aggregate pathophysiologic factors that comprise the metabolic syndrome.

**METHODS:** 23 normal weight healthy adolescents (14-17 y/o, 12 girls) completed 8-week exercise program (1 hour/session, 3 days/week).  $VO_{2max}$  was assessed, before and after the exercise program by ramp-type progressive cycle ergometer until exhaustion. Saliva was collected at baseline, 20 and 40 min following the completion of the ramp test. An exercise effect, a training effect and gender differences were assessed using repeated measure ANOVA.

**RESULTS:** Cortisol levels increased in response to a brief bout of exercise (baseline  $0.12 \pm 0.02$ ; 40min post  $0.24 \pm 0.04 \mu\text{g/dl}$ ,  $p=0.002$ ). No training or gender effects were found. sAA did not change in response to the acute exercise. However, sAA baseline levels decreased following the training program in both genders ( $p<0.007$ ). sUA levels increased in both genders in response to the acute exercise (girls,  $p<0.0001$ ; boys,  $p<0.001$ ). Training effect was shown only in girls with 16% decrease in sUA in the post-training state ( $p=0.036$ ).

**CONCLUSION:** The 3 SaBs yielded novel information about exercise in children. Specific effects of an acute bout of exercise as well as training and gender differences

in sUA were observed. SaBs may prove to be useful in gaging the impact of exercise training programs in children and adolescents and may be particularly useful for large-scale studies and to minimize participant burden when multiple measurement time points are required.

Supported by NIH Grant P01HD-048721

1467 Board #120 June 2, 8:00 AM - 9:30 AM  
**Effects Of The Menstrual Cycle And Aerobic Exercise On Salivary Secretory Immunoglobulin A.**  
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 (No relationships reported)

Exercise has been shown to enhance the immune system and many women perform aerobic exercise in daily life. Although, prolonged strenuous exercise results in a temporary immune suppression and athletes are susceptible to upper respiratory tract infection after exercise. The salivary secretory immunoglobulin A (SIgA) level, which is a marker for oral-respiratory mucosal immunity, shows a difference between sexes and women experience more upper respiratory symptoms than men. However studies carefully monitoring the influence of the menstrual cycle are rare. As female hormonal status varies according to the menstrual cycle, the effect of exercise on the salivary SIgA level might be different. **PURPOSE:** To examine the effect of the menstrual cycle on salivary SIgA levels at rest and in response to an acute bout of aerobic exercise. **METHODS:** Eight healthy recreationally active females completed a cycling test at 70% V(O<sub>2</sub>)peak for 45 mins at two time points of the menstrual cycle: during the mid-follicular phase (day 8 ± 2) and the mid-luteal phase (day 21 ± 2). All participants have a regular menstrual cycle and never take oral contraceptives. Timed unstimulated saliva samples were obtained before, immediately post exercise and 1 h post exercise and analyzed for salivary SIgA. We measured the concentrations of salivary SIgA and female sex hormone using enzyme immunoassays. **RESULTS:** The menstrual cycle did not significantly modify the levels of Saliva SIgA at rest (follicular: 110.4 ± 30.2 vs. luteal: 126.1 ± 58.8 µg/mL, NS) and in response to aerobic exercise. Salivary SIgA concentration and SIgA secretion rate were unchanged by both the menstrual phase and aerobic exercise. Saliva flow rate was slightly reduced at post-exercise from pre-exercise (pre: 0.47 ± 0.31 vs. post: 0.37 ± 0.24 mg/min, NS) but not significantly altered by the menstrual cycle. **CONCLUSION:** The pattern of salivary SIgA secretion rate response to aerobic exercise was not affected by the menstrual cycle. These findings indicate that the menstrual cycle may not need to be considered when assessing oral-respiratory mucosal immune responses to acute exercise.

1468 Board #121 June 2, 8:00 AM - 9:30 AM  
**The Effects of Ultra Marathon Trail Running on Salivary Biomarkers**  
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Numerous people are affected by performance challenges brought on by race induced psychological and physiological stress. Understanding how 50 Kilometer ultra-marathon trail running (UMT) alters endocrine and inflammatory biomarkers is currently unknown. **PURPOSE:** The purpose of this study was to investigate changes in salivary  $\alpha$ -amylase, cortisol, and interleukin-1 $\beta$  (IL-1 $\beta$ ) concentrations following participation in UMT. **METHODS:** Eighteen ultra-marathon racers (25-52 yr, average longest run 73.2 km +/- 45 km) participated in this study, eleven completed the study (male n=8, female n=3, age 35 +/- 10 years, height 176 +/- 9 cm, weight 70 +/- 8 kg). Two-minute oral swabs were taken 10 min prior to race start and again within 1 min of race finish. Samples were analyzed using ELISA kits. Data was analyzed using a paired sample t-test ( $p < 0.05$ ). **RESULTS:** Average finish time was 6:57:26 +/- 1:12. Salivary cortisol increased by (32% ug/dL) and  $\alpha$ -amylase (148% U/mL), both exhibited significantly increased concentrations at the end of the event relative to baseline values. No significant differences were observed for IL-1 $\beta$ . No significant correlations were found in changes in salivary cortisol or in changes in alpha amylase to race finish times. **CONCLUSION:** Participation in UMT is associated with activation of the sympathoadrenal and hypothalamic-pituitary-adrenal (HPA) axes. IL-1 $\beta$ , an inflammatory marker, does not appear to increase but could be a result of the collection timing. Future research should investigate the time course for inflammatory markers following UMT. Understanding stress and improved interpretation of biomarkers could lead to improvements in training and performance of participants involved in UMT as well as occupational specialties within the military that commonly undertake physical tasks of this nature.

Funded in part by a Soy Health Research Program (SHRP) award

1469 Board #122 June 2, 8:00 AM - 9:30 AM  
**Cardiorespiratory Fitness And Physical Activity Are Not Associated With Plasma LECT2 Levels**  
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LECT2 has recently been identified as a liver-derived novel hepatokine associated with obesity and insulin resistance. Previous studies have demonstrated that obese mice fed a high-fat diet exhibited insulin resistance in the skeletal muscle and an increase in circulating LECT2 levels, whereas LECT2 knockout mice showed an improvement in insulin resistance despite the high-fat diet. These findings suggest that reducing circulating LECT2 levels is a key factor in preventing insulin resistance and type 2 diabetes. Because high cardiorespiratory fitness (CRF) and physical activity (PA) levels are associated with a low incidence of insulin resistance and type 2 diabetes, CRF and PA may be responsible for reducing circulating LECT2 levels. However, the association of CRF and PA with circulating LECT2 levels remains unknown.

**PURPOSE:** To determine the association of CRF and daily PA levels with plasma LECT2 levels.

**METHODS:** Using an ELISA kit, plasma LECT2 levels were measured in 148 Japanese men aged 30-79 years (median: 64.0 years) without a history of diabetes. CRF was assessed by measuring maximal oxygen uptake (VO<sub>2</sub>max) using a bicycle ergometer. PA was assessed using a uniaxial accelerometer and quantified as time spent doing moderate and vigorous physical activity (MVPA). We also measured indices of obesity such as body mass index and visceral fat area to examine whether the association of VO<sub>2</sub>max and MVPA with plasma LECT2 levels is independent of indices of obesity.

**RESULTS:** An age-adjusted partial correlation analysis showed a significant negative correlation between VO<sub>2</sub>max and plasma LECT2 ( $r = -0.249$ ,  $P = 0.002$ ). However, the correlation was no longer significant after adjusting for visceral fat area ( $r = -0.135$ ,  $P = 0.104$ ). MVPA did not correlate with plasma LECT2 levels ( $r = -0.099$ ,  $P = 0.284$  adjusted for age and visceral fat area). A multiple linear regression analysis using plasma LECT2 levels as the dependent variable showed that visceral fat area was the strongest predictor of plasma LECT2 levels ( $\beta = 0.306$ ,  $P = 0.004$ ), whereas VO<sub>2</sub>max was not associated with plasma LECT2 levels ( $\beta = -0.034$ ,  $P = 0.740$ ).

**CONCLUSIONS:** The present study indicates that CRF and PA are not independently associated with plasma LECT2 levels. It also shows that visceral adiposity plays a key role in the regulation of LECT2, but exercise does not.

1470 Board #123 June 2, 8:00 AM - 9:30 AM  
**Anti-Inflammatory Effect of Exercise Training via Elevation of Testosterone Secretion in Rat Splenocyte**  
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Testosterone secretion can be increased by exercise, and administration of testosterone has been found to decrease expression of toll-like receptor 4 (TLR4) in macrophages. However, the spleen reacts in response to lipopolysaccharide (LPS) stimulation after adaptation to exercise under the regulation of testosterone is still not clear. **PURPOSE:** The purpose of this study was to investigate the relationship between testosterone and immune responses after exercise intervention in rat spleen. **METHODS:** Male rats were divided into sedentary and exercise groups. Exercise training group was performed on a treadmill (30 min/d, 20 m/min) daily for 1 week. At the end of the training protocol, rats were sacrificed and the spleens were removed for determination of immune functions. Meanwhile, we collected plasma for the measurement of testosterone levels. **RESULTS:** Here, we confirmed that exercise extractly elevated plasma testosterone concentration. Compared to sedentary group, the protein expressions of TLR4, and phospho-nuclear factor- $\kappa$ B (p-NF- $\kappa$ B) in the spleen were significantly lower in trained rats. Moreover, the exercised rats showed the some immune adaptations in vitro: (i) lower secretion of tumor necrosis factor (TNF- $\alpha$ ) and nitric oxide, and (ii) decreased proliferation rate in splenocytes after administration of LPS. Furthermore, LPS-elicited TNF- $\alpha$  secretion in splenocytes was negatively related to plasma testosterone concentration. **CONCLUSIONS:** Exercise dampened the secretion of inflammation mediators might be at least in part through inhibiting the expressions of TLR4, p-NF- $\kappa$ B in rat spleen, suggesting that testosterone may participate in exercise training-induced adaptation of immune system.

1471 Board #124 June 2, 8:00 AM - 9:30 AM  
**PCOS and Muscle Strength: Preliminary Results in Normal Weight Women**

Silvia Dona<sup>1</sup>, Elisabetta Bacchi<sup>1</sup>, Giuseppe Coratella<sup>1</sup>, Rosa Moretta<sup>1</sup>, Sara Flamigni<sup>1</sup>, Dario Livornese<sup>1</sup>, Flavia Tosi<sup>1</sup>, Carlo Negri<sup>1</sup>, Jean-Marc Kaufman<sup>2</sup>, Federico Schena<sup>1</sup>, Paolo Moghetti<sup>1</sup>. <sup>1</sup>University of Verona, Verona, Italy. <sup>2</sup>Ghent University, Ghent, Belgium.  
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Polycystic ovary syndrome (PCOS) is a very common endocrinopathy in reproductive-aged women, characterized by hyperandrogenism, chronic anovulation and polycystic ovaries on ultrasound. PCOS is also frequently associated with body fat excess and insulin resistance, factors that may limit physical performance. However, androgen excess could be an advantage, in these women, in terms of increased muscle strength and performance. To date, only few studies in overweight/obese women have addressed the possibility that PCOS may be associated with changes in muscle strength, with controversial results. **PURPOSE:** The aim of this preliminary study was to assess muscle strength in normal weight PCOS women, to avoid the confounder effect of excess body fat. **METHODS:** Eight sedentary women with PCOS and 10 age- and BMI-matched healthy controls, with a similar level of habitual physical activity, were recruited. The strength of the knee extensor muscle of the dominant leg was assessed by isokinetic dynamometry at two different rates of execution (30°/s and 120°/s) in concentric and eccentric phase, whereas muscle architectural characteristics (thickness, fascicle length and pennation angle) were analyzed by ultrasound scan of the vastus lateralis muscle. Anthropometric and metabolic features, serum total and free testosterone levels (as measured by LC-MS/MS and equilibrium dialysis) were also assessed. **RESULTS:** As expected, testosterone levels were higher in PCOS women compared with controls, while no significant differences were observed in body composition and metabolic features between PCOS women and controls. The PCOS group showed greater isokinetic muscle strength in concentric phase at slow rate of execution (30°/s) (difference between groups 17%,  $p=0.04$ ), whereas borderline differences were observed at higher rates of execution. No differences in muscle architectural characteristics were found. **CONCLUSION:** This preliminary study suggests that women with PCOS may have increased muscle strength. Further research should assess whether this phenomenon may be related to the effects of hyperandrogenemia on muscle fiber expression.

1472 Board #125 June 2, 8:00 AM - 9:30 AM  
**Resistance Training And Protein Supplementation On IGF-1, Adiponectin And CRP In Breast Cancer Survivors**

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**PURPOSE:** To evaluate 12 weeks of resistance training (RT;  $n=13$ ) and RT+protein ( $n=15$ ) on blood biomarkers of muscle (insulin-like growth factor-1 (IGF-1), fat metabolism (adiponectin), and inflammation [human C-reactive protein (CRP)] in breast cancer survivors (BCS). **METHODS:** Thirty-three BCS (59±8yrs) were measured pre and post training for serum levels of IGF-1, adiponectin and CRP via ELISA, body composition (lean mass (LM); fat mass (FM)) via DXA and muscular strength (chest press and leg extension) via one-repetition maximums (1-RM). RT consisted of 2 days/week using 10 exercises performed for 2 sets of 10-12 repetitions and 3rd set to failure at ~65-85% of 1RM. RT+protein consumed 20g of protein 2x/day. ANOVAs were used for analyses. Significance was set at  $p<0.05$ . **RESULTS:** There were no group by time interactions for strength, LM, FM, and biomarkers. Both groups significantly increased upper (34%) and lower (20%) body strength. Serum levels of IGF-1 significantly increased from baseline to 12 weeks in both the RT ( $102 \pm 34$  to  $115 \pm 33$  ng/ml) and RT+protein ( $110 \pm 40$  to  $119 \pm 37$  ng/ml) but adiponectin and CRP did not change. LM (+0.9kg), FM (-0.5kg), and percent body fat (-1%) significantly improved in both groups. **CONCLUSIONS:** 12 weeks of RT at 65-81% of 1RM was well tolerated and significantly improved strength, body composition and IGF-1. Protein intake of 40g/day did not provide additional benefits to RT nor did it cause values of IGF-1 to exceed healthy ranges. Supported by Dymatize Nutrition™, the National Strength and Conditioning Association and Florida State University.

**C-35 Free Communication/Poster - Movement Disorders**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
 Room: Exhibit Hall A/B

1473 Board #126 June 2, 9:00 AM - 10:30 AM  
**Relationship Of The Daily Sleepiness Epworth Scale With The Grip Strength In Elderly With Parkinson'S Disease.**

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**RELATIONSHIP OF THE DAILY SLEEPINESS EPWORTH SCALE WITH THE GRIP STRENGTH IN ELDERLY WITH PARKINSON'S DISEASE.**

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 University of Brasilia, Brasilia, Brazil.

The Parkinson's disease (PD) presents non motor symptoms like Sleepiness during the day and it may arise in patients with PD.

Sleep problems and fatigue – people with the disease may have difficulty staying asleep after they fall asleep. They may also have restless sleep and difficulty getting comfortable in bed. As a result, they may feel drowsy during the day. Thus, as the excessive daytime sleepiness causes body fatigue, could handgrip strength be related with this drowsiness?

**PURPOSE** – this study aims to verify the association between the daily *Sleepiness* with the grip strength in Parkinson's disease. **METHODS** – 34 individuals diagnosed with Parkinson disease were recruited by convenience. From those only 16 completed the assessments. The mean age of the sample was 68,81 (± 8.41 years), composed by 2 women and the 14 men. The daily drowsiness was assessed by the *Epworth Sleepiness Scale* (ESS) and handgrip strength was assessed with a JAMAR hydraulic dynamometer. The best result from 3 trials for each hand was recorded, as well as the average of 3 trials for both hands. Pearson's correlation coefficients were calculated to establish the correlations among variables. Given the significant age effect on handgrip strength, a partial correlations analysis were performed. The level of significance adopted was  $p \leq 0.05$ . **RESULTS** – The strength of both hands were statistically correlated with the daily *ESS* ( $r = -0.749$ ;  $p = 0.032$  to the right hand and  $r = -0.804$ ;  $p = 0.016$  to the left hand). Additionally, the *ESS* also demonstrated statically correlation with the average of right and left hands ( $r = -0.770$ ;  $p = 0.025$  and  $r = -0.904$   $e$   $p = 0.002$ , respectively). **CONCLUSION** – The daily sleepiness can be associated with the capacity of react to external stimulus and to the capacity of maintaining concentration. The results show the necessity of maintaining a physical exercises routine, mainly strength exercises.

1474 Board #127 June 2, 9:00 AM - 10:30 AM  
**Gait Termination Impairments In Individuals with Parkinson's disease And Essential Tremor.**

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**PURPOSE:** Gait termination (GT) is a complex locomotor task involving a transition from a dynamic state to a static state of motion. Challenges arise from this task due to the integration of multiple sensory inputs needed to detect and bilaterally modulate linear and angular propulsion and braking forces. Activities like this are associated with falls in elderly populations. Individuals with movement disorders (e.g., Parkinson's disease (PD) and Essential tremor (ET)) are even more likely to experience falling-related injuries than healthy older adults. The purpose of this study was to examine the different control strategies of the lower body between individuals with PD and ET via measurement of peak propulsive and braking forces, as well as the different postural stability characteristics exhibited during planned GT.

**METHODS:** Twenty-four individuals with ET (66 ± 7yrs) and twenty-four individuals with PD (63 ± 8yrs) participated in this study. Subjects were instructed to walk across the walkway at a self-selected pace and stop naturally at the last of three consecutive force plates, which was marked for visibility. Braking and propulsive forces were calculated by the peak ground reaction forces from the last two steps during gait termination. Dynamic postural stability index (DPSI), defined as an individual's ability to maintain balance while transitioning from a dynamic to a stable state, was measured from ground reaction force data.

**RESULTS:** No differences were detected in velocity between groups ( $p > .05$ ). Propulsive forces were significantly higher ( $p < 0.01$ ) in the PD group ( $0.99$  N/kg ± 0.33) compared to the ET group ( $0.73$  N/kg ± 0.21). Braking forces were also

significantly higher ( $p < 0.01$ ) in PD subjects ( $1.90 \text{ N/kg} \pm 0.50$ ) when compared to ET subjects ( $1.52 \text{ N/kg} \pm 0.41$ ). The t-test showed a significant difference ( $p < 0.001$ ) in DPSI scores between PD ( $0.180 \pm 0.042$ ) and ET ( $0.246 \pm 0.058$ ) groups.

**CONCLUSIONS:** We found that subjects with ET generate less force and are more unstable during planned GT. Based on the available data, we were able to ascertain that these different movement disorders differentially affect the ability to terminate gait. Deviation in GT may be the result of neurological deficits specific to each disorder.

1475 Board #128 June 2, 9:00 AM - 10:30 AM  
**Sit-to-stand Asymmetries Are Greater Among Higher Disability Ms Patients**

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(No relationships reported)

**Purpose:** People with multiple sclerosis (PwMS) have impaired balance and gait, which greatly affects the common sit-to-stand transition, especially at high disability levels. In addition, most PwMS exhibit hemiparesis, or motor dysfunction on one side of the body. Our purpose was to quantify weight distribution and balance asymmetries and to identify associations involving disability level during a five-repetition sit-to-stand (5xSTS) task in PwMS with varying disability levels.

**Methods:** 36 PwMS (9 male) performed two maximum pace 5xSTS trials on adjacent force platforms. Participants were grouped into low ( $n=22$ ) or high ( $n=14$ ) disability level via Patient Determined Disease Steps (PDDS) score: (0-2 low, 3-5 high). There were no significant differences between the groups in: Age = 55.5 (12.3) yrs; Height = 1.68 (0.16) m; Mass = 73.3 (16.4) kg; or Disease duration = 14.7 (9.2) yrs [whole group mean (SD),  $P \geq 0.216$ ]. Average vertical ground reaction force (GRFv), center of pressure (COP) sway, and COP max velocity (COPmv) were measured bilaterally. Relative symmetry index (RSI%) and absolute symmetry index (ASI%) for each variable were calculated as:  $RSI\% = 100\% * (L-M) / [0.5 * (L+M)]$  and  $ASI\% = |RSI\%|$ ; where L/M signify the less/more affected limb. Laterality of the affected side was determined via summation of knee extensor and flexor strength and self-reported affected side. Independent sample t-tests ( $\alpha < 0.05$ ) were used to compare low and high disability level for each factor above. Pearson correlations were used to identify associations.

**Results:** GRFv ASI% was found to be greater among the high disability group [16.0 (11.3) vs 8.8 (7.6),  $P = 0.029$ ]. No other measures were significant between groups ( $P \geq 0.093$ ). PDDS correlated with GRFv ASI% ( $r^2 = 0.166$ ,  $P = 0.014$ ) and time to complete the task ( $r^2 = 0.372$ ,  $P < 0.001$ ).

**Conclusion:** Disability level affects weight distribution asymmetries and time to complete the sit-to-stand transition among PwMS. Therefore, lower extremity bilateral strength differences should be addressed in comprehensive treatment programs among higher disability PwMS. Additionally, lower-disability PwMS should seek to maintain bilateral strength to prevent decreases in sit-to-stand performance.

1476 Board #129 June 2, 9:00 AM - 10:30 AM  
**Controlled Whole-body Vibration Training Reduces Risk Of Falls In People With Multiple Sclerosis**

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Despite the prevalence of falls among people with multiple sclerosis (MS), there are very limited evidence-based treatment approaches for fall prevention among this population. Controlled whole-body vibration (CWBV) training has recently emerged as a new modality to train older adults to reduce their risk of falls primarily because it is portable, safe, easy to use, and effective; and requires less intensive physical activity than traditional exercise-based methods. Nevertheless, there is a lack of evidence about the impact of CWBV training on reducing falls in people with MS.

**PURPOSE:** To examine if an 8-week CWBV training protocol can reduce risk of falls in people with MS.

**METHODS:** Twenty individuals (14 females) with MS (mean  $\pm$  SD age:  $52.0 \pm 14.3$  y/o, disease duration:  $16.1 \pm 11.5$  y) underwent the vibration training 3 times per week for 8 weeks while standing on a side alternating vibration platform. Each session included 5 repetitions of 1-min vibration exposure followed by a 1-min seated rest. The vibration frequency and amplitude were 20 Hz and 3.2 mm, respectively. Their risk of falls was quantified by the isometric knee extensor muscle strength capacity (normalized to the body mass), the EquiScale balance scale, and Timed-Up-and-Go (TUG) test; and was evaluated pre and post the 8-week training. Paired t-tests were used to examine if the training improves these risk factors of falls.

**RESULTS:** The knee extensor strength capacity on the affected side was significantly increased from  $0.92 \pm 0.51 \text{ Nm/kg}$  for pre-training test to  $1.06 \pm 0.52 \text{ Nm/kg}$  for the post-training test ( $p < 0.01$ ). Compared to pre-training values, there was a significant improvement at post-training for body balance ( $11.00 \pm 4.16$  vs.  $12.55 \pm 3.31$ ,  $p < 0.001$ ) and TUG ( $14.92 \pm 6.80$  vs.  $13.33 \pm 5.63$  s,  $p < 0.01$ ).

**CONCLUSIONS:** The findings of this study suggest that an 8-week vibration training program reduced risk of falls among individuals with MS by strengthening muscles, improving body balance, and enhancing functional mobility. The clinical application of CWBV may reduce falls for individuals with MS; however, more systematic studies based on large sample sizes are needed to examine the longitudinal effect of vibration training to reduce the number of real-life falls among persons with MS. Supported by NMSS Grant PP-3385 (to FY).

1477 Board #130 June 2, 9:00 AM - 10:30 AM  
**Vibration Training Improves Disability Status Among Individuals With Multiple Sclerosis**

Edson F. Estrada, Maria C. Sanchez, George A. King, FACSM, Feng Yang. *University of Texas at El Paso, El Paso, TX.* (Sponsor: George A. King, FACSM)  
(No relationships reported)

Multiple Sclerosis (MS) is a progressive neurological disease affecting more than 570,000 Americans, and is among the most common causes of neurological disability in young adults. Controlled whole-body vibration (CWBV) training has been recently used to improve functional mobility among older adults and individuals with movement disorders, primarily due to its attractive features, such as safe, portable, and easy to operate, etc. However, it remains undetermined if and to what degree CWBV training can improve the disability level among individuals affected by MS.

**PURPOSE:** To examine the effect of a vibration training program on reducing the disability level of people with MS.

**METHODS:** Twenty adults affected by MS (mean  $\pm$  SD age:  $52.0 \pm 14.3$  y/o, disease duration:  $16.1 \pm 11.5$  y; 14 females) participated in a vibration training course on a side-alternating vibration platform. They received the training 3 times a week for 8 weeks. Each training session included 5 repetitions of 1-min vibration exposure followed by a 1-min seated rest. The vibration frequency and amplitude were 20 Hz and 3.2 mm, respectively. The level of disability was assessed before and after the 8-week training using the Multiple Sclerosis Functional Composite (MSFC) z-score and the Patient Determined Disability Step (PDDS) score. Paired t-tests were used to compare both scores between pre- and post-training assessments in order to determine the possible training-induced changes.

**RESULTS:** Participants' PDDS score reduced significantly from  $3.68 \pm 1.91$  for the pre-training to  $3.10 \pm 2.03$  for the post-training assessments ( $p < 0.05$ ). MSFC z-score was also significantly increased following the vibration training (pre:  $0.00 \pm 0.59$  vs. post:  $0.32 \pm 0.69$ ;  $p < 0.01$ ).

**CONCLUSION:** Our results indicated that an 8-week CWBV training course reduced the disability level in individuals with MS by improving their PDDS and MSFC scores. CWBV training appears to be a promising alternative treatment for reducing the level of disability among people affected by MS, and may have implications for improved quality of life and delayed progression of the disease. Further studies based on a randomized controlled design are needed.

Supported by NMSS Grant PP-3385 (to FY).

1478 Board #131 June 2, 9:00 AM - 10:30 AM  
**Evaluation Of The Rehabilitation Effects On Balance With Virtual Reality Games For Patients With Stroke**

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Many survivors after stroke suffered postural and balance problems that limited daily life activities. Virtual reality (VR) balance training had already been used in stroke rehabilitation, and previous studies supported that it could improve balance ability and increase motivation and pleasure than conventional methods. Kinect for Xbox is a new commercial VR game system which can detect subject's activities without any body-attached marks and hand-held controllers. Few of studies had investigated the rehabilitation effects on balance with Kinect for patients with stroke.

**PURPOSE**

The purpose of this study is to investigate the effects of virtual reality balance training through Kinect for Xbox games in patients with chronic stroke.

**METHODS**

Fifty-four patients (mean age:  $55.41 \pm 9.65$ ) with mild to moderate motor deficits (Brunnstrom stage:  $4.35 \pm 1.40$ ) were recruited and randomly assigned to "VR plus standard rehabilitation group" ( $n=27$ ), and "standard rehabilitation group" ( $n=27$ ). After 12 training sessions (90 minutes a time, 2 times a week), the performance of balance was assessed by a blinded assessor. The outcome measures included Berg Balance Scale, Functional Reach Test, and Timed Up and Go (cognition) Test. The pleasure scale and adverse events were also recorded after each training session. Data was analyzed with SPSS version 20.0, and alpha level was set at 0.05.

## RESULTS

No significant differences were found between two groups in demographic and all outcome measures data before training. After intervention, VR group showed significant improvement in Berg Balance Scale ( $43.22 \pm 8.71$  vs  $46.04 \pm 6.72$ ,  $p=0.001$ ), and had greater pleasure than control group ( $31.61 \pm 2.68$  vs  $28.87 \pm 4.63$ ,  $p=0.010$ ). However, no significant difference was found between groups in Berg Balance Scale ( $46.04 \pm 6.72$  vs  $42.44 \pm 12.30$ ,  $p=0.189$ ), Functional Reach Test ( $24.10 \pm 5.63$  vs  $21.04 \pm 6.84$ ,  $p=0.189$ ), and Timed Up and Go (cognitive) Test ( $23.52 \pm 11.71$  vs  $32.22 \pm 27.20$ ,  $p=0.133$ ).

## CONCLUSIONS

Virtual reality balance training through Kinect for Xbox games has positive effects on balance ability among patients with chronic stroke. Subjects also have greater pleasure during intervention than standard rehabilitation only method.

1479 Board #132 June 2, 9:00 AM - 10:30 AM  
**Knee and Ankle Biomechanics during Level Walking Both Prior to and Following a Stroke**

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(No relationships reported)

One of the side effects to gait following a stroke is foot drop syndrome. This presents movement challenges at the ankle, which necessitate compensations at other lower extremity joints. The knee joint angle patterns during stance and swing are often altered, though at faster walking speeds knee joint angles tend to be more similar to normal able bodied individuals. Comparisons between able bodied individuals, though beneficial, lack the strengths of a longitudinal study. The inability of predicting a stroke make these types of studies nearly impossible, especially on a large scale. **Purpose:** To compare level walking biomechanics of one participant prior to and following a stroke. **Methods:** 3D kinematics and kinetics of the ankle and knee were analyzed during the stance phase of level walking for one participant (age: 64) at a self-selected walking speed prior to and 5 months post-stroke. A faster walking condition was added in post-stroke testing. **Results** Pre-stroke walking speed (1.37 m/s) was faster than post-stroke preferred walking speed (1.19 m/s) but similar to post-stroke fast walking speed (1.38 m/s). The ankle joint changed from dorsiflexion to plantarflexion post-stroke at heel strike [pre ( $4.0 \pm 1.2$  deg), post-slow ( $-8.34 \pm 1.9$  deg), post-fast ( $-5.11 \pm 1.4$  deg)] and knee flexion at foot strike became more flexed following the stroke [pre ( $0.22 \pm 0.7$  deg), post-slow ( $-13.02 \pm 0.06$  deg), post-fast ( $-16.7 \pm 1.28$  deg)]. In addition, the peak ankle plantarflexion moments were reduced following the stroke [pre ( $-1.49 \pm 0.4$  Nm/kg), post-slow ( $-1.02 \pm 0.06$  Nm/kg), post-fast ( $-1.03 \pm 0.05$  Nm/kg)]. The peak knee extension moment was only greater in the post-fast condition (1.32 Nm/kg) compared with pre-stroke (1.05 Nm/kg). **Conclusion:** During the fast condition, the participant appears to be more similar to the pre-stroke condition at the ankle, but not at the knee. Similar ankle moments between fast and preferred walking post stroke, paired with the large increase in the post-fast knee extension moment show greater reliance on the knee joint while walking fast. This data is consistent in showing that the subject had to compensate at the knee during the post-slow and post-fast testing. The longitudinal nature of this study help confirm findings of deficits in other studies that compare to healthy able bodied individuals.

1480 Board #133 June 2, 9:00 AM - 10:30 AM  
**Effects Of A 8-week Pilates Exercise On Static And Dynamic Balance In Post Stroke Patients**

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Stroke is the leading cause of long term adult disability in United States and impaired walking function is a common neurological deficit following stroke. Even after extensive inpatient and outpatient therapy only 60% of stroke survivors are able to walk independently. Furthermore, many continue to exhibit poor static and dynamic balance, which adversely impacts walking ability, independence and quality of life. Therefore, effective interventions aimed at improving these features are critically important. Recently, Pilates exercise that combines strength and flexibility training has been reported to improve gait performance in healthy older adults populations. However, researchers have not applied Pilates exercise for rehabilitation of post stroke patients, perhaps due to the perceived complexity of the exercise.

**PURPOSE:** To evaluate the effectiveness of an 8 week Pilates program designed around the neuromechanical deficits observed post stroke on static and dynamic balance. **METHODS:** Nineteen post unilateral stroke patients (age:  $63.9 \pm 6.2$  yr, years since stroke:  $13 \pm 4.65$  yr) participated in this study. They were randomly divided into two groups (Pilates training group: PTG and control group: CG). PTG performed Pilates exercise 3 times a week over 8 weeks. Each session lasts 1 hour and includes 10

minutes rest in the middle of the session. Static and dynamic balance was measured in one week before training and one week after completing the training. Ground reaction forces and moments were collected using an instrumented treadmill and the center of pressure time series was computed and evaluated. Training effects were assessed using separate Group x Time repeated measures ANOVAs (critical  $p < 0.05$ ).

**RESULTS:** In this study, an 8 week Pilates exercise positively affected both static and dynamic balance for post stroke patients. PTG showed 26% and 34% improved static balance in A-P and M-L directions, respectively ( $p < 0.05$ ). PTG also revealed that dynamic stabilities in A-P and M-L directions for both of the paretic and nonparetic foot were significantly improved 15% ~ 22% after training ( $p < 0.05$ ). **CONCLUSION:** The findings of this study provide initial evidence that a modified Pilates exercise can enhance post stroke static and dynamic stability in chronic patients.

1481 Board #134 June 2, 9:00 AM - 10:30 AM  
**Neural Control Of Posture In Individuals With A Post-concussion Syndrome**

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(No relationships reported)

**PURPOSE:** Postural instability has been shown to characterize individuals who suffered from long-term symptoms after mild traumatic brain injury (mTBI). However, recordings of neural processes during postural control are difficult to realize with standard neuroimaging techniques. Previous research revealed that functional NearInfraRed Spectroscopy (fNIRS) offers a reliable tool to investigate neural correlates of sustaining post-concussive symptoms. Since the frontal cortex critically subserves cognitive processes during postural control, we used fNIRS to investigate brain oxygenation in the frontal cortex of individuals with a (mild) post-concussion syndrome (PCS) during postural control tasks.

**METHODS:** We compared neuronal and kinematic parameters during postural control in three groups: individuals suffering from post-concussion syndromes ( $n=7$ ), individuals with a history of mTBI but without PCS ( $n=13$ ), and healthy controls ( $n=10$ ). Individuals were investigated during postural control tasks with 6 different conditions: (i) eyes opened, (ii) eyes closed, and (iii) blurred visual input, each while standing (a) on a stable and (b) an unstable surface. Cerebral activity in the frontal cortex was measured bihemispherically in 16 fNIRS channels. A force plate system was applied to investigate kinematic parameters.

**RESULTS:** In all groups, during the eyes closed / unstable surface condition as compared to the other conditions, the postural sway increased as well as the brain oxygenation in frontopolar / orbitofrontal areas of the right hemisphere. In that condition, as compared to the other two groups, subjects with PCS showed higher muscular efforts to keep balance. Furthermore, the PCS group showed a significantly greater activation in frontopolar / orbitofrontal areas of the right hemisphere as compared to the control group.

**CONCLUSIONS:** As PCS subjects needed more muscular effort to control balance, we propose that with regards to cognitive processes the increase of cerebral activation in these individuals indicates an increase of attentional processes during postural control in altered environments.

1482 Board #135 June 2, 9:00 AM - 10:30 AM  
**Effect of Vestibular Stimulation Exercises on Balance in Children With Down Syndrome**

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Children with Down Syndrome (DS) are delayed in motor development and coordination which contributes to poor balance. Purpose: The aim of this pilot study was to investigate whether the use of vestibular stimulation exercises would influence balance in children with DS. Methods: The study group consisted of 10 (6 male, 4 female) children ( $9.9 \pm 2.846$  years) with DS. Eight subtests of the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) were used for pre and post-testing focusing on measures of bilateral coordination, balance, running speed and agility, upper limb coordination, and strength. The intervention, the vestibular stimulation exercises, consisted of 15 exercise stations performed 2 times per week for 6 weeks. A trained instructor accompanied each subject during participation to reduce risk of injury. Results: Results indicated significant improvements in upper limb coordination ( $p=.013$ ), speed and agility ( $p=.001$ ). Conclusion: An early intervention that utilizes vestibular stimulation exercises may improve balance in children with Down Syndrome. Possible implications of improved balance include the ability to participate in an appropriate program for the long term which may in turn impact the ability to stand for prolonged periods of time at work or participate in organized sport.

1483 Board #136 June 2, 9:00 AM - 10:30 AM  
**Medio-Lateral Postural Control Instability Is Associated To Proprioception Deficiencies In Children With Mild Autism**

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Children diagnosed with Autism Spectrum Disorder (ASD) could exhibit postural control instability related to proprioception (PRO) and vestibular (VE) deficiencies. However, it is not very clear which system is affected the most, and the direction the instability is expressing; a medio-lateral (ML) or antero-posterior (AP) direction. PURPOSE: Assess which system (VE or PRO) has the greater impact in postural instability, and identify the direction in which this instability is displaying in children with ASD. METHODS: Postural stability was measured in 9 children with mild autism (8 male, 1 female, aged 8.7 ± 1.4 years old). Center of pressure (COP) and sway (ML and AP) were evaluated [in centimeters, (cm)] during eight sensory conditions that challenge PRO and VE systems on a pressure mat. We divided and compared our eight sensory conditions in four groups for each variable of interest to achieve our objectives. RESULTS: An ANOVA analysis was conducted to compare COP and sways within eyes open (EO), eyes closed (EC), eyes open head up/down (EOHUD), eyes closed head up/down (ECHUD) and all the aforementioned on an unstable surface (MAT). COP (cm) results showed a significant difference among the conditions evaluating the VE system, only in half of the comparisons (EOMAT=41±39/EOHUDMAT=102±79, P≤.05) and ECMAT=40±38/ECHUDMAT=99±13, P≤.05) and all the conditions assessing the PRO system (EO=7±7/EOMAT=41±39, EC=8±9/ECMAT=40±39, EOHUD=13±7/EOHUDMAT=102±79 and ECHUD=16±14/ECHUDMAT=99±55, P≤.05 for all). Sway data (cm) reveal significant alteration in one of four associations for VE system (ECMAT=5±4/ECHUDMAT=12±6, P≤.001) and half for PRO (EOHUD=6±3/EOHUDMAT=11±6, P≤.05 and ECHUD=7±5/ECHUDMAT=12±6, P≤.01) systems in the AP direction. Furthermore, ML (cm) results exhibited significant difference only for the PRO system in all the comparisons (EO=4±4/EOMAT=11±6, EC=3±1/ECMAT=12±4, EOHUD=5±3/EOHUDMAT=15±5 and ECHUD=4±2/ECHUDMAT=15±5, P≤.01 for all). CONCLUSIONS: It appears that the PRO system is more affected than the VE system, thus the impact on postural control is higher for the former. Likewise, children with ASD showed greater instability in a ML direction when the PRO system is challenge and in a lesser extent in the AP direction when the PRO and VE are altered.

1484 Board #137 June 2, 9:00 AM - 10:30 AM  
**Gait Pattern Evaluations of Children with Burns Compared to Age-Matched, Nonburned Pediatric Subjects**

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Muscle catabolism and burn scar contracture are common sequelae following thermal injuries in pediatric patients which may affect patients' gait patterns. PURPOSE: Compare ambulation patterns of children with LE burns to age-matched, non-burned pediatric subjects. METHODS: Ambulation testing was conducted on 12 children with LE burns (Mean burn surface area > 30%) and 12 non-burned subjects. Subjects' were age matched (mean age = 12±3 years). Testing was performed on the GaitRite<sup>®</sup> pathway and this equipment captured data on the following components: Mean Normalized Velocity, Step Length Difference, Step Time Difference, and Base Support. These values were evaluated using a one way ANOVA. RESULTS: There were significant differences in the general model (P < 0.001) and post-hoc Newman-Keuls Multiple Comparison tests showed the greatest differences were in the Mean Normalized Velocity (leg length/sec) where children with LE burns were 50% slower (3.89 ± 1.4 in/sec vs. 2.5 ± 0.8 in/sec; P = 0.001) and their Step Length Difference was 317% greater for the children with burns (mean 5.04 ± 4in vs 1.6 ± 1in; P = 0.027). DISCUSSION: This study demonstrates that gait patterns of children with LE burns are less symmetrical and slower, perhaps in order to maintain stability. Ambulation performance can be used in future studies to measure changes and effects following gait improvement exercises for burned patients. CONCLUSION: There was a significant difference in functional ambulation performance scores of children with LE burns vs. children without burns, and this reflects the need for gait-improving interventions for children with LE burns.

Movement	Children with Burns		Children without Burns		P value	T value
	Mean	SD	Mean	SD		
Normalized velocity (leg length/sec)	2.58	0.77	3.88	1.4	0.0101	2.814
Step Length Difference (inches)	5.04	4.9	1.59	1.1	0.0026	2.37
Step Time Difference (sec)	0.035	0.025	0.008	0.005	0.0014	3.66
Base Support	9.82	1.99	9.54	2.73	0.7671	0.299

1485 Board #138 June 2, 9:00 AM - 10:30 AM  
**Comparison of Balance Between Young Adults With and Without Hearing Impairment**

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Damaged vestibular system is one of the major causes of hearing impairment (HI), affects 1 to 6/1000 newborns in the United States, and is associated with balance impairment. Balance deficits may interfere with the development of motor skills. Studies have shown that balance in children with HI improves until adolescence. Few studies have investigated whether balance is impaired in young adults with HI and there results are inconsistent. PURPOSE: To compare balance between young adults with and without HI. METHODS: A total of 35 participants with HI and 35 control participants without HI (25.5 ± 3.56 years) were recruited for this study. Balance outcomes were assessed by using computerized dynamic posturography and long forceplate (NeuroCom International, Clackamas, OR, 2010). Balance tests included sensory organization test (SOT), motor control test (MCT), adaptation test (AT), and unilateral stance (US). Independent T-tests were used to analyze differences in balance between young adults with and without HI. RESULTS: The study is ongoing and to date 16 participants have completed the study. Significant differences were found in the SOT composite score between those with and without HI (HI: 67± 13.62; Control 79.75± 7.30; p<.05). When the tests required the use of the vestibular system to maintain balance, the results indicate significant impairment for participants with HI. This was evident when balancing on an unstable surface with eyes closed [EC] (HI: 46.96 ± 25.66; Control: 67.62 ± 11.38) as well as balancing on an unstable surface with incorrect visual information (HI: 37.29 ± 26.04; Control: 69.95 ± 15.51). A significant difference was also found in the single leg stance EC condition on both legs. The participants with HI showed significantly higher sway velocity (degree/sec) during EC conditions (LF: 4.92 ± 0.67; RT: 6.79 ± 2.85), which indicates unstable balance compared to controls. No difference was found between the two groups for the MCT and AT. CONCLUSION: The results showed that there are differences between young adults with and without HI. When a test required the use of the vestibular system, the balance of participants with HI was less stable compared to adults without HI.

1486 Board #139 June 2, 9:00 AM - 10:30 AM  
**Gait Adaptation Following Task-specific Locomotor Training In An Individual With Incomplete Spinal Cord Injury**

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Gait adaptation may be assessed in individuals with incomplete spinal cord injury (iSCI) by measuring center of pressure (COP) and ground reaction force (GRF) during stance phase. Force distribution and COP displacement may be indicators of improved walking. Variability of these measures may change over time as new motor strategies are adopted. PURPOSE: To characterize changes in GRF, COP mediolateral displacement (COP<sub>ML</sub>) and their variabilities in an individual with iSCI after 15 weeks of task-specific locomotor training (LT). METHODS: Pressure mapping insoles were placed in the shoes of a 20 year old male with iSCI (C4-C5, ASIA C, BMI 20.4, >1 year post injury) capable of step initiation and independent standing. COP and GRF for each limb during 10m overground unassisted walking were compared before and after 15 weeks of LT with movement drills based on components of the gait cycle (2 sessions/wk, 90 min/session). Data were interpolated over each step so that resultant means and standard deviations were determined at each 1% of stance phase. 95% confidence intervals of means and standard deviations were evaluated for GRF and COP. Force was normalized to the highest foot force over the entire trial.

**Results:** Before training, right GRF was greater than left over 88% of stance phase. After LT, asymmetry reduced to 25% due to increased loading of the left foot over 85% of stance phase. Force variability over left and right foot increased over 53% and 38% of stance phase, respectively. GRF changes were most pronounced during midstance. COP<sub>ML</sub> asymmetry, was present over 44% before training and 27% after, with a lateral shift of the left COP<sub>ML</sub> over 87% of stance phase and an increase in mediolateral (ML) excursion. COP<sub>ML</sub> variability of the left and right foot increased over 53% and 50% of stance phase, respectively, with the greatest change at mid to late stance.

**Conclusion:** 15 weeks of LT led to improved symmetry of force and COP<sub>ML</sub> excursion through stance phase in this individual. Increased symmetries are an indicator of gait adaptation and with increased variability, point toward motor learning. Increases in variability of force and COP<sub>ML</sub> may suggest exploration of novel strategies for successful unassisted walking. Propensity toward midstance changes may also reflect early prioritization of learning in single limb stance.

1487 Board #140 June 2, 9:00 AM - 10:30 AM  
**Effect Of Variable Practice On The Motor Learning Process In Manual Wheelchair Propulsion**

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Handrim wheelchair propulsion is a cyclic skill that needs to be learned during rehabilitation. It has been suggested that a higher intra-individual variability benefits the motor learning process of wheelchair propulsion.

**Purpose:** The goal of the current study was to determine the effect of variable practice, in the form of wheelchair basketball and skills training, on the motor learning process of wheelchair propulsion in novice able-bodied participants. Motor learning was operationalized as improvements in mechanical efficiency (ratio of power output and energy expenditure) and propulsion technique.

**Methods:** 11 Participants performed a pre-test, 7 practice sessions and a post-test. During the practice sessions, participants performed one-hour of variable practice, consisting of five wheelchair-skill tests and a 30 min wheelchair basketball game. Pre- and post-test were performed in a wheelchair on a motor-driven treadmill (1.11 m/s) at a relative power output of 0.23 W/kg. Energy consumption and the propulsion technique variables were calculated.

**Results:** Comparison of the pre- and the post-test showed that variable practice resulted in a 27% relative increase in mechanical efficiency (4.5 ± 0.6 vs. 5.7 ± 0.7%, p<0.001). With regard to propulsion technique, the push frequency reduced (65.4 ± 12.3 vs. 57.8 ± 8.6 pushes/min, p=0.011), the contact angle of the hand with the handrim increased (67.0 ± 8.6 vs. 77.6 ± 9.1°, <0.001) and the braking torque at (de)coupling reduced (-1.1 ± 0.8 vs. -0.5 ± 0.4 Nm, <0.001). No significant changes were found for the positive work (9.0 ± 1.8 vs. 9.7 ± 1.8 J, p=0.369) and peak torque per push (12.5 ± 2.2 vs. 11.6 ± 1.9 Nm, p=0.084).

**Conclusion:** The present study showed that variable practice results in an increase in mechanical efficiency and an improvement in propulsion technique. Interestingly the large relative improvement in mechanical efficiency was concomitant with only moderate improvements in the propulsion technique, suggesting that other factors besides propulsion technique contributed to the higher efficiency. It may be that variable practice facilitated the exploitation of the dynamics of the task and improved coordination, which may have contributed to a less straining propulsion.

1488 Board #141 June 2, 9:00 AM - 10:30 AM  
**Intracortical Inhibition Associates with Quadriceps Voluntary Activation in Individuals with an Anterior Cruciate Ligament Reconstruction**

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Quadriceps strength is important for maintaining high physical function following anterior cruciate ligament reconstruction (ACLR), and deficits in voluntary activation (VA) lead to quadriceps weakness. ACLR individuals with deficits in quadriceps VA also demonstrate diminished corticomotor excitability, which reflects the balance of intracortical inhibitory and facilitatory activity. Therefore, specific alterations in intracortical inhibition and facilitation may be responsible for persistent deficits in quadriceps VA following ACLR.

**PURPOSE:** To determine if short interval intracortical inhibition (SICI), intracortical facilitation (ICF), and the SICI: ICF ratio associate with quadriceps VA in individuals with ACLR.

**METHODS:** Twenty-seven individuals (74% Female; 169±11cm; 73±19kg; 44±37 months post ACLR) with a history of a primary unilateral ACLR were enrolled into this cross-sectional study. All outcome measures were collected with the participant seated in an isokinetic dynamometer with the knee flexed at 90°. Paired pulse transcranial magnetic stimulation was used to assess SICI and ICF. SICI and ICF paradigms utilized two stimuli delivered at 80% and 120% of active motor threshold (AMT) at 3 and 15 msec apart, respectively. Motor evoked potentials (MEPs) elicited via SICI and ICF paradigms were then normalized to MEPs elicited at 120% of AMT. A reduction in SICI indicates greater inhibition, whereas an increase in ICF indicates greater facilitation. Quadriceps VA was evaluated with the superimposed burst technique and calculated via the central activation ratio (CAR). We used Spearman correlations (ρ) to evaluate associations between the non-normally distributed outcome measures (α = 0.05).

**RESULTS:** Greater inhibition (i.e. lower SICI) was associated with lower VA (ρ = .502, P = 0.008). A greater SICI: ICF ratio, indicating more inhibition relative to facilitation, was associated with lower VA (ρ = -.530, P = 0.004). ICF was not associated with VA (ρ = -.089, P = 0.661).

**CONCLUSIONS:** Reduced intracortical inhibition is associated with higher quadriceps VA in individuals with ACLR. Interventions that seek to reduce intracortical inhibition may improve VA in ACLR patients demonstrating persistent deficits in VA.

1489 Board #142 June 2, 9:00 AM - 10:30 AM  
**Postural Steadiness During Quiet Standing in Cancer Survivors and Age-Matched Controls**

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Loss of balance is a common side-effect of many cancer treatments; however, quantitative evidence of decreased stability in cancer survivors is lacking. The evidence for a loss of balance or decreased stability in this population is based on self-reports or qualitative observations. **PURPOSE:** To compare postural steadiness, based on center of pressure (COP) measures, between cancer survivors and a group of age-matched controls.

**METHODS:** Quiet standing was assessed in 34 cancer survivors (mass = 78.5 ± 19.5 kg; height = 1.62 ± 0.07 m; age = 54 ± 13 yrs) and 34 age-matched controls (mass = 72.8 ± 21.1 kg; height = 1.62 ± 0.08 m; age = 54 ± 15 yrs). Participants performed a single 30s trial under four conditions: 1) rigid surface with eyes open, 2) rigid surface with eyes closed, 3) compliant surface with eyes open, and 4) compliant surface with eyes closed. COP data were collected at 1000 Hz and resampled at 100 Hz for analysis. Root-mean squares (RMS) of the anterior-posterior (AP), and medial-lateral (ML) COP; mean velocities (VEL) of AP, and ML COP; 95% confidence ellipse area (95CE); and sway area of the COP trajectories were investigated. A mixed model three-way MANOVA (p<.05) with repeated measures was used to identify main effects and interactions of the group, surface, and vision conditions.

**RESULTS:** A group main effect (Λ<sup>\*</sup>= .80, F(6,61)=2.49, p=.032) and a surface by vision interaction (Λ<sup>\*</sup>= .72, F(6,61)=3.98, p=.002) were identified at the multivariate level. Follow-up univariate ANOVAs revealed that ML RMS, ML VEL, 95CE, and sway area were all greater in cancer survivors than the control group (p<.012). Thus, regardless of test condition, these measures all suggest that cancer survivors were less stable than controls. For example, RMS in the ML direction of the COP trajectory was ~60% greater in the cancer group compared with the control group during the rigid surface eyes open condition. Similar responses to changes in surface and vision conditions were observed for both groups. In general, COP measures increased significantly when the surface changed from rigid to compliant and when vision was removed.

**CONCLUSIONS:** Cancer survivors exhibited less postural steadiness than age-matched controls.

1490 Board #143 June 2, 9:00 AM - 10:30 AM  
**Spinal Reflex Excitability does not Associate with Persistent Muscle Inhibition after Anterior Cruciate Ligament Reconstruction**

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Persistent deficits in quadriceps voluntary activation affect muscle function following anterior cruciate ligament reconstruction (ACLR). Previous research has attributed

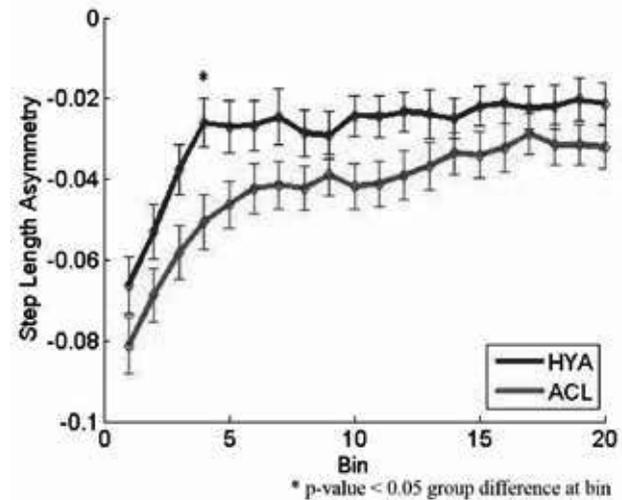
voluntary activation deficits to lower quadriceps spinal reflex excitability following acute knee effusion or injury. There is little evidence to indicate that spinal reflex excitability exists or influences persistent voluntary activation deficits in individuals with an ACLR. **PURPOSE:** To determine if quadriceps spinal reflex excitability in individuals with a unilateral ACLR differs between limb or compared to a control group. Additionally, we evaluated the ability of quadriceps spinal reflex excitability to predict full voluntary activation following ACLR. **METHODS:** One hundred and forty-seven individuals (74 ACLR and 73 controls) participated in this cross-sectional, case-control study. Quadriceps spinal reflex excitability was quantified using the Hoffmann reflex normalized to the maximal muscle response (H:M ratio). Quadriceps voluntary activation was evaluated with the burst superimposition technique and calculated via the central activation ratio (CAR). Separate 2x2 ANOVAs were used to compare differences between-limbs and between-groups for H:M ratio and CAR. From a receiver operating characteristic curve analysis, the area under the curve (AUC) was used to determine the accuracy of H:M ratio to predict full voluntary activation (CAR>0.95) in ACLR individuals. We determined the odds ratio (OR) of demonstrating full voluntary activation from spinal reflex excitability cutoff scores that maximized the sensitivity and specificity for predicting full activation. **RESULTS:** ACLR quadriceps H:M ratios were not different between limbs or compared to the control group (P>0.05). Quadriceps CAR was bilaterally lower in individuals with an ACLR compared to the control group (P<0.01), yet CAR did not differ between limbs. H:M ratio had poor accuracy for predicting ACLR participants exhibiting full voluntary activation (AUC=0.53, 95% CI=0.39,0.67; OR = 2.37, 95% CI=0.91,6.2). **CONCLUSIONS:** Spinal reflex excitability did not differ between limbs in individuals with ACLR or compared to controls. Quadriceps spinal reflex excitability has poor accuracy for predicting which ACLR individuals will demonstrate a CAR>0.95.

1491 Board #144 June 2, 9:00 AM - 10:30 AM  
**Altered Reciprocal Inhibition as a Cause of Hamstring Injury**  
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**PURPOSE:** To determine if tight hip flexor muscles could increase risk of hamstring injury (HSI). Hamstring injuries make up between 12-35% of all sport related injury, and are the most common muscular injuries in athletes. Traditionally, HSI has been related to short hamstring muscles, or an imbalance in strength between hamstring and quadriceps muscle groups. The more recent concept of synergistic dominance links HSI to chronically tight hip flexor muscles, which may inhibit the Gluteus Maximus through a change in the mechanism of reciprocal inhibition, causing the hamstring to take on greater loads during hip extension. There appears to be limited research on this proposed mechanism of HSI. We hypothesized that if this concept holds true, then athletes with tight hip flexors should have an increased rate of HSI.  
**METHODS:** 147 CSULA athletes were screened for hip range of motion (ROM) pre-season using a standard Thomas Test (TT) to test hip flexor ROM, and an assisted straight leg raise (ASLR) to test hip extensor ROM as a comparison. Subjects were monitored by the CSULA Athletic Training Center through their competition season for HSI. A non-parametric chi-square analysis was performed to determine if a significant difference existed between expected and actual rate of HSI in positive TT vs. negative TT athletes.  
**RESULTS:** 147 subjects, with 18 hamstring strains. A similar rate of injury was found between positive TT and negative TT subjects: 13.7% percent of +TT and 14% -TT subjects sustained HSI. A Chi Square Test for Independence showed that the rate of hamstring injury did not differ based on hip flexor ROM ( $\chi^2 = 0.024$ ,  $p = 0.99$ ,  $df = 1$ ,  $cv = 3.841$ ). In contrast, 4% of subjects who tested positive for moderate to severe hip extensor (hamstring) tightness (2+HST) and 17% of those who did not have 2+HST sustained hamstring injuries, a significant difference ( $\chi^2 = 5.54$ ,  $p = 0.016$ ,  $df = 1$ ,  $cv = 3.841$ ). When comparing subjects by gender, a significant effect was found with females ( $p = 0.012$ ), but not with males ( $p = 0.23$ ).  
**CONCLUSIONS:** There does not appear to be a relationship between tight hip flexors and increased risk of hamstring injury. There may be a connection between moderate to severely tight hamstrings and a decrease in hamstring injury rate, particularly for female athletes.

1492 Board #145 June 2, 9:00 AM - 10:30 AM  
**Differences in the Rate of Locomotor Adaption of Anterior Cruciate Ligament Reconstructed Individuals**  
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Even after ACL reconstruction and extensive therapy neuromuscular function and gait impairment often persists. These abnormalities and asymmetries may place individuals at risk for reinjury and degenerative joint disorders. These lingering deficits may arise because of reduced abilities to adapt the locomotor system following ACLR.  
**PURPOSE:** To investigate the locomotor adaptive capabilities of individuals who have undergone an ACLR.  
**METHODS:** We imposed novel locomotor constraints on a group of 20 ACLR individuals and 20 age-matched healthy young adults (HYA) by having them walk on a split-belt treadmill where one belt moved at twice the speed of the other belt (1.5 m/s:0.75 m/s) and then again in the opposite configuration. We collected motion capture data to determine spatiotemporal parameters during the first 200 strides of the adaptation period. The adaptation period was divided into 20 epochs containing ten consecutive strides. Step length asymmetry was determined for each stride and then the rate of adaptation of step length asymmetry was compared between groups by comparing (SLA) during each epoch using a repeated measures ANOVA.  $SLA = (Fast-Slow)/(Fast+Slow)$   
**RESULTS:** There was a significant ( $p$ -value < 0.05) overall group by epoch interaction and post hoc comparisons show that the ACLR individuals (Mean±SE, -0.051±0.07) have greater persisting SLA at the fourth epoch as compared to HYA (-0.029±0.07).  
**CONCLUSIONS:** Our results indicate that ACLR individuals may require more practice to adapt to locomotor perturbations than healthy controls. Future research in characterizing the mechanisms that underlie these differences in the rate of adaptation could be important for designing rehabilitation strategies.



1493 Board #146 June 2, 9:00 AM - 10:30 AM  
**Measurement Properties Of Postural Orientation Errors During Functional Tasks in Patients With Acl Injury**  
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**BACKGROUND**  
 Visual rating of postural orientation, i.e., the ability to stabilize body segments in relation to each other and the environment, is increasingly used for assessing sensorimotor deficiency after knee injury. Altered postural orientation in tasks resembling daily or sport activities appear to be more common in people with knee injury compared with controls. A test battery including tasks of varying difficulty would be helpful in the assessment of deficiencies and in the evaluation of treatment.  
**PURPOSE**  
 To evaluate measurement properties of a new test battery to assess postural orientation in patients with anterior cruciate ligament (ACL) injury.

**METHODS**

51 participants (23 women) with ACL injury performed 7 functional tasks, resembling daily or sport activities: mini squat (MS), single-leg mini squat (SLS), stair ascending (SA), stair descending (SD), forward lunge (FL), drop-jump (DJ) and single-leg hop for distance (SLHD). Postural Orientation Errors (POEs) of the lower extremity (LE), arm and trunk were assessed on-video and scored on a 4-point ordinal scale from 0 (no POEs) to 3 (major POEs) by two skilled physical therapists. The COSMIN guidelines were applied for determining measurement properties.

**RESULTS**

**Interpretability:** Floor effects (>80% scoring 0) were seen for arm displacement in SA and SD, trunk displacement in FL, and reduced LE flexion on landing in hop tasks. **Internal consistency:** Cronbach's alpha ( $\alpha$ ), calculated for the overall POE score within each of the 7 tasks, ranged from 0.209 to 0.857. MS, SA and DJ were excluded from further analysis based on low  $\alpha$  ( $\leq 0.478$ ). Arm displacement was excluded in 2 tasks based on 2 criteria; low inter-item correlations (SLS: 0.017, FL: 0.544) and higher  $\alpha$  when removed (SLS: 0.692, FL: 0.904). **Inter-rater reliability:** Moderate to almost perfect agreement ( $k=0.429-0.875$ ) was seen for each POE, and the overall POE score, within each task.

**CONCLUSION**

The final test battery, including SLS, SD, FL and SLHD, and the POEs foot pronation, knee medial to foot position, hip and trunk displacements, showed adequate internal consistency and at least moderate inter-rater reliability. This test battery will be used in further studies to determine construct validity and responsiveness.

1494 Board #147 June 2, 9:00 AM - 10:30 AM

**The Effect of Repeated Soccer Ball Heading on Cortico-spinal Excitability and Inhibition**

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Postural control has been shown to decline following a bout of soccer ball heading, although mechanisms underlying this impairment remain unclear. Repetitive sub-concussive head impacts (RSHI) may disrupt cortico-spinal pathways to trigger these changes, however, no data exists.

**Purpose:** To establish the effect of RSHI on cortico-spinal excitability and inhibition by repeated soccer ball heading. **Methods:** Twenty healthy male and female soccer players were recruited for baseline and subsequent post intervention measures. Following a familiarization session (Day 1), participants reported to the laboratory on 4 separate occasions. During Day 2, baseline measures for cortico-spinal excitability and inhibition were recorded using Transcranial Magnetic Stimulation; motor evoked potential amplitude (MEP; excitability) was measured during an isometric contraction at 20% of maximal voluntary contraction (MVC), whereas cortico-silent period (CSP; inhibition) during 100% MVC. Postural control was also measured. Participants then headed machine-projected soccer balls at controlled speeds (20-30 mph) towards a target. Each participant headed 20 balls, directing 10 to left and then right to respective targets. Baseline measures were repeated immediately post, 24h (Day 3), 48h (Day 4) and 2 weeks (Day 5) following heading. **Results:** Baseline CSP of Rectus Femoris was 117.8  $\pm$  4.6 ms, which then increased by 4% to 123.1  $\pm$  4.0 ms ( $p < 0.05$ ), immediately following ball heading and returned to baseline (119.9  $\pm$  4.5 ms) by 24h and remained there for the following 2 weeks. Whereas MEP amplitude remained unchanged across time and postural control improved over the first 3 days ( $p < 0.05$ ) and then returned to baseline by 2 weeks post heading. **Conclusion:** RSHI increased cortico-spinal inhibition, but without concurrent reduction in excitability. The likely reason for the lack of responsive excitability decline is from the low contractile forces (20% MVC) used for this measurement, which would have used a smaller proportion of the motor unit pool (early recruited motor units) than that of the inhibitory measurement (100% MVC). This may also explain why RSHI unaffected postural control as it is typically the early recruited units that govern this, not the later recruited ones. However, further research is needed to establish this.

1495 Board #148 June 2, 9:00 AM - 10:30 AM

**Variability Structure Measures Differ Between Uninvolved and Tendinopathic Limbs; Typical Kinematic Measures Do Not**

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(No relationships reported)

Studies have shown decreased kinematic variability (standard deviation magnitude) in those with overuse & recurrent injury, but have not examined the structure of this variability. **PURPOSE:** A case study to explore if joint-level structure of kinematic variability in the involved (IL) & uninvolved (UL) limbs differs in a subject with unilateral Achilles tendinopathy (uAT). **METHODS:** 1 uAT male (34y/o) hopped (unipedal) at 2Hz for motion capture. Stance phase was divided into propulsive and weight acceptance sub-phases, each split into 4 bins (Q1-Q4). Uncontrolled manifold analysis (UCM) was used to quantify variance structure in the space of kinematic variables (sagittal plane foot-to-floor, ankle & knee intersegmental angles) with respect to performance (vertical limb length) stabilization. Task-irrelevant ( $V_{UCM}$ ) & task-relevant ( $V_{ORT}$ ) variance, and the normalized difference between them (IMA) are reported. Averaged kinematic data were compared at each time-point with paired t-tests.  $V_{UCM}$ ,  $V_{ORT}$  & IMA were compared across stance with paired t-tests. **RESULTS:**  $V_{UCM-UL} > V_{UCM-IL}$  ( $p = 0.02$ ).  $V_{ORT-UL}$  &  $V_{ORT-IL}$  did not differ ( $p = 0.17$ ).  $IMA-UL > IMA-IL$  ( $p = 0.002$ ). There were no differences in ankle or knee intersegmental angles between IL & UL at any time-point of stance ( $0.07 \leq p \leq 0.98$  ankle,  $0.08 \leq p \leq 0.89$  knee). **CONCLUSION:** Differences between IL & UL of a uAT subject was detected by UCM, but missed by typical kinematic measures. Greater exploitation of  $V_{UCM}$  indicates adaptive stabilization of vertical limb length across hopping trials in the UL. This promising analysis provides a window into the motor control strategies of individuals, and possible insights into why some develop tendinopathies while others do not.

UL		$V_{UCM} (x10^{-3})$		$V_{ORT} (x10^{-3})$		IMA ( $x10^{-1}$ )	
		IL	UL	IL	UL	IL	UL
Propulsive	Q1	1.5	1.6	0.4	0.6	9.0	8.1
	Q2	2.1	1.4	0.7	0.5	8.3	7.8
	Q3	5.0	2.8	1.6	0.9	8.7	8.9
	Q4	10.3	8.2	6.2	6.4	5.0	3.2
Weight Acceptance	Q1	8.6	5.0	4.8	3.6	5.1	3.2
	Q2	5.7	2.9	1.3	0.8	10.6	9.3
	Q3	2.0	2.0	0.4	0.7	10.4	8.0
	Q4	1.3	1.7	0.3	0.6	10.2	8.2

**C-36 Free Communication/Poster - Neuromuscular Control**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
Room: Exhibit Hall A/B

1496 Board #149 June 2, 8:00 AM - 9:30 AM

**Post Activation Potentiation in Upper and Lower Extremities**

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(No relationships reported)

Post-Activation Potentiation (PAP) occurs when muscular performance during a fast, powerful movement increases due to a prior high force contraction. Previous researcher has found PAP in the lower extremity (LE) when a vertical jump is performed immediately after a set of heavy back squats. Yet, there has been limited observation of PAP in the upper extremity (UE). **PURPOSE:** To determine whether performing PAP exercises in the UE will be equally effective as in the LE. **METHODS:** 15 resistance trained men (age = 21.8  $\pm$  1.5 y, height = 1.81  $\pm$  0.1 m, body mass = 89.3  $\pm$  8.9 kg) had their one repetition maximum (1RM) back squat and bench press (153.7  $\pm$  27.9 kg and 117.9  $\pm$  19.9 kg, respectively) determined for proper load to activate PAP effects. On a subsequent day subjects performed fast, powerful movements pre- and post PAP enhancing resistance exercises (3 repetitions at 80% 1RM), which included vertical jump pre & post a back squat (LE) and bench press throw on smith-machine pre & post a bench press (UE). Force data of these performance exercises were collected

using a force plate and peak force and center of mass velocity and power were measured pre- and post-PAP exercises for comparison. Significance was determined using a paired t-test. **RESULTS:** Peak force increased pre- to post-PAP exercises in both LE and UE, yet neither was significant (LE: 1863.3±212.2 N vs 1931.3±323.1 N, p=0.11; UE: 1829.5±292.3 N vs. 1841.5±253.9 N, p=0.73, respectively). There were no significant PAP improvements in performance in the LE or UE. **CONCLUSION:** Because majority of participants did not show PAP, there was no overall significance in the study. Some subjects exhibited positive PAP effects in both LE and UE, while others exhibited a decrease in performance. This corroborates several other studies that have noted PAP "responders" and "non-responders" potentially due to differences in training status or fiber type distribution patterns.

1497 Board #150 June 2, 8:00 AM - 9:30 AM  
**Power-Velocity Relationship of Skeletal Muscle Evoked by Cycle Ergometry**

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 (No relationships reported)

Power (work/time), the product of strength and speed, is a muscle property with profound influence over physical performance. Muscle power varies as a function of force and contraction velocity, and is commonly measured with Wingate, jumping or sprinting tests. The power-velocity relationship (PVR) of skeletal muscle has been studied primarily in-situ, and data reveal an essentially parabolic relationship; peak power is produced with resistances which restrain the contraction to about half of maximum unloaded velocity. In-vivo power-velocity relationships have been studied less, and likely have greater practical applications to human movement. **PURPOSE:** To measure in-vivo cycle ergometry power over a spectrum of resistance and rpm; plot the PVR; assess the influence of muscle fatigability on maximum unloaded rpm (maxrpm), peak power achieved at any resistance (PP), PP to lean body mass (LBM) ratio (PPLBM), and absolute (AR) and relative (% maxrpm) (RR) rpm at which PP was produced. **METHODS:** 28 moderately-trained male subjects provided informed consent, were familiarized with testing procedures, and divided into fast- (FF) and slow-fatiguing (SF) groups using a Thorstenson Test. Thirteen 6s Wingate Tests separated by 3min rest were performed with zero resistance and then 85 to 195 g·kg<sup>-1</sup> LBM in 10g increments. Testing order was randomized over two testing sessions. Descriptive statistics were calculated for subject characteristics and maxrpm, PP, PPLBM, AR, and RR. Independent t-tests with Bonferroni corrections were used to compare dependent variables between the FF and SF groups. Mean power was plotted against mean rpm at each resistance to generate a power-velocity curve. **RESULTS:** The FF and SF groups were nearly identical in maxrpm (196,199), PPLBM (15.4, 15.9 W·kg<sup>-1</sup>LBM) and RV (57%, 58%). AV was notably but non-significantly higher in SF (117 rpm) compared with FF (109 rpm). The power-velocity curve exhibited two distinct peaks (115 and 145 g·kg<sup>-1</sup> LBM), suggesting two offset overlapping parabolas. **CONCLUSION:** Traditional 30-s Wingate Tests underestimate PP; resistances of 115 or 145 g·kg<sup>-1</sup> LBM appear necessary to evoke PP. Muscle fatigability was unrelated to PPLBM and RV, but may influence AV. The in-vivo PVR exhibited two peaks, one more influenced by velocity, the second more influenced by force.

1498 Board #151 June 2, 8:00 AM - 9:30 AM  
**Type I Myosin Heavy Chain Expression Influences Motor Unit Behavior of the Vastus Lateralis**

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 (No relationships reported)

**PURPOSE:** Differences in motor unit (MU) behavior as a result of chronic training have previously been reported. It is hypothesized that MU behavior is regulated by the physical properties of a muscle rather than the central nervous system. Thus, it has been suggested that differences in MU firing rates between training statuses were likely due to differences in the physical properties of the MU, such as, percent myosin heavy chain [%MHC] expression. No study has correlated MU control strategies during a voluntary contraction with MHC expression *in vivo*. **METHODS:** Twelve individuals (age = 20.91 ± 2.30 yrs, weight = 70.76 ± 14.47 kg) volunteered for this investigation. Participants performed 3 isometric maximal voluntary contractions of the leg extensors on an isokinetic dynamometer followed by an isometric trapezoid muscle action at 40% MVC. An electromyographic (EMG) sensor was placed over the vastus lateralis (VL). EMG signals were decomposed to extract action potentials and firing events of single MUs. Only MUs with > 90% accuracies were used for further analysis. Recruitment (REC) thresholds and mean firing rates (MFR) were calculated for each MU. MFR was calculated as the average value of the MFR trajectory during steady force. Subjects gave a muscle biopsy of the VL. Type I %MHC expression was determined by SDS-PAGE. Linear regressions were performed to determine the slopes

and y-intercepts of the MFR versus REC relationships. Pearson product-moment correlations were used to determine the relationship between type I %MHC expression with the slopes and y-intercepts. Alpha was set at 0.05. **RESULTS:** Pearson's product moment correlations were significant between the type I %MHC expression and the slopes (P = 0.001, r = 0.844) from the MFR versus REC relationships, but not the y-intercepts (P = 0.826, r = -0.071). **CONCLUSION:** Individuals with a greater percentage of type I %MHC expression had greater firing rates of the higher-threshold MUs at the targeted force level than individuals with a lower percentage of type I %MHC expression. It is plausible that the firing rates of the higher-threshold MUs are lower in individuals with greater percentages of type II MHC isoform content as a result of greater twitch forces. This study supported the hypothesis that the MU control scheme is regulated by the physical properties of the muscle.

1499 Board #152 June 2, 8:00 AM - 9:30 AM  
**Effects of Short-term Strength Training on Maximal Motor Unit Firing Rates and Antagonist Co-activation**

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 (No relationships reported)

Recent advancements in the decomposition of surface electromyographic (sEMG) signals enable the recording of a large sample of motor units across the recruitment threshold (RT) during a maximal voluntary isometric contraction (MVC). There is limited evidence regarding the effects of strength training (ST) on maximal motor unit firing rates (MUFRs) across the RT range (i.e., low- and high-threshold motor units). **PURPOSE:** To examine the effects of short-term unilateral ST on MUFRs and antagonist co-activation (ANT<sub>Co-A</sub>) in the trained (TL) and untrained leg (UL). **METHODS:** Thirteen healthy, males (TG; age = 22 ± 1.9 yrs.) who had not performed ST within the past 6 months performed 4 weeks of unilateral isokinetic ST. The ST was performed 3 times/week and consisted of 4 sets of 10 maximal concentric knee extensions at 45°·s<sup>-1</sup>. A control group (CG; n = 8, age = 23 ± 4.3 yrs.) performed the testing only. For both the TL and UL, sEMG of the vastus lateralis (VL) and biceps femoris were obtained during an MVC of the knee extensors before (pre) and after (post) ST. The sEMG signals for the VL were decomposed into their constituent motor unit action potential trains and MUFR (pulses per second) and RT (%MVC) were calculated. Linear regression was applied to the pooled data to examine the relationship between MUFR and RT. The slope and y-intercept coefficients for pre and post were compared for the TG and CG separately. Paired samples t-tests were used on the slope and y-intercept coefficients as well as peak torque (PT) and ANT<sub>Co-A</sub> to examine changes from pre to post. **RESULTS:** All dependent variables remained unchanged for both legs from pre to post in the CG (p > 0.05). The TG exhibited a 28% (p < 0.001) and 14% (p = 0.006) increase in PT for the TL and UL, respectively. There were no training induced changes in either the slope (p = 0.474-0.275) or y-intercept (p = 0.974-0.328) of the linear regression for either leg. ANT<sub>Co-A</sub> remained unchanged for both the TL and UL (p = 0.432 and p = 0.503, respectively). **CONCLUSION:** The present study revealed that a training induced increase in PT was not accompanied by changes in MUFRs or ANT<sub>Co-A</sub> for either the TL or UL. While it is possible that other factors (i.e., hypertrophy) accounted for the strength gain in the TL, the mediating factors for the UL are less clear.

1500 Board #153 June 2, 8:00 AM - 9:30 AM  
**Acute Effects of Vibration on Recruitment Threshold versus Peak Firing Rate Relationship during Isometric Contraction**

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 (No relationships reported)

**PURPOSE:** This study examined the acute effects of vibration (VIB) on motor unit (MU) behavior of the vastus lateralis (VL) during 40% maximal voluntary contraction (MVC). **METHODS:** Five males (age= 22.0±2.4 yrs) and three women (age=20.7±3.1 yrs) volunteered for this study. An electromyographic (EMG) sensor was placed over the VL. Participants performed 3 isometric MVCs followed by isometric trapezoid muscle actions at 40% MVC (CON). Procedures were performed twice separated by 3-5 days. VIB was then applied at 55 Hz, to the patella tendon for 10 min. prior to testing and continued throughout the remainder of testing, including a 40% MVC (VIB) at the same absolute force as the 40% CON. Decomposition techniques were applied to the EMG signals to extract action potentials and firing events of single MU. Only MUs decomposed with accuracies >92% were included for analysis. Linear regressions were performed on the MU recruitment threshold (REC) vs. peak firing rate (PFR) relationships during the first, middle, and final sec of the steady force segment for each subject. Slopes and y-intercepts were calculated for each subject and time point. Two separate 2-way repeated measures ANOVAs (treatment [CON vs. VIB] x time [first vs. middle vs. final sec]) were used to examine possible differences among

y-intercepts and slopes. When appropriate, follow-up analyses for the ANOVA models were performed using paired samples t-test with Bonferroni corrections. The level of significance was set at  $P \leq 0.05$ .

**RESULTS:** The analyses for the y-intercepts indicated that there was no 2-way interaction ( $P = 0.681$ ) and no main effect for time ( $P = 0.803$ ), however, there was a main effect for treatment ( $P = 0.047$ ). The y-intercepts were greater for the VIB ( $29.49 \pm 1.74$  pps) than CON ( $26.49 \pm 1.83$  pps). The analyses for the slopes indicated no 2-way interaction ( $P = 0.684$ ) or main effects for time ( $P = 0.729$ ) and treatment ( $P = 0.055$ ).

**CONCLUSIONS:** The firing rates of the motoneuron pool were greater during VIB than the CON at the same absolute force. Thus, supporting the hypothesis that muscle spindles provide inhibitory effects on MU firing rates. When Ia afferent feedback from muscle spindles is removed the firing rates of the motoneuron pool increase. In addition, there was no time-dependent alterations in the REC vs. PFR relationships as a function of VIB.

1501 Board #154 June 2, 8:00 AM - 9:30 AM  
**Spinal Reflex Excitability and Homosynaptic Depression Following Bouts of Whole-Body Vibration of Varying Frequencies.**

William J. Armstrong, Tiffany J. Garcia, Eyka W. Brill, Jake D. Reynolds, Joshua J. Salvador, Cesar Velazquez-Mosqueda, Waylon K. Silva. *Western Oregon University, Monmouth, OR.*  
 (No relationships reported)

**PURPOSE:** The present pilot study sought to determine the time-course of changes in spinal reflex excitability (H-reflex) and homosynaptic depression (HD) in the medial gastrocnemius (MG) and soleus (SOL) muscles following 1-min of whole-body vibration (WBV) at varying frequencies (35, 40, 45, and 50 Hz). **METHOD:** Six college-aged participants (4M/2F) having no indicated neurological defects, history of lower extremity surgery, or lower extremity injury for 12 months prior to the study participated. A partial H-M recruitment curve was recorded until the test reflex intensity (10% of the maximum M-wave) was identified. A paired pulse technique to assess HD consisted of two stimulations delivered with a 100-ms inter-stimulus interval. The first stimulus produced an unconditioned reflex response (H-reflex), and the second stimulus resulted in a conditioned response. The amount of HD is calculated as follows:

$\%HD = [1 - (\text{conditioned reflex response} / \text{unconditioned reflex response})] \times 100\%$   
 Ten paired stimulations were performed to determine the baseline. Post-vibration data (i.e., paired pulse stimulation at the test intensity were delivered every 15 second) were recorded for analysis as 1-min averages. Subjects stood relaxed with the feet shoulder-width apart and the knees slightly flexed on a TurboSonic (Hood River, OR) WBV platform for 1 min at the treatment vibration frequency (35-50 Hz, randomly ordered). The signals recorded, conditioned, normalized and processed for analysis using AcqKnowledge 4.0 (Biopac Systems, Inc., Santa Barbara, CA); repeated measures ANOVA ( $\alpha = 0.05$ ) and post-hoc paired t-tests ( $\alpha = 0.005$ ) were performed. **RESULTS:** Repeated measures ANOVAs showed significant effects for H-wave amplitude (H) for muscle, time, and muscle x time ( $p < 0.001$ ). There were no significant effects for HD. Post-WBV H for MG differed from baseline ( $p < 0.001$ ) at all time points. Post-WBV H for SOL differed significantly from baseline only at 1- ( $p = 0.007$ ) and 10-min ( $p < 0.001$ ). **CONCLUSION:** As a group, there are no suggested differences in H and HD following a 1-min bout of WBV. Individual responses, however, suggest that an acute bout of WBV is highly individual, and participants may respond differently to varying frequencies of vibration. These results warrant further study.

1502 Board #155 June 2, 8:00 AM - 9:30 AM  
**Reliability of Transcranial Magnetic Stimulation Measures**

Eli K. Edwards, Alia L. Yasen, Anita D. Christie. *University of Oregon, Eugene, OR.* (Sponsor: David Gabriel, FACSM)  
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 (No relationships reported)

Measurements of motor cortex inhibition and excitability can provide useful insights when assessing pathological damage as well as neuronal recovery from injuries.

**PURPOSE:** The aim of this study was to determine the reliability of single pulse transcranial magnetic stimulation (TMS) measures in men and women. **METHODS:** Nine (5 female) healthy college age participants were tested at three time points, each separated by one week. Single pulse TMS was delivered to the contralateral motor cortex of the dominant first dorsal interosseous. Resting motor threshold (RMT) and the peak-to-peak amplitude of motor evoked potentials (MEP) at 120% RMT were used to quantify motor cortex excitability. The duration of the cortical silent period (CSP), evoked at 120% RMT while participants maintained a contraction at 50% of maximum force, was used to quantify motor cortex inhibition. Reliability was assessed with the intraclass correlation coefficient (ICC 2,1). **RESULTS:** There was no significant difference across time ( $p=0.82$ ;  $p=0.83$ ;  $p=0.70$ ) or between sexes ( $p=0.83$ ;

$p=0.68$ ;  $p=0.36$ ) for RMT, MEP, or CSP, respectively. Also, there was no significant sex by time interaction ( $p \geq 0.34$ ) for any of the measures. Reliability across days was strong for RMT ( $R=0.69$ ), and very strong for MEP ( $R=0.87$ ) and CSP ( $R=0.95$ ). **CONCLUSIONS:** These results support the use of single pulse TMS measurements to reliably assess and track motor cortex physiological function in men and women.

1503 Board #156 June 2, 8:00 AM - 9:30 AM  
**Effects Of Current Amplitude And Pulse Duration Modulation On Neuromuscular Fatigue During Repetitive Electrical Stimulation**

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 (No relationships reported)

Neuromuscular electrical stimulation (NMES) is effective for preventing muscle atrophy. However, rapid muscle fatigue and discomfort during the stimulation are major obstacles for prolonged force production at moderate levels of force production which limit its use for functional purposes. Previous studies have shown that long stimulus pulse widths can reduce muscle fatigue. However only very low force levels (5-10% maximum voluntary isometric contraction (MVIC)) have been investigated. **PURPOSE:** To compare the effects of two different combinations of NMES parameters on the degree of muscle fatigue and pain during evoked repetitive isometric contractions of 25% MVIC. **METHODS:** Stimulating electrodes were placed over the right quadriceps of 8 males and 2 females ( $24 \pm 1$ ). The participant's MVIC was measured in a practice session performed at least 48 hours prior to the first test date. Two testing sessions were performed at least 48 hours apart and in random order. In the one session, a stimulus with a long pulse duration (1000  $\mu$ s) and a low current amplitude set (LL) to evoke a contraction force of 25% MVIC at 30 Hz was applied repetitively for 2 minutes. The participants rated their pain during the stimulation a scale of 0 to 10. The other test session followed the same protocol with the exception that a shorter pulse duration (200  $\mu$ s) and a high current amplitude set (SH) was used to produce 25% MVIC force at 30 Hz. Fatigue and pain comparisons were made using one-way ANOVAs with repeated measures. **RESULTS:** Percent muscle fatigue was significantly lower for LL than for SH ( $29.20 \pm 2.12$  vs.  $33.89 \pm 2.01$  %,  $p = 0.002$ ). The force recovery rate was significantly higher for LL than for SH ( $0.75 \pm 0.06$  vs.  $0.53 \pm 0.07$  N/5s,  $p = 0.019$ ). Pain scores were also lower for LL than for SH ( $4.38 \pm 0.83$  vs.  $5.75 \pm 0.49$ ,  $p = 0.033$ ). **CONCLUSION:** The use of longer pulse durations helps to reduce muscle fatigue and pain during NMES for moderate-level contractions of 25% MVIC.

1504 Board #157 June 2, 8:00 AM - 9:30 AM  
**Bilateral Facilitation During The Squat Jump Is Not Affected By Training State In College-aged Women.**

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 (No relationships reported)

Bilateral deficit in strength and power have been reported and several studies suggest that training state may impact the apparent deficit. **PURPOSE:** To investigate bilateral deficit during jumping in women. **METHODS:** Athlete (ATH,  $n=18$ ) and non-athlete (C,  $n=5$ ) women gave informed consent to participate in this university approved study. ATH included participants in intercollegiate sports (volleyball, soccer, and track and field) while C were physically active but not playing organized sports. Subjects completed repeat trials of a 2-leg (2L) and single-leg (1L; left and right leg) squat jump without countermovement while hands remained on hips. Data were averaged across trials. Jumps were conducted on individual force plates for 2L or singularly for 1L. Jump height was calculated from flight time (HtFT) determined with an infrared optical timing system and from jump impulse from ground reaction force. **RESULTS:** Height (ATH:  $178.2 \pm 4.9$  cm; C:  $163.3 \pm 4.4$  cm) and body mass (ATH:  $75.6 \pm 9.3$  kg; C:  $59.8 \pm 3.3$  kg) were greater in ATH, but ATH were younger (ATH:  $19.8 \pm 1.3$  yrs; C:  $23.0 \pm 1.2$  yrs). 2L HtFT (ATH:  $27.6 \pm 0.5$  cm; C:  $27.3 \pm 0.5$  cm) and 1L HtFT (left & right: ATH:  $12.9 \pm 0.3$  &  $12.8 \pm 0.3$  cm; C:  $12.0 \pm 0.4$  &  $12.7 \pm 0.4$  cm, respectively) were not different between groups ( $p > 0.05$ ) with 2L being greater than either 1L jump ( $p = 0.001$ ). To accomplish the same 2L jump impulse both groups produced a greater jump impulse in one leg (ATH:  $90.7 \pm 12.2$  N; C:  $81.1 \pm 15.2$  N) vs the other leg (ATH:  $73.7 \pm 13.9$  N; C:  $59.6 \pm 11.9$  N;  $p = 0.01$ ). This greater leg jump impulse during 2L was similar to that observed in the same leg during 1L (ATH:  $112.3 \pm 25.3$  N,  $p = 0.63$ ; C:  $84.8 \pm 18.1$  N;  $p = 0.81$ ). In contrast, the jump impulse of the other leg during 2L was less than that observed in the same leg during 1L (ATH:  $106.0 \pm 16.4$  N; C:  $116.0 \pm 33.1$  N). 2L jump height calculated from jump impulse overestimated (ATH:  $34.1 \pm 1.1$  cm, C:  $40.1 \pm 1.3$  cm) and underestimated (ATH:  $18.6 \pm 2.1$ ; C:  $20.1 \pm 2.8$  cm) 2L HtFT. The asymmetry index (AI=L-R/L+R) for jump impulse during 2L was 10.4% in ATH and 15.7% in C. **CONCLUSION:** A bilateral facilitation rather than deficit was observed in ATH and C during 2L jump. Jump performance was facilitated during 2L jumps by producing an impulse equivalent to that of a 1L jump in one leg. Participation in intercollegiate sports does not appear to alter this jumping strategy in women.

1505 Board #158 June 2, 8:00 AM - 9:30 AM  
**Effects Of Kinesiology Tape On Proprioception**  
 Jolaolu M. Jimoh<sup>1</sup>, Qinglai Zhang<sup>2</sup>, Jeremy A. Patterson, FACSM<sup>1</sup>, Rich Bomgardner<sup>1</sup>, Nicole L. Rogers<sup>1</sup>, Michael E. Rogers, FACSM<sup>1</sup>. <sup>1</sup>Wichita State University, Wichita, KS. <sup>2</sup>Shandong University of Technology, Zibo City, China. (Sponsor: Michael E. Rogers, FACSM)  
 (No relationships reported)

It has been proposed that kinesiology tape could enhance proprioception based on the physiologic role of proprioception in providing conscious sensations and adjusting movement. **PURPOSE:** To determine the effects of kinesiology tape on proprioception in college-aged individuals. **METHODS:** 28 participants (10 men, 18 women; 23.9 ± 3.5 yr) performed two tests (threshold to detect passive motion (TTDPM) and joint position sense (JPS)) of knee proprioception on an isokinetic dynamometer under three conditions in random order: control (no tape) and tape applied at 25% and 50% tension to the anterior thigh of the non-dominant leg. With sensory feedback minimized, TTDPM and JPS were tested with the knee starting at 45°. The knee was moved passively toward flexion or extension at 0.5°/s. For JPS, participants pressed a button on a handheld device when they perceived motion and could identify the direction. When participants thought that the leg was at an original target angle, they pressed the button for TTDPM. TTDPM was the difference in degrees between the starting angle and the angle at which participants identified the direction of movement. For JPS, the difference in degrees between the target and reproduced angles, which is the ability to estimate angular motion (lower number = better proprioceptive acuity), was used for analysis. **RESULTS:** There were no differences in TTDPM and JPS between the three tested conditions. Data are provided in the table below. **CONCLUSIONS:** Kinesiology tape does not appear to have an effect on proprioception of the knee. Further research is needed to determine if kinesiology tape affects additional parameters under other conditions.

	Joint Angle (mean ± SD)		
	No Tape	25% Tension	50% Tension
TTDPM: Extension (°)	3.9 ± 1.9	3.4 ± 1.4	3.3 ± 1.37
TTDPM: Flexion (°)	4.7 ± 2.3	4.6 ± 2.0	4.1 ± 1.6
JPS: Extension (°)	3.6 ± 2.1	3.2 ± 1.9	3.6 ± 1.9
JPS: Flexion (°)	4.9 ± 5.0	4.4 ± 2.9	4.6 ± 3.9

1506 Board #159 June 2, 8:00 AM - 9:30 AM  
**Immediate Effects Of Verbal Encouragement On Fatigued Quadriceps Strength, Activation, And Knee Joint Position Sense**  
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 (No relationships reported)

**PURPOSE:** To examine the effects of verbal encouragement on quadriceps maximal voluntary isometric contraction (MVIC), central activation ratio (CAR), and knee joint position sense (KJPS). **METHODS:** Sixty eight active healthy male adults (age: 23.3±2.6) randomly underwent either condition (verbal: “kick, kick, harder” or control: non-verbal encouragement during MVIC). Measurements were assessed at time-0 (baseline), -1, -2, and -3. Superimposed burst was delivered to the quadriceps during MVIC assessments (knee locked at 90°) for CAR calculations. For KJPS, subjects flexed their knees and stopped when they thought that their knee flexion angle was 15° or 45° (in a randomised order), then absolute error scores were calculated. Each assessment was performed on a dynamometer and assessed three times at time-0 and twice for other time intervals. Between assessments, muscular fatigue protocols (continuous knee extensions at 60°/s until three consecutive torque values dropped below 50% of the averaged MVIC value recorded during the previous assessments) were implemented. To test effects of verbal encouragement on quadriceps muscle and knee joint function over time, we performed mixed model ANOVAs and Tukey-Kramer post hoc tests (p<0.05) and calculated between-time effect sizes (ES). **RESULTS:** Our fatigue protocol immediately decreased both group’s MVIC (F3,198=4.42, p=0.005; verbal: a 24% reduction, ES: 1.13; control: a 27% reduction, ES: 1.44) and CAR (F3,198=10.91, p<0.0001; verbal: a 2.1% reduction, ES: 0.33; control: a 3.2% reduction, ES: 0.73) at time-1. While subjects in the control group showed a 6.8% and a 3.3% further decrease in MVIC (p=0.03, ES=0.30) and CAR (p<0.0001, ES=0.49), respectively, subjects in the verbal group did not change both values at time-2. Regardless of the conditions, absolute error scores in KJPS at 15° were began to alter at time-2 (F3,198=7.74, p<0.0001, a 17% reduction, ES=0.28) while those in KJPS at 45° were immediately altered at time-1 (F3,198=11.76, p<0.0001, a 29% reduction, ES=0.49), from the baseline values. **CONCLUSIONS:** (1) verbal encouragement may delay reduction of force output and activation, (2) fatigued muscle may affect adjacent joint position sense, and (3) less knee flexion, 15° appears to be more fatigue resistance.

1507 Board #160 June 2, 8:00 AM - 9:30 AM  
**Muscle Activation in Seated and Standing Uphill Cycling**  
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 (No relationships reported)

When climbing, cyclists often alternate between seated and standing positions despite a small economy penalty while standing. What prompts a rider’s transition between positions is unclear as is any implication for muscle mechanics during cycling. **PURPOSE:** Compare muscle activations for seated and standing cycling positions when riding uphill at constant speed. **METHODS:** Muscle activations of four elite male cyclists (22.5 ± 4.5 yrs, 65.5 ± 5.5 kg) were collected during a single continuous bout of uphill riding using both seated and standing positions. Cycling was at subthreshold intensity with fixed speed (8 mph; 3.58 m/s) and grade (8%) on a large treadmill. Electromyography (EMG) electrodes and wireless transmitters were placed on muscles of the lower body: Rectus Femoris (RF), Biceps Femoris (BF), Vastus Medialis (VM), and Gastrocnemius (GM). 3D position markers were placed on leg landmarks and on the pedal axle from which crank angle was determined. EMG data were sampled at 1000 Hz while position data were sampled at 100 Hz and synchronized to the same start point. After a 10 minute warmup, a 4 minute trial began which alternated 1 minute stages of either seated or standing cycling. Specific gears generating cadences of about 66 and 60 rpm (seated and standing respectively) were required during each stage. EMG data were collected for the last 30 seconds of each stage from which 10 cycles were extracted and used for seated vs. standing comparisons. Raw EMG data were rectified, smoothed (RMS, 100 ms window), and normalized across crank angle (0 to 360 degrees). Each muscle amplitude was normalized to the maximum observed during seated cycling. **RESULTS:** Muscle activations for RF and VM were greater for the standing compared to seated position (p < .05). Mean EMG amplitudes (normalized to peak during seated cycling) for RF were 34 ± 3% seated vs. 47 ± 5% standing while for VM they were 36 ± 8% seated and 57 ± 15% standing. Peak amplitudes when standing were 59 and 34% greater than when seated (RF and VM). Mean activations for BF and GM were not different for seated and standing positions. However, considerable variability of activation was observed across riders when standing, particularly for BF. **CONCLUSIONS:** Standing while pedaling uphill elicits considerably greater activation of quadriceps muscles compared to a seated position.

1508 Board #161 June 2, 8:00 AM - 9:30 AM  
**Changes In Muscle Activation Patterns And Kinematics While Learning The Bilateral Barbell Squat**  
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While the barbell squat has been subjected to many biomechanical analyses, it is not known how the kinematics and muscle activation profiles will change as an individual learns how to perform the movement. Previous work using different motion patterns have noted decreased variability in movement patterns between repetitions as an individual learns a new movement pattern. **PURPOSE:** The goal of this work was to document changes in variability of kinematic and muscle activity patterns while individuals learn to perform a standard bilateral barbell squat. **METHODS:** Ten university age females with no prior barbell squatting experience were recruited. The participants attended four weekly sessions where they performed 4 sets of 10 squats at 50% of their one-repetition maximum (1RM) while receiving feedback on their squatting technique. During the squats the participants had their motion captured in the sagittal plane using a high speed video camera and electromyography (EMG) was recorded from 8 lower-limb muscles that were involved in the squatting motion from the right lower-limb. Prior to the first session and at the end of the last session a 1RM test was performed to determine the maximum capacity for the barbell squat. **RESULTS:** Despite using a load where a strength adaptation would not be expected, the participants demonstrated a significant increase in 1RM across the study (50.1±8.6 kg vs 57.1 ± 10.0 kg; p < 0.05). Interestingly, most changes in kinematic variability occurred at the ankle joint, where increased variability was observed across the 4 sessions (p < 0.05). It was also observed that the participants were squatting deeper as sessions progressed, as measured by the angle of the thigh segment (p < 0.05). Rectus Femoris (RF) showed decreased variability across the sessions (p < 0.05). **CONCLUSIONS:** Although an increase in 1RM was found, this improvement is likely due to changes in technique rather than strength. Our findings that the ankle increased in variability may be supported by the uncontrolled manifold hypothesis, which states since attentional

focus was on the hips in this study (due to the nature of our feedback), that variability may increase in other areas. Changes in muscle activity of RF may indicate that the participants became more adept at coordinating the hip and knee joints during the squat.

1509 Board #162 June 2, 8:00 AM - 9:30 AM  
**Comparison Of Muscle Activation Using A Nitrogen Piston-based Resistance Device With Free Weights**

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Resistance training is especially important for populations at risk of sarcopenia and osteopenia such as older adults or astronauts working in microgravity. A limitation of common forms of resistance training is that they are gravity-based and lack efficacy in microgravity. Therefore, to maintain muscle and bone mass in microgravity, an alternative solution must be sought. One alternative is the use of a gas-filled piston-based resistance training system. **PURPOSE:** The goal of the current study is to assess the effectiveness of a Nitrogen-filled piston-based resistance training system (NitroForce) compared to isotonic resistance training. **METHODS:** Thirty recreational athletes performed five repetitions of squat and toe-raise exercises, in two experimental conditions: NitroForce and Isotonic. The NitroForce condition was characterized by resistance of approximately 70% of the participant's one repetition maximum (1RM) while resistance was supplied using the NitroForce system. Isotonic condition was characterized by participants performing each exercise with resistance equal to 70% of 1RM provided by free weights. Surface electromyography (sEMG, 1928 Hz, Delsys) was recorded from the vastus medialis (VM), vastus lateralis (VL), and the lateral (LG) and medial heads of the gastrocnemius (MG). Mean sEMG amplitude was quantified using the RMS (20 ms smoothing window) and normalized to MVC for each muscle in each condition. Paired samples t-tests were used to compare mean sEMG values. Significance was set at  $p < 0.05$ . **RESULTS:** In the squat exercise, VM activation was significantly greater in the NitroForce compared to isotonic condition ( $p = 0.039$ ), but no differences were observed in the VL ( $p = 0.367$ ). No significant differences were observed between the NitroForce and isotonic conditions for the LG ( $p = 0.400$ ) or MG ( $p = 0.442$ ) in the toe-raise exercise. **CONCLUSIONS:** These data demonstrate that muscle activation intensity as measured by sEMG is not significantly different in the NitroForce compared to isotonic conditions. Therefore, the NitroForce provides a similar level of resistance and overload to standard isotonic resistance training loads. However, due to the non-gravity-based nature of the NitroForce, it may provide a better resistance training solution in microgravity environments.

1510 Board #163 June 2, 8:00 AM - 9:30 AM  
**Muscle Activity During Backward And Forward Running At Reduced Body Weight**

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 (No relationships reported)

Body weight (BW) support during locomotion is used for both forward and backward locomotion. However, muscle activity during locomotion in different directions at different levels of BW support is not known. **PURPOSE:** To investigate muscle activity during backward (BR) and forward (FR) running at different BW support conditions. **METHODS:** Ten subjects (23.1±3.5 yrs) completed BR and FR on a low body positive pressure treadmill; selecting a preferred speed for different BW support conditions (0%, 20%, 40%, 60%, and 80% of BW). Muscle activity from the rectus femoris (RF), biceps femoris (BF), tibialis anterior (TA), and gastrocnemius (GA) were measured and averaged across 15 s (zero offset removed, full-wave rectified). In addition, rating of perceived exertion (RPE), preferred stride frequency (PSF), and preferred speed (PS) were measured. All parameters were analyzed using 2 (direction) x 5 (BW) repeated measures ANOVA ( $\alpha = 0.05$ ). When an interaction effect was observed, post hoc analysis was performed using a Fisher's protected least significant difference multiple comparison test ( $\alpha = 0.05$ ). **RESULTS:** Muscle activity (BF, TA, and GA), RPE, PSF, and PS were not influenced by the interaction of direction and BW support ( $P > 0.05$ ). BF, TA, and GA were not different between directions ( $P > 0.05$ ) but were different between BW support conditions ( $P < 0.05$ ). RF was influenced by the interaction of direction and BW support ( $P < 0.05$ ). For example, RF during BR at 0% BW support condition was significantly higher than that of BR at 40% ( $P < 0.05$ ), 60% ( $P < 0.05$ ), and 80% ( $P < 0.05$ ) BW support conditions. RF, BF, TA, and GA during BR were lower with increasing BW support (e.g., a decrease of 33%~60% between 80% and 0% BW support conditions). RPE during BR and FR were lower with increasing BW support ( $P < 0.05$ ) regardless of direction of locomotion ( $P > 0.05$ ). PSF and PS were different between directions ( $P < 0.05$ ) and between BW support conditions ( $P < 0.05$ ). PSF during BR and FR were lower and PS higher with increasing BW support. PSF during BR was 6%~9% higher than that of FR. PS during BR was 24%~31% lower than that of FR (e.g., 8.9±1.7 km/h vs. 11.9±3.2 km/h for BR

and FR at 80% BW support condition, respectively). **CONCLUSION:** BW support influenced muscle activity whereas direction of locomotion did not even though slower speeds were selected BR vs. FR.

1511 Board #164 June 2, 8:00 AM - 9:30 AM  
**Electromyographic Analysis Of The Infrapinatus Muscle During Shoulder Elevation With Reference To Load Magnitude.**

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 (No relationships reported)

**PURPOSE:** We reported that the activity of the infrapinatus muscle during shoulder elevation with shoulder flexion, abduction and internal rotation was higher than another popular shoulder external exercise. ACSM 2012). However, this study has not examined differences in infrapinatus and posterior deltoid muscle activities under various loads. The purpose of the present study was to examine changes the activities in the infrapinatus and posterior deltoid, as well as the ratio of the infrapinatus to posterior deltoid activity, during shoulder elevation with flexion, abduction and internal rotation for the increase of weight load.

**METHODS:** Nine normal men, means (SD) age: 22.0 (4.6) yrs., height 171.7 (5.6) cm, weight 70.3 (13.1) kg, participated in this study. They performed 3 times isometric contractions (7s) of shoulder elevation at 30 degrees within flexion and abduction with internal rotation under conditions of increasing load (used the weight to 1 kg - 9 kg progressively) for a standing posture that was leaning against the wall. Surface EMG was recorded from the muscle belly of infrapinatus (the upper portion; [ISU], and the lower portion; [ISL]) and posterior deltoid [DP] muscles, and root mean square [RMS; normalized as MVIC; (%)] was analyzed. Significant differences in EMG activities of ISU, ISL and DP, and the ratio of the infrapinatus to the posterior deltoid (ISU/DP, ISL/DP) were assessed using ANOVA.

**RESULTS:** The activity (%MVIC) of ISU increased from 11.4 (7.86) at 1kg weight loads, to 50.9 (35.87) at 9kg. And the activity (%MVIC) of ISL increased from 11.9 (7.82) at 1k to 63.0 (27.86) at 9kg. On the other hand, the activity (%MVIC) of DP increased from 2.16 (1.03) at 1kg to 23.3 (13.29) at 9kg, that were significantly lower activity than ISU and ISL from 1kg to 5kg weight loads ( $p < .05$ ). The ISU/DP were 6.23 at 1kg, 3.80 at 5kg, and 2.39 at 9kg. The ISL/DP were 6.91 at 1kg, 5.66 at 5kg, and 3.27 at 9kg.

**CONCLUSIONS:** The result of this study showed that the infrapinatus muscle activity was higher than the posterior deltoid from 1kg to 5kg weight loads during shoulder elevation isometric contraction with diagonal and spiral pattern. The findings of this study, including the ratio of the infrapinatus to the posterior deltoid, will provide therapist with useful information for design effective exercise programs.

1512 Board #165 June 2, 8:00 AM - 9:30 AM  
**Muscle Group Specific Changes In The Electromechanical Delay Following Short-term Resistance Training**

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**PURPOSE:** The time delay between the onset of a muscle's electrical activity and force is believed to have important functional implications, and has been shown to decrease following resistance training in males. The purpose of this investigation was to examine changes in the voluntary electromechanical delay (EMD) for the leg extensors and flexors following a short-term resistance training intervention in females.

**METHODS:** Twenty-two previously untrained females (mean ± SD age = 21 ± 2 years; mass = 65.4 ± 13.3 kg) were randomly assigned to training (n = 10) and control (n = 12) groups. The training group performed barbell back squats and deadlifts twice per week for four weeks. Each training session was closely supervised, and additional weight was added throughout the study to induce progressive overload. Bipolar surface electromyographic signals and isometric torque-time curves were used to calculate EMD for the vastus lateralis (extensors) and biceps femoris (flexors) during maximal voluntary contractions at both pre- and posttesting. Data were examined using analyses of covariance (ANCOVAs) with the pretest and posttest scores serving as the covariate and dependent variable, respectively, and by evaluating the number of participants that exceeded the minimal difference statistic.

**RESULTS:** For the leg extensors, the adjusted EMD posttest mean for the training group was significantly lower than that for the control group (74.3 vs. 91.8 ms;  $p = 0.015$ ;  $\eta^2 = 0.275$ ), and five training participants displayed decreases that exceeded the minimal difference. The Cohen's d effect size for the decline in EMD was 0.80. The ANCOVA for the leg flexors was not significant (adjusted means = 98.0 vs. 90.0 ms;  $p = 0.487$ ;  $\eta^2 = .026$ ).

**CONCLUSIONS:** Four weeks of multi-joint resistance training resulted in decreased EMD for the leg extensors, but not the flexors. The lack of a decrease in leg flexor EMD may have been related to training specificity, biarticular muscle function, and/or an insufficient training stimulus.

1513 Board #166 June 2, 8:00 AM - 9:30 AM  
**Effects of Work-to-Rest Ratios on Peak Torque and Neuromuscular Responses during Submaximal, Isometric Muscle Actions.**

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 (No relationships reported)

**PURPOSE:** The purpose of the present study was to examine the effects of work-to-rest ratios on the maximal voluntary isometric contraction (MVIC) torque and neuromuscular responses to intermittent, submaximal, isometric muscle actions. **METHODS:** Twenty resistance-trained men and women (mean age  $\pm$  SD = 23  $\pm$  2 years; resistance training = 15  $\pm$  5 days per month) visited the lab on two occasions (separated by  $\geq$  48 hours) and performed two MVICs before (pretest) and after (posttest) randomly performing two protocols (4-s on, 4-s off vs. 4-s on, alternating 6- and 2-s off) that consisted of 50 intermittent, submaximal (65% of MVIC), isometric muscle actions of the dominant forearm flexors on a calibrated isokinetic dynamometer. In addition, bipolar surface electromyographic (EMG) and mechanomyographic (MMG) signals were simultaneously recorded from the biceps brachii muscle. Separate 2 X 2 (Time [pretest, posttest]) X (Protocol) repeated measures ANOVAs were used to analyze the MVIC torque, EMG amplitude (AMP), EMG mean power frequency (MPF), MMG AMP, and MMG MPF data. **RESULTS:** There were no significant ( $p > 0.05$ ) interactions for any of the variables. There were, however, significant main effects for time (marginal means collapsed across protocol). Specifically, as a result of the 50 repetitions MVIC torque, EMG MPF, and MMG MPF decreased 22, 20, and 16%, respectively, while MMG AMP increased 21% from pretest to posttest. **CONCLUSIONS:** Work-to-rest ratios had no effects on MVIC torque or any of the neuromuscular parameters. As a result of the 50 submaximal muscle actions, however, there were decreases in MVIC torque, possibly due to a decrease in global motor unit firing rate (MMG MPF). The decrease in MMG MPF may also have resulted in decreased muscle stiffness and, therefore, allowed greater oscillations of the activated motor units which increased MMG AMP. The non-significant increase in EMG AMP suggested that muscle activation was unaffected by the submaximal muscle actions, while the decreases in action potential conduction velocity (EMG MPF) may reflect a fatigue-induced buildup of metabolic byproducts.

1514 Board #167 June 2, 8:00 AM - 9:30 AM  
**The Contribution of the Neuromuscular System in the Repeated Bout Effect**

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Maximal eccentric contractions induce an immediate strength loss that results from skeletal muscle damage, the symptoms of which can persist for several days after the exercise insult. The repeated bout effect (RBE) refers to the acute adaptive response precipitated from a single bout of eccentric contractions that result in an attenuated damage response on subsequent, potentially damaging, bouts of exercise. The mechanisms for this adaptive response are thought to be, at least in part, from neural adaptations. **PURPOSE:** To evaluate the neuromuscular mechanisms that might underpin the acute adaptive response to repeated bouts of eccentric exercise. **METHODS:** Eight male participants (24  $\pm$  7 y) performed two bouts of 30 maximal eccentric contractions with the elbow flexors, separated by 4 weeks. Muscle soreness, maximal voluntary force (MVC) and creatine kinase were used to assess traditional indices of muscle damage, and peripheral stimulation (motor nerve and motor point) and transcranial magnetic stimulation (TMS) of the primary motor cortex, were obtained to assess neuromuscular function. All measures were assessed pre-, immediately post- and at 24, 48, 72, 96 and 168 h (days 1-7) post-exercise. **RESULTS:** Muscle soreness, recovery of MVC and the appearance of CK were all attenuated following the second bout ( $P < 0.05$ ), demonstrating the presence of a RBE. Peripheral fatigue (reductions in potentiated twitch) was evident following both bouts, however interaction effects showed a faster recovery following the second bout by 32% at 168 h ( $P < 0.05$ ). An attenuated reduction in voluntary activation measured with TMS was observed following the repeated bout ( $P = 0.003$ ) immediately post, 24 and 48 h by 9, 11, 10%, respectively, which was explained by a reduction in the superimposed twitch

force elicited during an MVC ( $P = 0.04$ ). **CONCLUSION:** Muscle damaging exercise can be attenuated by a single, pre-conditioning bout of eccentric exercise. The greater recovery following the second bout was accompanied by improved peripheral function, but importantly there was evidence of a change in centrally mediated mechanisms of muscle function. This study suggests that the RBE phenomenon may be attributed, at least in part, to neural adaptations that are manifested as modifications in motor cortical drive.

1515 Board #168 June 2, 8:00 AM - 9:30 AM  
**No Effect of Carbohydrate Consumption on Quadriceps EMG Following Fatiguing Cycling**

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 (No relationships reported)

Carbohydrate [CHO] ingestion is known to extend performance, and we have previously reported it to help preserve central activation in men during cycling. EMG metrics during maximal isometric contractions have been shown to decrease with fatigue but most protocols use relatively high-intensity, short-duration exercise to induce fatigue. **PURPOSE:** To examine EMG changes during maximal isometric contractions before and after fatiguing cycling, with and without CHO ingestion. We hypothesized that EMG AMP and MF would decrease with fatigue, and this decrease would be blunted by CHO.

**METHODS:** 11 trained cyclists [6 M, 5 F] were assigned, in a double-blind crossover design, to an artificially sweetened, non-caloric, electrolyte beverage [4C Totally Light 2 Go; PL] and to a sports drink [Gatorade; CHO] at a rate of 1% of body weight each hour. In each condition, subjects cycled for 2 hrs at ventilatory threshold, interspersed with 5 1-min sprints, followed by a 3-km time trial. Prior to and following cycling, knee extension strength [MVC] was tested with subjects seated and the ankle attached to a force transducer, with EMG electrodes on the vastus lateralis [VL] and rectus femoris [RF]. The effects of fatigue and beverage on EMG measures were compared using repeated-measures ANOVA.

**RESULTS:** MVC declined by ~20% [ $P < 0.001$ ] indicating fatigue. EMG data are shown in the table; VL and RF AMP and MF showed no changes with fatigue [ $P > 0.210$ ] nor differences between beverages.

**CONCLUSIONS:** Consistent with previous work in our lab, no changes in EMG activity were seen during maximal isometric contractions following prolonged cycling, regardless of CHO ingestion. This is different from what is seen following high-intensity, short-duration exercise.

EMG Changes with Fatigue; P val for time x beverage interaction.						
Muscle	AMP change [uV] CHO	AMP change [uV] PLA	P	MF change [Hz] CHO	MF change [Hz] PLA	P
VL	-6 $\pm$ 32	-16 $\pm$ 10	0.912	3.0 $\pm$ 4.6	-1.1 $\pm$ 4.3	0.740
RF	-10 $\pm$ 7	-4 $\pm$ 11	0.680	1.0 $\pm$ 1.3	-0.5 $\pm$ 2.2	0.584

1516 Board #169 June 2, 8:00 AM - 9:30 AM  
**Determinants of Fatigue in the Biceps Brachii During Blood Flow Restriction Training**

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 (No relationships reported)

Training loads of 60% - 80% of maximum are traditionally recommended for increasing muscular strength and size, though lighter loads (~20% max) with concomitant blood flow restriction (BFR) can increase muscle strength and muscle protein synthesis similar to training with traditional loads. It is unknown if this adaptation with BFR is limited to the muscle or also due to changes in the nervous system. **PURPOSE:** To examine changes in the output of the motor cortex and the force-generating capacity of the muscle with electrical stimulation, when subjects perform light load training (20% maximal strength), light load training with BFR, and moderate load training (60% maximal strength) where the overall amount of mechanical work is matched.

**METHODS:** 5 subjects (age 22.2  $\pm$  3yrs) completed three isometric training sessions with the elbow flexor muscles. Maximal voluntary contraction (MVC) strength was measured before and after each training session. Voluntary activation was tested with cortical stimulation (TMS) and with direct electrical stimulation of the biceps brachii during additional MVCs. Subjects trained with a block of 4 isometric contractions at 20% MVC (120s, 3@60s durations) or at 60% MVC (40s, 3@20s durations).

**RESULTS:** Perceived exertion (RPE) was higher training with the 60% load than either of the 20% loading conditions. However, fatigue (% decrease in MVC after training) was similar between 20% BFR and 60% conditions (18.6% and 16%) and less in the 20% without BFR condition (9.7%). Cortical voluntary activation decreased similarly between the 20% BFR and 60% conditions (-3.6% and -3.3%) and showed less change

with 20% without BFR (-1.8%). Alternatively, with electrical stimulation of the muscle, both 20% training conditions showed a decline in voluntary activation (-3.1% and -5.15), while voluntary activation increased by 8% after the 60% condition. **CONCLUSIONS:** The results show similar levels of fatigue occur at different contraction intensities when BFR is applied during the lighter contraction. Both 20% with BFR and 60% loading causes deficits in cortical voluntary activation, though the limiting factor in the 20% BFR condition is a decrease in activation of the muscle directly, while in the 60% contraction it is due to an inability to drive the motorneuron pool sufficiently.

1517 Board #170 June 2, 8:00 AM - 9:30 AM  
**Influence of Focus of Attention Instructions on Performance of Manual Tracking Task at Different Speeds**

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 (No relationships reported)

**PURPOSE:**

Instructions are an essential part of skill acquisition. Previous research (Wulf, 2007; Porter, 2010) has established that external focus of attention instruction (EFI) supersedes that of internal focus of attention instruction (IFI) on performance of a specific task. Tenets of dynamics systems theory however, dictate that a resulting performance occurs through the most optimal performance subsystems. Thus, as the constraints placed on a task shift so too does the performance of the system. Previously, Porter (2011) demonstrated that time on task (TT) performance on a novel rotary pursuit tracking task, at 15 rpms, was greatest with EFI compared to IFI. When the constraints on the task are altered, such as movement speed, it was hypothesized that self-organization of the subsystems would reduce the influence of instructions on performance outcomes. **METHODS:**

18 subjects (mean age=26.4; f=6; m=12) performed 3 x 30 s trials of a rotary tracking task in three experimental conditions at 40 rpm. The three conditions were: control (C), IFI and EFI. Conditions were counterbalanced to prevent an order effect with trials being performed on separate days. Data was analyzed using a 2 way repeated measures ANOVA 3 (instruction) x 3 (trial). **RESULTS:**

Main effects for instruction (F<sub>2, 34</sub> = 7.19, p=0.002) and trial (F<sub>2, 34</sub> = 16.58, p=0.001) were observed between conditions. Post hoc analysis with Bonferroni adjustment indicated that both IFI and EFI demonstrated more TT than C, but were not different than each other (C = 18.21 SE = .88; IF = 20.24 SE = 1.08; EF = 21.32 SE = .92). **CONCLUSIONS:**

Previous research would predict that EFI instruction would have more TT than IFI instruction. However, as evidenced by no differences between IFI & EFI conditions suggests performance is more greatly influenced by task constraints than focus of attention instructions. These findings suggest that movement practitioners should consider task constraints as a performance variable in conjunction with instructional considerations.

1518 Board #171 June 2, 8:00 AM - 9:30 AM  
**Effects Of Visual Deprivation On Stability Among Young Adults During Treadmill Walking**

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 (No relationships reported)

Visual system is one of the three essential systems providing sensory information for maintaining balance during human locomotion. While over-ground walking directly simulates real-world conditions, assessing dynamic stability control during human locomotion is appealing to researchers and practitioners because of the ability to create a highly-controlled environment. Although previous research has reported the impact of visual deprivation on human dynamic stability during over-ground walking, it remains unknown whether and to what extent the lack of vision affects dynamic stability during treadmill walking.

**PURPOSE:** To examine the effects of visual deprivation upon human stability control during treadmill walking.

**METHODS:** Ten healthy young subjects (mean ± SD age: 23.5 ± 2.3 y/o) performed two 90-s walking trials on the treadmill at their preferred speed under two conditions: eyes open (EO) and eyes closed (EC). Participants were instructed to walk normally during both conditions. Full-body kinematics were recorded using a motion capture system. Step length (normalized to body height or bh) and foot landing angle (deg) were computed for each step during the middle 80-s of the two trials. Stability, quantified by the variability (i.e., the standard deviation) of the step length and foot landing angle, was calculated. Paired t-tests were used to identify any condition-related differences of these variables.

**RESULTS:** Compared to the EO trial, participants during EC treadmill walking had a significantly shorter step length (0.28 ± 0.05 vs. 0.34 ± 0.02 bh, p < 0.01) and a flatter foot landing (22.98 ± 7.95 vs. 32.32 ± 5.94 deg, p < 0.01). Subjects exhibited more variability in step length (0.058 ± 0.011 vs. 0.014 ± 0.002 bh, p < 0.01) and foot angle (13.87 ± 10.04 vs. 3.35 ± 3.64 deg, p < 0.05) during EC walking than during EO walking.

**CONCLUSION:** Our results indicated that young adults are less stable during treadmill walking when visual input is blocked than when receiving visual input. To counteract such instability, a cautious gait characterized by short step and flat-foot landing are adopted. Our findings are in agreement with previous reports involving over-ground walking. This study could provide guidance to develop fall prevention paradigm aiming at older adults.

Supported by TRRF Grant 2014-070 (to FY).

1519 Board #172 June 2, 8:00 AM - 9:30 AM  
**Effect Of Dual-task On Turning Characteristics While Walking Among Collegiate Athletes**

Lauren A. Brown<sup>1</sup>, Eric E. Hall, FACSM<sup>1</sup>, Caroline J. Ketcham<sup>1</sup>, Kirtida Patel<sup>1</sup>, Thomas A. Buckley<sup>2</sup>, David R. Howell<sup>3</sup>, Srikant Vallabhajosula<sup>1</sup>. <sup>1</sup>Elon University, Elon, NC. <sup>2</sup>Delaware, Newark, DE. <sup>3</sup>Boston Children's Hospital, Boston, MA. (Sponsor: Dr. Eric Hall, FACSM)  
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 (No relationships reported)

Many sports require athletes to complete turns during competition. While many studies have examined spatio-temporal gait parameters both with and without a concurrent cognitive load, there is little information on the turning characteristics while walking and performing a concurrent cognitive task. Such information could help evaluate the effects of concussion on an activity of daily living like turning while walking.

**PURPOSE:** To determine the effect of dual-task on turning characteristics while walking in collegiate athletes. **Methods:** 53 subjects performed 5 trials of a 10m walk under single- and dual-task conditions at self-selected speed. Each trial consisted of one turn. The Mini Mental Status Exam (MMSE) was used as the concurrent dual-task. MMSE consists of spelling five-letter words in reverse, subtraction by sevens, and reciting the months of the year in reverse order. Participants were fitted with 6 OPAL sensors as part of the Mobility Lab system (APDM Inc., Portland, OR). The trunk and lumbar sensor and a mathematical model developed by APDM was used to detect the exact moment of beginning and end of turning. Absolute and variability measures of turning velocity and duration were calculated. Number of steps during turning were also obtained. A paired samples t-test and Wilcoxon Signed Rank test were used to compare turning performance under single and dual task conditions. **Results:** See Table 1. **Conclusion:** Athletes turned significantly slower and took longer time to complete the turn while dual-tasking albeit taking similar number of steps to complete the turn. Whether these results hold true for post-concussion evaluation needs to be determined.

**Table 1**

	Single Task	Dual Task	P
Mean velocity (cm/s) *	183.52 (4.17)	155.99 (3.71)	< 0.001
Mean duration (s) *	2.33 (0.04)	2.63 (0.05)	< 0.001
Mean Number of steps	3.94 (0.09)	3.97 (0.12)	0.093
SD velocity (cm/s)	19.88 (1.49)	20.26 (1.84)	0.912
SD duration (s) *	0.31 (0.02)	0.39 (0.02)	0.004
CV velocity %	10.75 (0.78)	12.76 (0.98)	0.08
CV duration %	13.29 (0.79)	14.76 (0.88)	0.227

SD - Standard deviation; CV - Coefficient of variation; P<0.05 significant

1520 Board #173 June 2, 8:00 AM - 9:30 AM  
**Motor Learning Occurs In Both Unexpected And Expected Events During A Novel Visuomotor Training Task**

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 (No relationships reported)

Motor learning enhances functional movement of the wrist in people with and without CNS impairment. Whether motor skill acquisition/retention improves one's ability to respond to unexpected events is not known but critical rehabilitation research.

**PURPOSE:** We determined whether motor learning occurs during both expected and unexpected events in response to tracking a visual target and whether the change of corticomotor excitability modulates motor learning after acquiring the motor skill. **METHODS:** Thirty-four individuals tracked a target set at 3 velocities and 3 resistance levels using the left hand before and after motor training over 1 week (Day 1Pre,

Day1Post, Day3, Day7pre, and Day7post). Between Day7pre and Day7post, 16 individuals received paired associative stimulation (PAS) to increase the corticomotor excitability of left extensor carpi radialis (ECR) (PAS group), whereas 18 individuals received control stimulation (Control group). Unexpected stretches were imposed to the wrist extensor muscles by releasing the resistance of the device. We calculated the error to measure learning. The ECR EMG was recorded to measure long latency responses. We used a Repeated Measures ANOVA to compare errors and EMG across time and between PAS and Control groups.

**RESULTS:** PAS and Control groups demonstrated similar motor acquisition and retention following learning. The absolute error decreased at all times following the Day1Pre condition ( $p < 0.05$ ). The absolute error for both unperturbed and perturbed events decreased for the Day1Post and Day3 conditions ( $p < 0.05$ ); but was not changed from Day3 to Day7Pre ( $p > 0.26$ ). The absolute error reduced from Day7pre to Day7post for the unperturbed event ( $p = 0.04$ ), but not the perturbed event ( $p = 0.67$ ). There was a trend that the error decreased between Day1Post and Day3 at 50-100 ms after the perturbed event ( $p = 0.06$ ) and over the same time for the unperturbed event ( $p = 0.08$ ). ECR EMG was not changed at 50-100 ms after the perturbed event.

**CONCLUSION:** This study demonstrated that motor learning occurs during expected and unexpected events (50-100ms) and corticomotor excitability does not modulate motor learning in the retention stage. These findings assist in designing novel rehabilitation interventions for people with CNS dysfunction.

Supported by NIH Grant RO1-HD-062507

1521 Board #174 June 2, 8:00 AM - 9:30 AM

**Is There a Sex Difference With Aging In Stimulus-Response Characteristics of The Lower Limb?**

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(No relationships reported)

Age and sex differences are observed in the stimulus-response curves for motor evoked potentials (MEPs) induced by transcranial magnetic stimulation (TMS) in a hand muscle. Whether the same sex and age differences occur for the lower limb motor cortical areas is not known. **Purpose:** The aim of this study was to compare the input-output characteristics of the motor cortex of young and old men and women. **Methods:** MEPs of the vastus lateralis (VL) were recorded from 11 young (19-30 yr, 6 women) and 26 old adults (61-79 yr, 13 women) with bipolar EMG electrodes by delivering single-pulse TMS over the motor cortex. The active motor threshold (AMT) was determined and MEPs elicited at increasing intensities (5% increments of simulator output, SO) during intermittent isometric contractions at 10% maximal voluntary contraction. MEP amplitudes were expressed relative to the resting maximal compound muscle action potential of the VL ( $M_{max}$ ) and plotted against the SO (%AMT) to generate an input-output curve and determine the following parameters: the estimated maximal MEP amplitude ( $MEP_{max}$ ), the stimulus intensity required to elicit a response equal to half  $MEP_{max}$  ( $S_{50}$ ), and the peak slope of the sigmoidal curve.

**Results:** AMT was similar between the young and old adults ( $44.9 \pm 9$  vs  $47.4 \pm 4.4$  %SO, respectively) and between men and women ( $54.4 \pm 9.6$  vs  $54.8 \pm 12.2$  %SO respectively).  $M_{max}$  was less in young women ( $10.41 \pm 1.72$  mV) compared with young men ( $17.28 \pm 2.8$  mV,  $P < 0.05$ ). When the MEP amplitudes were expressed relative to  $M_{max}$ , young women and men were similar for the  $MEP_{max}$  ( $35.3 \pm 15.1$  vs  $34.8 \pm 23.7$  % $M_{max}$ ,  $P > 0.05$ ), peak slope ( $0.08 \pm 0.04$  vs  $0.13 \pm 0.06$ ,  $P > 0.05$ ). However,  $S_{50}$  was lower in young women compared with young men ( $110.9 \pm 5.9$  vs  $124.3 \pm 5.5$  %AMT).

$M_{max}$  was less in old women compared with old men ( $6.5 \pm 2.4$  vs  $10.9 \pm 3.7$  mV,  $P < 0.05$ ). However, when the MEP amplitudes were expressed relative to  $M_{max}$ , old women and men were similar for the  $MEP_{max}$  ( $30.7 \pm 17.5$  vs  $31.7 \pm 11.7$  % $M_{max}$ ,  $P > 0.05$ ), peak slope ( $0.091 \pm 0.02$  vs  $0.084 \pm 0.03$ ,  $P > 0.05$ ) and the  $S_{50}$  ( $113.9 \pm 13.2$  vs  $123.3 \pm 17.5$  %AMT,  $P > 0.005$ ).

**Conclusion:** When normalized to the compound muscle action potential, there were minimal sex differences for the young and old adults in most input-output characteristics and AMT of the knee extensor muscles.

1522 Board #175 June 2, 8:00 AM - 9:30 AM

**Comparison Of Trunk And Pelvis Kinematic Between Sexes And Tasks Of Running, Walking, And Squatting**

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(No relationships reported)

Sex differences in trunk/pelvis kinematics have been reported in single leg squats (SLS) and running (RUN), but not across task and sex. **Purpose:** Compare sexes in trunk/pelvis kinematics across RUN, walking (WALK), and SLS.

**Methods:** Fifteen male and 15 female healthy runners volunteered. Participants completed 5 trials running and walking and 5 consecutive SLS in a randomized order.

Kinematics were collected and peak trunk (forward lean, ipsilateral lean, contralateral lean, right rotation, left rotation) and pelvis (anterior tilt [APT], ipsilateral lift [IPL], contralateral drop [CPD], right rotation [RPR], left rotation [LPR]) variables were retrieved. Variables were analyzed with 2-way repeated measures ANOVAs. Sidak tests (main effect) and 95% confidence intervals (interaction) for pairwise comparisons.

**RESULTS:** No significant differences were found for a task and sex interaction or sex main effect for the trunk ( $p > 0.05$ ). Task main effects for the trunk can be found in Table 1. A task and sex interaction was found for IPL ( $p = 0.007$ ), RPR ( $p = 0.049$ ) and LPR ( $p = 0.014$ ). SLS IPL was greater in males ( $6.1 \pm 2.9^\circ$ ) than females ( $3.8 \pm 3.9^\circ$ ). In women, LPR was greater in WALK ( $5.8 \pm 4.9^\circ$ ) than RUN ( $0.5 \pm 3.5^\circ$ ) but in men SLS ( $7.1 \pm 3.8^\circ$ ) was greater than RUN ( $2.1 \pm 3.4^\circ$ ). RPR was greater during WALK in women ( $-10.1 \pm 3.8^\circ$ ) than men ( $-4.8 \pm 3.3^\circ$ ); in women, WALK was greater than SLS ( $-5.0 \pm 5.1^\circ$ ). APT was greater in SLS ( $-25.4 \pm 10.1^\circ$ ) than RUN ( $-12.3 \pm 2.9^\circ$ ;  $p < 0.001$ ) and WALK ( $-5.7 \pm 2.7^\circ$ ;  $p < 0.001$ ); RUN was greater than WALK ( $p < 0.001$ ). CPD was greater in females ( $-5.6 \pm 0.6^\circ$ ) than males ( $-3.8 \pm 0.6^\circ$ ;  $p = 0.038$ ).

**CONCLUSIONS:** Differences in trunk/pelvis kinematics are task but not necessarily sex dependent. Comparison of studies with different tasks is cautioned.

Table 1: Post-hoc Sidak tests for multiple comparisons of trunk kinematics across tasks

	Single-Leg	Run	Walk	P-values
	Squat			
Forward Trunk Lean	$-31.4 \pm 14.2^*$	$-7.1 \pm 3.5^*$	$-2.9 \pm 4.0^*$	SLS v. Run $< 0.001^*$ SLS v. Walk $< 0.001^*$ Run v. Walk $< 0.001^*$
Ipsilateral Trunk Lean	$7.1 \pm 3.2^*$	$2.1 \pm 1.3^*$	$1.4 \pm 1.1^*$	SLS v. Run $< 0.001^*$ SLS v. Walk $< 0.001^*$ Run v. Walk $0.009^*$
Contralateral Trunk Lean	$0.2 \pm 2.9^*$	$-0.1 \pm 1.2^*$	$-1.3 \pm 1.2^*$	SLS v. Run $0.951$ SLS v. Walk $0.037^*$ Run v. Walk $< 0.001^*$
Right Trunk Rotation	$-3.8 \pm 3.0^*$	$-9.4 \pm 4.1^*$	$-3.9 \pm 3.0^*$	SLS v. Run $< 0.001^*$ SLS v. Walk $1.000$ Run v. Walk $< 0.001^*$
Left Trunk Rotation	$3.6 \pm 3.4^*$	$5.6 \pm 3.7^*$	$2.6 \pm 3.4^*$	SLS v. Run $0.069$ SLS v. Walk $0.558$ Run v. Walk $< 0.001^*$

Values expressed as mean  $\pm$  SD

\*Significant at  $p < 0.05$

1523 Board #176 June 2, 8:00 AM - 9:30 AM

**Intersegment Dynamics In Multi-joint Control Of The Lower Limb During Walking**

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(No relationships reported)

**Purpose:** To fully understand the control and regulation of multi-joint movements, the biomechanical properties of the moving subject, specifically intersegment dynamics, must be considered in the motor control research. This study was to understand the multi-joint control of the lower limbs during walking, by studying the intersegment dynamics of the hip, knee and ankle.

**Methods:** Subjects ( $n = 16$ , male) performed over-ground walking at 2 different speeds (1.5m/s, 2m/s). Three-dimensional kinematic data were collected via 16 high-resolution cameras (200 Hz). The Ground reaction forces were collected by 2 recessed forceplates (1000 Hz). Data from the right lower extremity in the sagittal plane were used for the intersegmental dynamics analysis. Torques at each joint were separated into five categories: net torque (NET), gravitational torque (GRA), interactive torque (INT), external contact torque (EXT), and muscle torque (MUS). NET is the sum of the other four components. An impulse analysis was used to evaluate the contribution of each component to the NET. All the torques were normalized by the product of body weight (N) and height (m).

**Results:** During the stance phase, the dominant joint torques which provided the positive contribution to the joint movement were all MUS at the hip, knee and ankle (e.g. 2.0m/s,  $2.0 \pm 0.5$ ,  $1.2 \pm 0.6$ ,  $2.5 \pm 0.4$ ). However, during the swing phase of walking, the dominant joint torques which provided the positive contribution to the joint movement were GRA at the hip (e.g.  $0.4 \pm 0.1$ ); GRA at the knee during 1.5m/s walking ( $0.4 \pm 0.01$ ), MUS at the knee during 2.0 m/s walking ( $0.6 \pm 0.02$ ); INT at the ankle ( $0.02 \pm 0.01$ ). Speed was significantly associated with the impulse of each torque, especially INT (e.g. INT at knee in swing phase:  $0.5 \pm 0.01$  vs  $0.7 \pm 0.01$ ,  $p < .01$ ).

**Conclusions:** During the stance phase of walking, the joint motion was mainly generated by the muscle strength at each joint. However, during the swing phase, interactive forces and the gravity were exploited to generate the joint motion. The control strategy also changed as the movement speed increased. The central nervous system not only exploits the muscle strength, but the passive torques to perform effective and economical limb movement.

**C-37 Free Communication/Poster - Obesity - Exercise**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM

Room: Exhibit Hall A/B

**1524 Board #177 June 2, 9:00 AM - 10:30 AM  
Heart Rate Variability Threshold Estimates Ventilatory Threshold In Young People With Different Body Mass Index**

Marilene Gonçalves Queiroz, Jaqueline Alves de Araújo, Diego Augusto Nunes Rezende, André Rodrigues Lourenço Dias, Fabiola Isoton Novelli, Gabriel Kolesny Tricot, Kamila Meireles dos Santos, Gisela Arsa da Cunha, Lucieli Teresa Cambri. *Federal University of Mato Grosso, Cuiabá, Brazil.*  
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The anaerobic threshold (AT) is a good indicator of aerobic fitness, commonly determined by ventilatory variables - ventilatory threshold (VT) - and more recently, by indexes of heart rate variability (HRVT). However, there are few studies in young people with overweight and obesity. **Purpose:** To compare the HRVT, determined by two HRV index, with the VT in young people with different body mass index. **Methods:** 31 sedentary men (21.2 ± 1.7 years), 10 eutrophic (E: 22.7 ± 1.7 kg·m<sup>-2</sup>), 10 overweight (Ov: 27.0 ± 1.5 kg·m<sup>-2</sup>) and 11 obese (O: 33.7 ± 2.7 kg·m<sup>-2</sup>) were evaluated. A maximum incremental test on a cycle ergometer (INBRASPORT®, CG-04 model), with increments of 15 watts/min until volitional exhaustion was performed. The RR intervals were measured (Polar®, RS800CX model) and treated (Kubios HRV) to obtain SD1 and RMSSD index. The HRVT was determined in the first exercise intensity with SD1 (HRVT<sub>SD1</sub>) and RMSSD (HRVT<sub>RMSSD</sub>) less than 3 ms (Lima, 1999). The VT was determined by analysis of the ventilatory equivalent (VO2000, MEDICAL Graphics®) O<sub>2</sub> (VE/VO<sub>2</sub>) and CO<sub>2</sub> (VE/VCO<sub>2</sub>). **Results:** The HRVT<sub>SD1</sub> was determined in 100% and HRVT<sub>RMSSD</sub> in 90.3% of subjects. There were difference between methods (Kruss Kall Wallis Test and Duns Post Hoc, p<0.05; different letters indicate significant difference between methods) to the load (W) (E - HRVT<sub>SD1</sub>: 105 ± 36 HRVT<sub>RMSSD</sub>: 132 ± 57, VT: 109 ± 36; Ov - HRVT<sub>SD1</sub>: 85 ± 36; HRVT<sub>RMSSD</sub>: 101 ± 22, VT: 90 ± 16; O - HRVT<sub>SD1</sub>: 105 ± 30; HRVT<sub>RMSSD</sub>: 130 ± 16<sup>b</sup>, VT: 96 ± 24<sup>a</sup>) in obese, as well to the HR (bpm) (E - HRVT<sub>SD1</sub>: 138 ± 6<sup>a</sup>; HRVT<sub>RMSSD</sub>: 157 ± 17<sup>ab</sup>, VT: 140 ± 17<sup>b</sup> - Ov - HRVT<sub>SD1</sub>: 134 ± 14; HRVT<sub>RMSSD</sub>: 142 ± 13, VT: 133 ± 15; O - HRVT<sub>SD1</sub>: 137 ± 15; HRVT<sub>RMSSD</sub>: 150 ± 12, VT: 139 ± 33) in eutrophic. There were difference between groups (different symbols indicate significant difference between groups) in VO<sub>2</sub> (ml·kg<sup>-1</sup>·min<sup>-1</sup>): HRVT<sub>SD1</sub> (E: 22.2 ± 6.1\*, Ov: 17.18 ± 5.5<sup>a</sup>; O: 16.8 ± 2.7<sup>a</sup>); HRVT<sub>RMSSD</sub> (E: 20.9 ± 4.2; Ov: 19.7 ± 6.1, O: 18.7 ± 2.4); VT (E: 20.9 ± 6.0\*, Ov: 18.0 ± 4.0<sup>ab</sup>, O: 15.3 ± 2.4<sup>a</sup>). **Conclusion:** Sedentary young people with different BMI have similar aerobic fitness determined by VT and HRVT<sub>SD1</sub>. However, RMSSD index seem overestimate the VT in eutrophic (HR values) and obese (watts values), which refers caution in the use of this HRV index to assess aerobic fitness and exercise prescription in this population.

Supported by FAPEMAT (15141/2014), CNPq

**1525 Board #178 June 2, 9:00 AM - 10:30 AM  
Eight Weeks of Zumba Fitness Training Improves Balance Ability in Sedentary Obese Women.**

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Zumba fitness (Zumba) is a Latin-inspired dance-fitness program that blends Latin music and repetitive steps/dance moves that form a “fitness-party”. There is very little evidence to the effectiveness of Zumba as a mode of exercise despite its widespread popularity with more than 14 million people of genders and all ages. **PURPOSE:** This study examined the effects of 8 weeks of Zumba fitness training on balance ability and body composition in sedentary obese women. **METHODS:** Fourteen sedentary obese women, aged 24.6±5.7 yrs, were assigned into two groups: Zumba fitness training group (ZT; n=6) and aerobic exercise training group (AT; n=8). Subjects in ZT performed the Zumba fitness at 60-80% of maximal heart rate, 60 min/session, and 3 sessions/week for 8 weeks, whereas subjects in AT performed aerobic exercises including walking and/or jogging on treadmill or elliptical machine as well as cycling on cycle ergometer at the same exercise intensity, frequency and duration as the ZT. Height (cm), body mass (kg), waist circumference (cm), hip circumference (cm), percent body fat (%), blood pressure (mmHg), resting heart rate (b·min<sup>-1</sup>), blood glucose (mg·dL<sup>-1</sup>), blood lipids (mg·dL<sup>-1</sup>), maximal oxygen consumption (VO<sub>2</sub>max,

ml·kg<sup>-1</sup>·min<sup>-1</sup>), muscular strength (kg), and balance ability (sec) were measured pre- and post-intervention, and the results were analyzed utilizing a repeated measures two-way ANOVA. **RESULTS:** Balance ability in the dominant limb was significantly increased only in ZT (12.2±3.5 to 20.8±8.6 sec, p<.05). In the non-dominant limb, increased tendency of the time was shown in ZT (8.8±6.2 to 17.7±15.4 sec, p=.084). VO<sub>2</sub>max increased significantly in AT (30.1±5.1 to 33.3±5.6 ml·kg<sup>-1</sup>·min<sup>-1</sup>, p<.05). Systolic blood pressure (p=.013) and diastolic blood pressure (p=.032) decreased significantly in both groups. There was no significant difference in other variables after 8 weeks of training. **CONCLUSION:** The results indicate that Zumba fitness is an effective exercise regimen to improve balance ability in sedentary obese women. Supported by Internal Faculty Grant from the Midwestern State University

**1526 Board #179 June 2, 9:00 AM - 10:30 AM  
Different Cardiorespiratory Fitness And Clinical Characterization In Morbidly Obese Women**

Andreas M. Niess<sup>1</sup>, Patrick Schneeweiss<sup>1</sup>, Arno Hipp<sup>1</sup>, Florian Gollhofer<sup>1</sup>, Julian Kolatschek<sup>1</sup>, Tobias Meile<sup>2</sup>, Stephan Zipfel<sup>3</sup>, Christof Burgstahler<sup>1</sup>. <sup>1</sup>Sports Medicine, University Hospital, Tuebingen, Germany. <sup>2</sup>General and Transplantation Surgery, University Hospital, Tuebingen, Germany. <sup>3</sup>Psychosomatic Medicine, University Hospital, Tuebingen, Germany.  
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**In morbid obesity, assessment of cardiorespiratory fitness (CRF) is becoming increasingly important in the clinical setting.**

**PURPOSE:** To determine CRF in a representative cohort of morbidly obese women (mOB) and to compare it with overweight and moderately obese controls (C). We also asked whether mOB selected for low CRF exhibit differences in the cardiorespiratory response and the prevalence in obesity-related disorders.

**METHODS:** 715 women (20 - 67 yrs), underwent incremental walking exercise on the treadmill. Oxygen consumption (VO<sub>2</sub>) was assessed by spiroergometry at peak exercise (peak) and at the anaerobic threshold (AT) and reported relative to predicted normal body weight (peakVO<sub>2</sub>PW, AT-VO<sub>2</sub>PW) or in % of predicted VO<sub>2</sub> (peakVO<sub>2</sub>%, AT-VO<sub>2</sub>%, respectively). Linear trends of variables between C (BMI range 25.4 - 39.9 kg·m<sup>-2</sup>) and mOB (40.0 - 68.5 kg·m<sup>-2</sup>) were assessed by one-way ANOVA. mOB (n=489) were divided into 4 fitness quartiles (Q1 - 4) according the AT-VO<sub>2</sub>% and studied for differences in their cardiorespiratory response and prevalence of disorders as revealed from the medical reports. **RESULTS:** AT-VO<sub>2</sub>PW (C: 24.6 ± 0.3 / mOB: 28.3 ± 0.2 ml·kg<sup>-1</sup>·min<sup>-1</sup>, mean ± SD) and peakVO<sub>2</sub>PW (33.7 ± 5.6 / 36.4 ± 5.6 ml·kg<sup>-1</sup>·min<sup>-1</sup>) were higher in mOB (p<0.0001). AT-VO<sub>2</sub>% (106.1 ± 20.8 / 104.4 ± 17.8%) did not differ between C and mOB (p=0.253). In contrast, peakVO<sub>2</sub>% (108.8 ± 17.6 / 100.8 ± 14.9%) was lower in mOB (p<0.0001), but mean values of mOB remained within the reference range. mOB with low CRF (Q1: AT-VO<sub>2</sub>% < 88.7% of reference) exhibited a dampened response of heart rate, ventilation and tidal volume at AT and peak (p<0.0001), while respiratory exchange ratio at peak was similar between the groups. Prevalence of type 2 diabetes (DM) was higher in mOB with low CRF (Q1: 26%, Q2: 29%, Q3: 16%, Q4: 19%, p<0.05), while no differences were apparent for the prevalence of hypertension, COPD, lumbar and joint complaints. **CONCLUSION:** The majority of mOB exhibit a preserved CRF, which can be delineated by peak and submaximal exercise variables. However, a subgroup of mOB exhibit a low CRF, which is paralleled and possibly linked to an attenuated cardiorespiratory response. Moreover, a low CRF may aggravate the risk of DM in mOB. Our results show that spiroergometry may add important findings to improve individualized therapy decisions in mOB.

**1527 Board #180 June 2, 9:00 AM - 10:30 AM  
Effect Of A Lifestyle Intervention On Body Composition And Cardiorespiratory Fitness In Obese Subjects**

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(No relationships reported)

Obesity is increasing worldwide and obese people are at increased risk of developing non-communicable diseases and early death. **PURPOSE:** Primary to investigate changes in body composition and maximal oxygen uptake (VO<sub>2</sub>max) after an eight-week lifestyle intervention on obese subjects, and secondary to investigate if the changes were maintained after six months.

**METHODS:** In an experimental study with a pre-posttest design, 23 subjects (♀=19, ♂=4) aged 30-66 years and with a body mass index (BMI) of 34.0 ± 3.9 kg·m<sup>-2</sup> (mean± SD) were included. All subjects volunteered to participate in an eight-week intervention program with attendance to a rehabilitation clinic once a week. The intervention consisted of interdisciplinary treatment with theoretical and practical education in physical activity, nutrition and coping strategies. Anthropometrical

measurements were performed according to standardized methods. Body composition was measured with bioelectric impedance analysis (Inbody720) and VO<sub>2</sub>max was measured on a treadmill with a modified Balke protocol with MetaMax® II, analysator (CORTEX Biophysik GmbH, Leipzig, Germany) at baseline and after eight weeks and six months. ANOVA (repeated measurements) was used to analyze differences between measurements.

**RESULTS:** A significant reduction (mean [95% CI]) in bodyweight: -6.8 kg [-7.8, -6.0], BMI: -2.4 kg·m<sup>-2</sup> [-2.7, -2.2] and fat mass: -5.7 kg [-6.4, -5.0] (p<0.001) were found after eight weeks. VO<sub>2</sub>max increased significantly with 5.9 ml·kg<sup>-1</sup>·min<sup>-1</sup> [4.4, 7.4] and 0.3 L·min<sup>-1</sup> [0.2, 0.5] (p<0.001), respectively. From eight weeks to six months post intervention a further significant reduction in body weight: -1.8 kg [-3.6, -0.0], BMI: -0.6 kg·m<sup>-2</sup> [-1.1, -0.2] (p<0.05) and fat mass: -1.9 kg [-3.4, -0.5] (p=0.01) respectively were found. VO<sub>2</sub>max (ml·kg<sup>-1</sup>·min<sup>-1</sup>) increased significantly (p<0.05), but no change was found in L·min<sup>-1</sup>. At six months post intervention, all variables were significantly changed from baseline (p<0.001). After six months, 87 % of the participants had a weight loss of ≥ 5 % and 43 % ≥ 10 %.

**CONCLUSIONS:** An eight-week lifestyle intervention had a favorable effect on body composition and cardiorespiratory fitness in obese subjects. After six months, the changes were still maintained, and a minimal reduction in muscle mass was observed.

1528 Board #181 June 2, 9:00 AM - 10:30 AM  
**Six-Weeks Loaded Versus Unloaded Whole-Body Vibration Training on Arterial Function and Muscle Strength in Overweight/Obese Young Women**

Stacey Alvarez-Alvarado, Jacob Pacilio, Salvador J. Jaime, Jeremiah C. Campbell, Joy Post, Arturo Figueroa, FACSM, The Florida State University, Tallahassee, FL. (Sponsor: Dr. Arturo Figueroa, FACSM)  
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 (No relationships reported)

Obesity is directly associated to arterial stiffness (pulse wave velocity, PWV) and inversely related to muscle strength. Although high-intensity resistance exercise is the preferred modality to counteract muscle weakness, detrimental effects on arterial function (PWV; augmentation index, AIx@75; aortic systolic blood pressure, aSBP) have been observed. Unloaded whole-body vibration training (WBVT) has improved PWV, aSBP, and AIx@75 in overweight/obese women. Conventional unloaded-WBVT (U-WBVT) appears to be low-intensity and the effects of moderate-intensity (by adding external load) WBVT on arterial and muscle function are unknown. **PURPOSE:** To examine whether loaded-WBVT (L-WBVT) would induce greater benefits than U-WBVT on arterial and muscle function in young overweight/obese women. **METHODS:** Thirty-eight young overweight/obese women (age 21 ± 2 yrs; BMI 30.9 ± 3.4 kg/m<sup>2</sup>) were randomized into L-WBVT (n=13), U-WBVT (n=12), or control (CON, n=13) for 6 weeks. Leg PWV (faPWV), systemic PWV (baPWV), aSBP, AIx@75, and leg muscle strength were evaluated before and after 6 weeks. **RESULTS:** Because the vascular and muscular responses were similar, both WBVT groups were combined and compared with CON. WBVT significantly reduced faPWV (-0.33 ± 0.01 m/s, P < 0.01), baPWV (-0.54 ± 0.05 m/s, P < 0.001), AIx@75 (-4.9 ± 0.3 %, P < 0.001), and aSBP (-5 ± 1 mmHg, P < 0.001) and these decreases were significant (P < 0.01) when compared to CON. WBVT increased leg muscle strength (16.7 ± 1.3 %, P < 0.001) compared to CON (P < 0.001). **CONCLUSIONS:** This study provides evidence that WBVT (low- and moderate-intensity) have beneficial effects on peripheral and systemic arterial stiffness, aortic hemodynamics, and leg muscle strength in young obese women. Seemingly, the use of an external load during WBVT to increase exercise intensity does not provide any additional improvement in vascular function and muscle strength in overweight/obese premenopausal women.

1529 Board #182 June 2, 9:00 AM - 10:30 AM  
**Caloric Restriction During Aerobic Training Enhances Cardiorespiratory Fitness in Obese, Older Adults: A Randomized Controlled Trial**

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**PURPOSE:** Obesity exacerbates age-related declines in cardiorespiratory fitness (CRF). Aerobic training (AEX) improves CRF, but its efficacy may be blunted by obesity. This study determined whether adding caloric restriction (CR) to achieve weight loss during AEX affects improvement in CRF in obese older adults. **METHODS:** This study (Investigating Fitness Interventions in the Elderly, INFINITE) was a 5-month, randomized trial in 180 older (65-79 yrs), obese (BMI=30-45 kg/m<sup>2</sup>) adults randomized to: 1) AEX only (supervised treadmill walking four d/wk, progressed to 30 min at 65-70% heart rate reserve), 2) AEX with moderate CR (-250 kcal/d deficit; AEX+LowCR), or 3) AEX with intensive CR (-600 kcal/d deficit;

AEX+HighCR). The controlled diet for CR participants consisted of two meals/day prepared by a metabolic kitchen. Peak aerobic capacity (VO<sub>2</sub>peak, primary outcome) was determined with a graded exercise treadmill test to exhaustion.

**RESULTS:** There were 156 (87%) completers. Body mass decreased more (p<0.0001) in AEX+LowCR (-8.0 kg, 8.5%) and AEX+HighCR (-8.8 kg, 9.4%) compared to AEX (-1.4 kg, 1.5%). Fat mass and %fat decreased in all groups, with greater declines in CR groups; lean mass declined only in the CR groups. All groups increased VO<sub>2</sub>peak (ml/kg/min) and peak MET level (p<0.05), but increases were significantly greater in CR groups (see Table). All interventions improved 400-meter walk time, gait speed over 4 meters, and overall lower-extremity function with no difference in the magnitude of improvement between groups.

	AEX			AEX+LowCR			AEX+HighCR		
	Pre	Post	% change	Pre	Post	% change	Pre	Post	% change
VO <sub>2</sub> peak (L/min)	1.78 ± 0.39	1.88 ± 0.40	6.3%	1.76 ± 0.44	1.80 ± 0.47	2.8%	1.68 ± 0.42	1.74 ± 0.43	4.2%
VO <sub>2</sub> peak (ml/kg/min)	19.0 ± 3.5	20.4 ± 3.9	7.9%	18.6 ± 3.8	21.2 ± 4.3	14.6%	17.7 ± 2.8	20.5 ± 3.8	15.7%
MEtS	5.3 ± 1.1	5.6 ± 1.2	8.3%	5.2 ± 1.0	6.0 ± 1.3	16.7%	5.0 ± 0.8	5.8 ± 1.1	17.2%

**CONCLUSION:** Adding CR during AEX improves CRF more than AEX alone and does not compromise other functional adaptations to AEX in obese, older adults. Supported by NHLBI Grants R01HL093713 and P30AG21332

1530 Board #183 June 2, 9:00 AM - 10:30 AM  
**Supramaximal Exercise Training Enhances several Health-Related Outcomes in Obese Adults**

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 (No relationships reported)

Studying the effects of exercise training on health- and performance-related outcomes may be the best approach to describing its beneficial effects among obese individuals. **PURPOSE:** The present study evaluates the effects of six weeks of supramaximal exercise training (SET) on performance variables and metabolic changes in sedentary obese adults. **METHODS:** Twenty-four obese adults were randomized into a non-trained (NT) [n=12; body mass index (BMI)=33(3)] and SET group [n=12; BMI=33(2)]. After baseline metabolic, anthropometric, and fitness measurements, the participants completed a 6-week SET intervention comprising 18 sessions of 6 repeats of 6-second supramaximal sprints on an electromagnetically braked cycle ergometer, with 2-minute recovery between each repetition. Metabolic, anthropometric, and fitness assessments were repeated post-intervention. **RESULTS:** Neither anthropometrics nor maximal oxygen uptake differed between the groups after 6 weeks of SET. For SET, fasting glucose (4.64(0.15) vs 4.32(0.22) mmol/l; p<0.01), insulin (23.2(4.6) vs 13.8(3.3) µmol/ml; p<0.01), HOMA-IR (4.78(1.2) vs 2.65(1.5); p<0.01), and systolic blood pressure (127(3) vs 120(3) mmHg; p<0.01) were significantly lower 24-hours post-intervention than at baseline and for the NT group, and these changes remained significant at 72-hours and two-weeks post-intervention (p<0.01, respectively). Interestingly, NFEA (0.62(0.09) vs 0.71(0.11) mmol/l; p<0.01) and resting fat oxidation rate (57(11) vs 63(4) %; p<0.01) increased significantly from baseline 24-hours post-intervention in the SET group and decreased significantly from baseline at 72-hours (p<0.01, respectively) and two-weeks post-intervention (p<0.01, respectively). **CONCLUSIONS:** Although there were no changes in the participants' anthropometric and aerobic fitness variables, six weeks of SET improved a number of metabolic and vascular risk factors in obese, sedentary adults, highlighting the potential of SET to provide an alternative exercise model for the improvement of metabolic health in this population.

**C-38 Free Communication/Poster - Physical Activity, Cognition, and Emotion**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM

Room: Exhibit Hall A/B

- 1531 Board #184 June 2, 9:00 AM - 10:30 AM  
**Running Augments Felt Positive Emotion And Dampens Prefrontal Cortical Responses To Negative Emotions**  
 Grace E. Giles<sup>1</sup>, Marianna D. Eddy<sup>2</sup>, Tad T. Brunye<sup>2</sup>, Heather L. Urry<sup>1</sup>, Harry L. Graber<sup>3</sup>, Caroline R. Mahoney<sup>2</sup>, Holly A. Taylor<sup>1</sup>, Robin B. Kanarek<sup>1</sup>. <sup>1</sup>Tufts University, Medford, MA. <sup>2</sup>Center for Applied Brain & Cognitive Sciences, Medford, MA. <sup>3</sup>SUNY Downstate Medical Center, Brooklyn, NY.  
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 (No relationships reported)

**PURPOSE:** To determine whether prolonged exercise influences emotion, emotion regulation choice and success, and activity in the prefrontal cortex in physically fit individuals. **METHODS:** Thirty six individuals (21 female; age 18-30 years) participated. All ran regularly: at least 30 miles per week, with at least one run per week of 9 miles or more. On separate occasions, participants ran at 70% age-adjusted maximum heart rate (MHR) or walked at 57% MHR for 90 minutes. Participants completed subjective measures of affective state (on a scale from "very bad" to "very good") and arousal ("low arousal" to "high arousal") 10 minutes before, every 30 minutes during, and 30 minutes after exercise. They also completed an emotion regulation task after exercise: the cognitive reappraisal task, in which they viewed negative and neutral pictures, while attempting to either reappraise (heard decrease) or maintain their thoughts of the pictures. They were then asked to rate the picture's unpleasantness on a scale from 1 (not at all unpleasant) to 7 (very unpleasant). Functional near-infrared spectroscopy (NIRS) was used to quantify changes in prefrontal cortex oxygenation (O2Hb). **RESULTS:** Exercise intensity increased positive affect and arousal. Consistent with previous results, negative images were rated as less unpleasant when paired with the instruction to decrease relative to maintain. However, exercise intensity did not influence rated unpleasantness between negative and neutral images, or between the instruction to decrease and maintain. Self-report of regulation strategies indicated that a higher proportion of participants used cognitive reappraisal rather than other emotion regulation strategies following the run than walk, suggesting that running promoted the choice to reappraise as instructed. O2Hb signals decreased upon viewing Negative relative to Neutral images, particularly following the 90-minute walk, potentially signifying that running mitigated the heightened neural response to unpleasant images. O2Hb did not differ as a function of emotion regulation instruction. **CONCLUSION:** Prolonged running accentuates positive emotions and dampens neural responses to negative emotions in the prefrontal cortex, and running increased the choice to use cognitive reappraisal but not its ultimate success.

- 1532 Board #185 June 2, 9:00 AM - 10:30 AM  
**Measured Emotion and Exercise: The Effect of Exercise Intensity**  
 Patrick Wood, Allyson Gillespie, Alex Pennetti, Michelle Wong, Kevin Milne. *University of Windsor, Windsor, ON, Canada.*  
 (No relationships reported)

The Borg Scale of ratings of perceived exertion (RPE) is widely used to determine subjective exercise difficulty. However, RPE does not indicate emotional state of exercising humans. Consequently, the Self-Assessment Mannikin (SAM) of emotional states was used in conjunction with the Borg Scale to determine valence, arousal and dominance feelings during exercise of 3 different intensities in men and women. **PURPOSE:** To determine human emotional responses to exercise at various intensities. **METHODS:** Participants (n=28; female=18, male=10) reported SAM and RPE prior to and at 17.5 minutes during steady state cycle ergometer exercise designed to elicit 40% (LOW), 60% (MOD), or 80% (HIGH) of maximal oxygen consumption. Data were analyzed using a 2 factor (3: intensity x 2: sex) repeated measures ANOVA and presented as mean (SD). **RESULTS:** RPE was significantly greater at each exercise intensity (9.2 (1.9), 11.3 (2.0) vs 13.9 (1.8) for the LOW, MOD and HIGH intensities, respectively; p<0.001). In each of the dimensions of emotion as measured by the SAM, there was a significant main effect for intensity such that participants in the HIGH intensity group reported significantly less positive scores than participants in the LOW and MOD intensity groups during exercise. Sam results are as follows: valence (1 = pleasant, 9 = unpleasant) mean ratings were 3.9 (0.8) for HIGH versus 2.7 (1.0) and 2.9 (1.1) for LOW and MOD, respectively (p<0.001); arousal (1 = excited, 9 = calm) mean ratings were 5.1 (0.7) for HIGH versus 6.8 (0.7) and 6.1 (0.8) for LOW and MOD, respectively (p<0.001); dominance (1 = dominated, 9 = dominant) mean ratings were 5.3 (0.9) for HIGH versus 6.4 (1.4) and 6.6 (1.0) for LOW and

MOD, respectively (p<0.05). There was no significant effect of sex. **CONCLUSION:** At the highest intensity, participants reported significantly different emotional states as measured by SAM. These observations have implications for exercise prescription, adherence and mood.

- 1533 Board #186 June 2, 9:00 AM - 10:30 AM  
**The Effect of Exercise Intensity on Memory Consolidation**  
 Michelle Wong, Shihan Rajasingham, Alex Pennetti, Patrick Wood, Allyson Gillespie, Kevin Milne. *University of Windsor, Windsor, ON, Canada.*  
 (No relationships reported)

The physiological response to stress involves activation of the fight or flight response. In particular, sympathetic nervous system (SNS) activity, circulating catecholamines and glucocorticoids (cortisol) are elevated. Acute stress is associated with enhanced memory consolidation, a result linked to catecholamine and cortisol at the time of information presentation. Since physical exercise elicits a physiological stress response, it is possible that exercise-induced stress could mimic the memory consolidation processes of other stressors. **PURPOSE:** To examine the effect of exercise intensity on memory consolidation. **METHODS:** College-aged participants (n=40; female = 18, male = 22) were shown 20 IAPS rated images (10 seconds per image) following 25 minutes of seated rest (REST; n=10) or cycle ergometer exercise designed to elicit either 40% (LOW; n=10), 60% (MOD; n=9), or 80% (HIGH; n=11) of maximal oxygen consumption. Saliva samples were taken before and after each exercise bout for the analysis of salivary cortisol. Seven days following image viewing, participants were asked to recall as many images as possible and both correct and incorrect recalls were recorded for analysis. Data are presented as means and (SD). **RESULTS:** Salivary cortisol change was greatest after HIGH [87.6 (154.7) µg/dL] but only significantly different than REST [4.4 (33.1) µg/dL], p<0.05. The greatest number of correctly recalled images [6.4 (3.1)] and lowest number of incorrectly recalled images [1.6 (2.2)] were observed in HIGH. However, the number of correctly recalled images in HIGH was significantly different than only the REST group [4.1 (1.9)]. Of the images recalled, participants in MOD and HIGH recalled a greater percentage of images (45.5% and 45.1%, respectively) than REST and LOW (24.3% and 17.0%, respectively) that were rated less pleasurable (p<0.05). There was also a tendency for participants in the HIGH group to recall a greater percentage of images rated as arousing. **CONCLUSIONS:** An acute exercise bout of sufficient intensity can improve memory consolidation, particularly of information rated less pleasurable and arousing. However, more information is needed to determine the mechanisms behind this exercise-induced response.

- 1534 Board #187 June 2, 9:00 AM - 10:30 AM  
**Body Composition And Muscle Strength Predict Cognitive Function Of The Community Dwelling Elderly**  
 Cheng-Hung Lai, male, Chiao-nan Chen. *Chang Gung University, Taoyuan City, Taiwan.*  
 (No relationships reported)

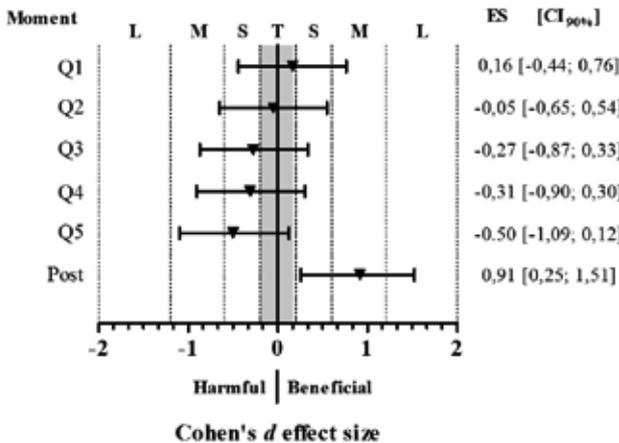
Cognitive function declines with aging. The age-related cognitive decline not only decreases the independence of the elderly but also increases the need of care services. Studies have shown the positive relationship between physical activity or physical fitness and cognitive function. However, it is unknown which component of physical fitness is most correlated to the cognitive function in the healthy elderly. **Purpose:** (1) To examine the relationships between cognitive function and components of physical fitness in the community dwelling elderly. (2) To understand whether physical fitness can predict cognitive function of the elderly. **Method:** Sedentary individuals who aged above 65 years old and lived in the community were recruited in this study. Cognitive function including Cognitive Abilities Screening Instrument (CASI), Trail Making Test (TMT) and N-back test were assessed. Physical fitness including body composition (body mass index, waist circumference, body fat percentage (BFP)), muscle strength (grip strength, chair-stand test), flexibility (forward reach), balance (one leg standing test) and cardiopulmonary fitness (6 minute walk test and 2-minute step test) were measured. Pearson correlation coefficient was used to examine the correlation between variables. Linear regression analysis was used to construct models that predict cognitive function. **Result:** Twenty community dwelling elderly (age: 69.8±4.5 years old) were recruited in this study. Muscle strength assessed by chair-stand-test and body composition assessed by BFP were two components of physical fitness that were correlated with the cognitive function. BFP was correlated with the CASI score (r=-.557, P=0.01) and the CASI sub-score in the memory category (r=-.557, P=0.01), and was correlated with the time that individuals completed the TMT (r=.479, P=0.045). Time to finish five sit to stands was correlated with TMT (r=.56, P=0.02) and N-back test (r=-.666, P=0.005). Chair-stand test and BFP independently predicted the cognitive function assessed by TMT and N-back test (adjusted R2 = 0.4 for both test, P=0.01 and 0.005, respectively). **Conclusion:** Body composition and muscle strength of lower extremities are good predictors of cognitive function in the community dwelling elderly.

1535 Board #188 June 2, 9:00 AM - 10:30 AM  
**The Effect of Aerobic Exercise Duration on Affective Responses**

Bruno R R Oliveira<sup>1</sup>, Andréa C. Deslandes<sup>2</sup>, Leônidas M. Fagundes<sup>3</sup>, Sarah C. Generoso<sup>3</sup>, Tony M. Santos<sup>4</sup>. <sup>1</sup>Federal University of Rio de Janeiro, Rio de Janeiro, Brazil. <sup>2</sup>Rio de Janeiro State University, Rio de Janeiro, Brazil. <sup>3</sup>President Antônio Carlos University, Barbacena, Brazil. <sup>4</sup>Pernambuco Federal University, Recife, Brazil.  
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 (No relationships reported)

**ABSTRACT**

Considering a possible influence of affective responses in exercise adherence, a better understanding on the effect of exercise duration on affective responses could contribute for the increase of affective responses in aerobic exercise sessions, increasing the likelihood of exercise adherence. **PURPOSE:** The objective was to verify the effect of exercise duration on affective responses. **METHODS:** Fifteen men (age = 24 ± 4 years; VO<sub>2peak</sub> = 47.9 ± 7.4 mL.kg<sup>-1</sup>.min<sup>-1</sup>; and percent body fat = 10.8 ± 4.5) underwent to two visits on a treadmill. In the first visit, anthropometric measurements were recorded and a maximal incremental test was performed to determine the VO<sub>2peak</sub>, HR<sub>Max</sub> and the respiratory compensation point. In the second visit, the aerobic exercise session was performed, we recorded physiological variables (VO<sub>2</sub> and HR) and the affective response using the Feeling Scale before, during and after the exercise session. The total number of records of the affective response was reduced and equalized into quintiles. **RESULTS:** A linear regression analysis between the Feeling Scale and the exercise duration showed an inverse relationship between exercise duration and affective response which reduced at a rate of -0.4 every 5 minutes of exercise (r<sup>2</sup> = 0.97; p = 0.001). An effect size analysis comparing the different moments of measurement of affective response indicated a reduction from quintile 3 (≈ 14 minutes of exercise) to quintile 5 (≈ 24 minutes of exercise) compared to the affective response measured before the exercise with an effect size classified as Small (Figure). **CONCLUSIONS:** The results indicates that the duration may influence the affective response during an aerobic exercise session.



1536 Board #189 June 2, 9:00 AM - 10:30 AM  
**Influence Of Physical And Emotional Stress On Cognitive Control**

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 (No relationships reported)

Studies exploring effects of exercise on cognitive control have yielded inconsistent results, possibly due to a number of factors including exercise intensity, duration or baseline fitness levels. Certain studies found that moderate exercise facilitated cognitive control whereas extreme physical fatigue selectively impaired response inhibition with no effect on other cognitive tasks. Stress-induced anticipatory anxiety has also been shown to facilitate response inhibition. The ability to inhibit response to irrelevant information may not be critical during all forms of exercise, but stressful situations like those experienced by military personnel require maintaining peak levels

of cognitive control while operating under physically and emotionally demanding conditions. Research has focused on the independent effects of physical and emotional stress on cognitive control, but interactions between the two remain poorly understood. **PURPOSE:** To test if anticipatory anxiety mitigates detrimental effects of physical fatigue on cognitive control, specifically response inhibition. **METHODS:** 21 young adults performed an auditory response inhibition (go/no-go) task at rest or while cycling at high intensity on an ergometer for 50 minutes. Anticipatory anxiety was induced using a common stress-induction paradigm known as “threat of shock”. Participants were told that they may receive a mild electric shock at any time during the experiment, and that shocks would be unpredictable and unrelated to task performance. **RESULTS:** Participants reported higher levels of anxiety under threat of shock, and perceived exertion increased throughout the exercise session. Overall participants made more false alarms (indicating reduced response inhibition) when exercising. Anxiety had no effect on false alarm rate across all trials. Participants did show an overall bias toward responding (on both go and no-go trials) in the safe condition later in the study, when reporting higher perceived exertion. **CONCLUSION:** These data suggest that cognitive control is impaired during exercise, and that anticipatory anxiety does not mitigate these performance decrements but does influence overall response bias as perceived exertion increases. Supported by the US Army Natick Soldier Research, Development and Engineering Center.

1537 Board #190 June 2, 9:00 AM - 10:30 AM  
**Reduction In Oxygen Delivery Under Severe Hypoxia Affects Cognitive Function During Moderate Exercise**

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Reduction in oxygen delivery during hypoxia might impair cognitive function at rest. In contrast, acute moderate exercise can improve cognitive function. A recent study suggested that cognitive function improves during moderate exercise even under moderate hypoxia. However, it is unclear how moderate exercise affects cognitive function under severe hypoxia. **PURPOSE:** To clarify the effects of moderate exercise on cognitive function under severe hypoxia. **METHODS:** Thirteen subjects completed cognitive tasks under either normoxia or severe normobaric hypoxia (FIO<sub>2</sub>: 0.12–0.13) in a randomized crossover design. For each condition, participants underwent preliminary testing to assess peak oxygen uptake (peak VO<sub>2</sub>) while pedaling an ergometer. After a 5-min warm-up (30% peak VO<sub>2</sub>), they cycled at moderate intensity (50% peak VO<sub>2</sub>) for 15 min. Cognitive tasks were performed at rest and 5 min after the start of exercise at moderate intensity. Cognitive tasks were a spatial delayed-response task and a Go/NoGo task, which required working memory and executive function. Pulse oximetric saturation (SpO<sub>2</sub>) and cerebral oxygenation were monitored throughout the experiment. Cerebral oxygenation was recorded by near infrared spectroscopy and was expressed as changes from baseline. **RESULTS:** Severe hypoxia significantly decreased SpO<sub>2</sub> and cerebral oxygenation at rest relative to normoxia (SpO<sub>2</sub>: 97.9 ± 0.7 vs. 87.8 ± 1.5 %, p < 0.01; cerebral oxygenation: 0.2 ± 1.3 vs -8.9 ± 1.7 %, p < 0.01). Moreover, relative to rest, exercise significantly decreased SpO<sub>2</sub> and cerebral oxygenation under hypoxia (SpO<sub>2</sub>: 87.8 ± 1.5 vs. 77.5 ± 3.0 %, p < 0.01, cerebral oxygenation: -8.9 ± 1.7 vs. -17.0 ± 2.4 %, p < 0.01). Compared with rest, reaction time (RT) on the Go/NoGo task improved during exercise in both conditions (Normoxia: 1015 ± 315 vs. 862 ± 208 ms, p < 0.01, Hypoxia: 1023 ± 228 vs. 896 ± 236 ms, p < 0.01). Neither exercise nor hypoxia altered the accuracy on the cognitive tasks. In the hypoxic condition, ΔRT was negatively correlated with changes in SpO<sub>2</sub> (r = -0.56; p < 0.05). **CONCLUSIONS:** Acute moderate exercise improves cognitive function even under severe hypoxia. However, the improvements under hypoxia appear to lessen as SpO<sub>2</sub> decreases during exercise.

1538 Board #191 June 2, 9:00 AM - 10:30 AM  
**Cognitive Function And Affective States Following Exercise Under Severe Hypoxia.**

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It has been suggested that acute exercise improves cognitive function. Recent studies indicated that cognitive function improves during exercise under moderate hypoxia. However, it is unclear how cognitive function and affective states are influenced after exercise under severe hypoxia.

**PURPOSE:** The purpose of this study was to determine cognitive function and affective states following exercise under normoxia and severe hypoxia.  
**METHODS:** The participants performed cognitive tasks at rest (pre) and after exercise (post) under normoxia and severe hypoxia (FIO<sub>2</sub>=0.12). The participants cycled an ergometer at 30% peak VO<sub>2</sub> for 5 min as a warm-up exercise, and then cycled at 50% peak VO<sub>2</sub> for 15 min in the respective conditions. We used a Stroop task where executive function is required. Executive function was assessed by reaction time (RT) and accuracy of the task. Stroop-interference was calculated by subtracting RT in the neutral trial from that in the incongruent trial. The Mood Check List-short form 2 (MCL-S.2) was used to assess affective states. We measured blood flow velocity in the middle cerebral artery (MCAv) using transcranial Doppler ultrasonography during the cognitive tasks at rest and after exercise.  
**RESULTS:** We observed no differences in accuracy of the task between at rest and after exercise in both conditions. The Stroop-interference was not altered after exercise in hypoxia condition (pre: -2.1 ± 27.6, post: -3.6 ± 24.4 ms), while the Stroop-interference significantly increased after exercise in the normoxic condition (pre: 9.0 ± 39.6, post: 79.9 ± 29.1 ms, *p* < 0.001). MCAv tended to increase after exercise relative to rest in the hypoxic condition (pre: 48.2 ± 12.7, post: 50.8 ± 16.8 cm/s, *P* = 0.07). In contrast, we observed no differences in MCAv between pre and post in the normoxic condition (pre: 47.5 ± 12.8, post: 40.2 ± 12.5 cm/s). The results of MCL-S.2 indicated that anxiety significantly decreased in the hypoxic condition (pre: -8.2 ± 2.3, post: -11.4 ± 1.3, *P* = 0.02). However, anxiety was not affected in the normoxic condition (pre: -10.6 ± -2.19, post: -10.6 ± 2.6).  
**CONCLUSIONS:** These results suggest that the absence of impairments in executive function and improved anxiety in the hypoxic condition may be, at least in part, due to an increase in cerebral blood flow following exercise under severe hypoxia.

1539 Board #192 June 2, 9:00 AM - 10:30 AM  
**The Effect of Anaerobic Exercise on Working Memory**

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>Aerobic exercise has been shown to increase cerebral blood flow to specific regions of the brain, especially the hippocampus. Physically active individuals have increased brain perfusion and enhanced memory in comparison to matched sedentary counterparts. There are two types of memory storage systems, working memory (WM) and long term memory. Working memory is composed of a limited storage system in which information is lost, or decays within seconds without the allocation of conscious rehearsal strategies. WM is usually measured with the digit span memory test (DSMT) which measures the subjects working number storage capacity. Participants are presented with a series of digits (e.g., '8, 2, 4') and must immediately repeat them back. If they do it successfully, they are given a longer list (e.g., '9, 2, 4, 1'). The length of the longest list a person can remember is that person's digit span. Numerous studies have examined the effects of aerobic exercise on both working memory and long term memory. However, there are few studies that have examined the effects of anaerobic exercise on working memory. **PURPOSE:** The purpose of this study was to determine if there is a relationship between anaerobic exercise and working memory in college-aged adults. **METHODS:** 20 subjects (age 23 ± 2.1 yr, body mass 72.7 ± 7.8 kg, ht. 170.2 ± cm) were familiarized with the DSMT and the Wingate anaerobic power test (WAPT). Within one week following the familiarization trial, subjects performed a randomly assigned, cross over protocol of either the control (C) trial (pre-DSMT, rest 10 minutes, followed by the 5 minute post-DSMT, and the 30 minute post-DSMT) or the exercise (WAPT) trial (pre-DSMT, rest five minutes, followed by the WAPT, the 5 minute post-DSMT, and the 30 minute post-DSMT). There was a minimum of 48 hrs between trials. **RESULTS:** Pre-DSMT were 7.1 ± 1.6 and 7.05 ± 1.3, post-5 min were 7.10 ± 1.2 and 6.65 ± 1.1, and 30 minute post-DSMT were 7.35 ± 1.1 and 7.05 ± 1.4, for C and WAPT, respectively. Statistical analysis by ANOVA (*p* > .05) revealed no significant difference between trials. **CONCLUSION:** Unlike

aerobic exercise, the performance of intense WAPT does not improve working memory as measured by the digit span memory test. In addition, participants can engage in high intensity training without fear of a negative impact on working memory.

1540 Board #193 June 2, 9:00 AM - 10:30 AM  
**Don't Forget To Exercise: The Effects Of Aerobic Or Resistance Exercise On Prospective Memory**

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Prospective memory is the ability to remember to perform a task or action at a future point in time. Everyday examples include remembering to take medication on schedule or to attend a meeting on time. Although an acute bout of exercise has been shown to improve retrospective memory, its impact on prospective memory has never been examined. **PURPOSE:** The purpose of the present study was to determine the effects of acute aerobic or resistance exercise on prospective memory within college-age students. **METHODS:** Undergraduate students were randomly assigned to one of three groups: 1) treadmill running (R) (n=17), 2) kettlebell resistance exercise (K) (n=15), or 3) sitting (S) (control group) (n=12). As part of a larger study on the effects of exercise on cognition, participants were administered two prospective memory tasks. Specifically, participants were asked to 1) remind the researcher to send an email to his/her supervisor to submit their research participation credits and 2) request a red pen whenever they were asked to write or draw a response. Instructions for each task were administered prior to the exercise or sitting phase of the experiment and participants were expected to execute each of these tasks shortly after the exercise or sitting phase of the experiment (while they were undergoing further cognitive testing). Participants in the R and K groups performed their respective exercises for 20 minutes, and participants assigned to the S group sat for 20 minutes. Heart rates (HR) of the R and K participants, who were asked to exercise at a moderate intensity (50-70% of max HR), were analyzed via HR telemetry. **RESULTS:** Results showed that 16.7% of participants in the S group completely forgot to give the reminder, 0% of participants in the K group forgot to give the reminder and only 5.9% of participants in the R group forgot to give the reminder. Results were the same for the red pen prospective memory task. Chi-square analysis of the data revealed that these differences were not statistically significant ( $\chi^2(2) = 2.95, p = .23$ ). **CONCLUSION:** Preliminary findings indicate an acute bout of aerobic or resistance exercise do not have a significant effect on prospective memory performance. However, small sample size may have precluded significance due to low statistical power.

1541 Board #194 June 2, 9:00 AM - 10:30 AM  
**Affective and Motivational Responses to 3D Body Imaging**

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 (No relationships reported)

Common body weight and composition testing has been shown to impact emotional, motivational, and behavioral responses. Three-dimensional body imaging is a relatively new technology to be utilized in medical and fitness settings to provide detailed body image feedback to the patient or client, while encouraging motivation to control body weight, fat, and shape. However, such responses to 3D body imaging have not been examined. **PURPOSE:** To examine the acute affective and motivational responses to 3D body imaging (Fit3D) in a sample of college-aged women (*N* = 32), classified as either normal weight (NW; *n* = 13) or overweight/obese (OWOB; *n* = 19). **METHODS:** Positive and negative affect were assessed with the Positive (PA) and Negative Affect (NA) Schedule (PANAS; range: 1-5), and one item assessed motivation to lose weight (range: 1-10). These variables were assessed immediately before and after a single 3D body imaging session. Participants had 1-minute to examine their 3D body scan, and then continued to examine their scan during all post-measures. **RESULTS:** Overall, PA did not change pre- to post-scan (3.11 ± .98 to 3.18 ± 1.07, *p* > .05), nor did NA (1.52 ± .58 to 1.63 ± .89, *p* > .05). In addition, there was not a time by BMI (NW versus OWOB) interaction for both PA and NA. Overall, motivation to lose weight slightly increased (6.41 ± 2.78 to 7.09 ± 2.75, *p* = .001). There was not an interaction of time by BMI, with both groups increasing over time. However, there was a between-subjects effect with OWOB holding higher pre-motivation to lose weight than NW participants (7.63 versus 4.62, respectively; *p* < .01). **CONCLUSIONS:** Within the present sample of college-aged women, a 3D body image scanning session did not appear impact PA or NA responses, but did produce a slight increase in motivation to lose body weight in participants classified as NW or OWOB. This research provides foundational insight to future research and the use of this novel technology for health behavior change in fitness and clinical settings.

1542 Board #195 June 2, 9:00 AM - 10:30 AM  
**Effects Of A 3d Body Imaging Trigger On Self-perceived Attractiveness, Self-conscious Emotions And Coping**

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 (No relationships reported)

Novel technologies currently being utilized in fitness and clinical settings, such as 3D body scans, are proposed to act as a trigger or spark for weight control behavior. However, other weight-related triggers in women have been shown to produce variation in emotional and weight control response. **PURPOSE:** To examine the acute effect of 3D body imaging system (Fit3D) on self-conscious emotions (guilt, shame, pride) and body weight-related coping in a sample of college-aged women ( $N = 30$ ) classified as normal weight (NW,  $n = 12$ ) or overweight/obese (OWOB,  $n = 18$ ). **METHODS:** The Body and Appearance-related Self-conscious Emotions Scale (BASES; range: 1-5) and the WEIGHTCOPE (range: 1-7) were used to assess self-conscious emotions and intention to utilize 10 different weight-related coping strategies following a single 3D body scanning session. Body fat percentage (BF%) was assessed via DXA. **RESULTS:** Following the scan, participants experienced low to moderate feelings of guilt ( $3.18 \pm .99$ ), shame ( $2.67 \pm 1.05$ ), authentic pride ( $2.68 \pm .96$ ), and hubristic pride ( $2.49 \pm .87$ ). Significant differences ( $p < .05$ ) were found between participants classified as NW or OWOB, respectively, in shame ( $2.11 \pm .76$  vs.  $3.05 \pm 1.07$ ), guilt ( $2.82 \pm .85$  vs.  $3.43 \pm 1.02$ ), and authentic pride ( $3.10 \pm .78$  vs.  $2.39 \pm .98$ ). Increasing physical activity and self-regulation, eating healthier, and positively reframing the situation were the highest rated coping responses ( $M = 5.23$  to  $6.25$ ). Differences were found between BMI groups for intention to cope by suppressing appetite (NW =  $2.68 \pm 1.05$ , OWOB =  $3.56 \pm 1.02$ ;  $t = 2.24$ ,  $p < .05$ ), supplement use (NW =  $1.14 \pm .22$ , OWOB =  $1.85 \pm 1.28$ ;  $t = 2.30$ ,  $p < .05$ ), and a trend for camouflaging body (NW =  $2.70 \pm .51$ , OWOB =  $3.14 \pm .99$ ,  $t = 1.57$ ,  $p = .06$ ). Feelings of shame were correlated with intention to camouflage body ( $r = .46$ ,  $p = .01$ ), while authentic pride trended toward a negative correlation with suppressing appetite ( $r = -.31$ ), camouflaging ( $r = -.35$ ), and supplement use ( $r = -.34$ ). **CONCLUSIONS:** An acute 3D body image scan session was shown to produce variation in self-conscious emotions (shame, guilt, pride) and coping choices between NW and OWOB participants. These individual differences should be taken into consideration to better accommodate healthy behavior change following 3D imaging use.

1543 Board #196 June 2, 9:00 AM - 10:30 AM  
**Role Of Acute Moderate-intensity Dynamic Exercise Duration On Post-exercise Executive Function**

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Acute moderate-intensity dynamic exercise (MI) can improve cognitive function (especially executive function (EF)). It is not evident, however, whether acute exercise training programs differing in exercise duration also differ in their relative ability to alter post-exercise EF.

**PURPOSE:** We hypothesized that a hormetic relation exists between the duration of exercise and EF because increased mental fatigue might induce executive decline. The purpose of the present study was to directly compare acute exercise training programs of differing duration in an attempt to discern an effective exercise prescription for improving EF.

**METHODS:** Fifteen healthy male subjects performed 10 min of MI ( $10_{MI}$ ), 20 min of MI ( $20_{MI}$ ), and 40 min of MI ( $40_{MI}$ ) protocols in a randomized and counterbalanced order. The MI protocol was 60% VO<sub>2peak</sub>. To evaluate EF, a color-word Stroop task (CWST) was performed pre- and post-exercise for 30 min (four times with 10-min intervals; i.e. 0 min, 10 min, 20 min, and 30 min after exercise). We measured both reaction time and response accuracy using the CWST, and reverse-Stroop interference scores were obtained. To evaluate mental fatigue, we used visual analog scale (VAS). The subjects drew line on VAS immediately after measurements of CWST.

**RESULTS:** The EF immediately after  $20_{MI}$  and  $40_{MI}$  were significantly improved as compared with those before exercise ( $P < 0.05$ ), while not in  $10_{MI}$  (the EF at 10 min point of post- $10_{MI}$  recovery was slightly improved as compared with that before exercise ( $P = 0.067$ )). The improved EF during post-exercise recovery was sustained longer in response to  $20_{MI}$  than  $10_{MI}$ . Furthermore, the improved EF during post-exercise recovery was sustained longer in response to  $40_{MI}$  than  $20_{MI}$ . The mental fatigue immediately after  $40_{MI}$  was significantly increased as compared with  $10_{MI}$  and  $20_{MI}$  ( $P < 0.05$ ).

**CONCLUSION:** On the contrary to our hypothesis, we could not find a hormetic relation between the duration of exercise and EF during post-exercise recovery albeit mental fatigue increased with exercise duration. The finding suggests that substantial MI duration might play an important role in improvement of post-exercise EF.

1544 Board #197 June 2, 9:00 AM - 10:30 AM  
**Chronic Exercise And Protein-content Of A Single Meal Influence Hippocampal-dependent Learning**

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Chronic aerobic exercise improves cognitive performance with benefits particularly evident for measures of hippocampal-dependent memory. Improvements in cognitive performance due to diet modification are also documented. However, the impact of individual meals on cognitive performance is less clear, and research exploring the potential combined benefits of exercise and diet is limited. **PURPOSE:** This pilot study was designed to evaluate the combined effect of chronic aerobic exercise and protein-content of an individual meal prior to a hippocampal-dependent cognitive task. **METHODS:** Male adult Sprague-Dawley rats ( $n=27$ ) were randomly assigned to a 5 or 6-week forced exercise protocol (Ex) or to a sedentary control condition (Sed). Exercise (last hour of light cycle) duration and intensity were increased over a 4-wk period up to 60 min at 30 m/min and a 10.5% grade. The weekly exercise consisted of 2 days of rest after 5 days of exercise. Rats were on a feeding schedule consisting of a 30 min meal (20% daily calories) provided 60 min into the dark period and *ad libitum* access to chow the last 5 hrs of the dark cycle throughout. During the last week of exercise, rats memory was assessed 60 min after a low (15% casein) or high (50% casein) protein meal in a Barnes maze (a task requiring that rodents detect an escape hatch in a fixed location) on 4 consecutive days. **RESULTS:** Results showed that there was a main effect for days,  $F(3,69)=3.81$ ,  $p<.05$ , indicating that latency decreased (e.g., learning occurred) over Days 1-4. Results also suggested that the low protein Ex group did not learn as well as the other groups (Ex15 v Sed15:  $d = -0.88$ ; Ex15 v Sed50:  $d = -1.17$ ; Ex15 v Ex50:  $d = -1.14$ ). This finding was supported by means for a subset of the animals ( $n=11$ ) on a probe trial in which there was no escape hatch and time spent in the target portion of the maze was used as the outcome variable (Ex15:  $M=35.78$  sec; Sed15:  $M=66.11$  sec; Sed50:  $M=43.16$  sec; Ex15:  $M=55.41$  sec). **CONCLUSION:** These preliminary results suggest considering the combined effects of chronic exercise training and the protein-content of a single meal on hippocampal-dependent memory. If these results prove reliable, they indicate that this level of chronic training may necessitate more protein to provide the necessary biological precursors to support memory processes.

1545 Board #198 June 2, 9:00 AM - 10:30 AM  
**That Feeling I Get: Examination of the Exercise Intensity-Affect-Enjoyment Relationship**

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While affective responses to aerobic exercise are fairly well documented, only recently have affective responses to high-intensity interval exercise been examined. **PURPOSE:** To evaluate affective responses before, during, and following, as well as enjoyment following aerobic and higher intensity interval exercise, along with a sedentary control. **METHODS:** Participants ( $N=207$ ; 111 female; 20.4±2.6 yrs,  $M \pm SD$ ) completed randomly ordered 15-min conditions: walking (W; avg RPE=8.4), reading (R), high-intensity cardio resistance (HICR; avg RPE=14.1; 2 min activity, 1 min recovery). Affect (Energy, Tiredness, Tension, Calmness) and state anxiety (SA) were assessed before (Pre), immediately after (P0), and 20 min after (P20) each condition; enjoyment (Physical Activity Enjoyment Scale) was measured post exercise only. Affective valence (Feeling Scale; FS) was assessed Pre, every 3 min during, and P20. **RESULTS:** Affect and SA changed from Pre to P0 with Condition x Time interactions (all  $P < 0.001$ ) for all measures, reflecting improved affect following HICR and W relative to R. Affective valence (i.e., FS) progressively decreased during HICR: by P0 it was less positive than Pre ( $M_{diff} \pm SE = -0.49 \pm 0.20$ ,  $P = 0.014$ ), then rebounded at P20 to be greater than Pre ( $0.66 \pm 0.13$ ,  $P < 0.001$ ) and P0 ( $1.15 \pm 0.15$ ,  $P < 0.001$ ). FS also decreased during R, with P0 FS being less positive than Pre ( $-0.66 \pm 0.11$ ,  $P < 0.001$ ) and P20 ( $-0.27 \pm 0.09$ ,  $P = 0.003$ ). During W, FS increased from Pre to P0 ( $0.55 \pm 0.13$ ,  $P < 0.001$ ) and remained elevated at P20 ( $0.75 \pm 0.11$ ,  $P < 0.001$ ). Enjoyment was greater following HICR ( $92.31 \pm 19.55$ ) than both W ( $88.21 \pm 17.61$ ;  $P = 0.025$ ;  $d = 0.22$ ) and R conditions ( $53.03 \pm 18.47$ ;  $P < 0.001$ ;  $d = 2.07$ ); W resulted in

greater enjoyment than R ( $P < 0.001$ ;  $d = 1.95$ ). Further, after accounting for age, sex, and Pre FS, FS during each condition (i.e., average across 5 assessments) predicted unique variance in enjoyment (HICR: 31.5%; W: 32.5%; R: 22.6%; all  $P$ s  $< 0.001$ ). **CONCLUSION:** These findings extend previous research by examining affective responses to aerobic and high-intensity interval exercise plus a sedentary control. The findings suggest the HICR exercise used here may elicit more enjoyment than continuous low intensity exercise. This also highlights the importance of in-task affect for predicting exercise enjoyment.

1546 Board #199 June 2, 9:00 AM - 10:30 AM  
**Correlations Between Omega-6: Omega-3 Fatty Acid Ratio and Physical and Cognitive Function in Older Adults**

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Aging is associated with declines in both physical and cognitive function. The extent to which lifestyle factors may influence physical and cognitive function with aging is unclear. There is evidence suggesting that increased physical activity and a lower ratio of omega-6 to omega-3 fatty acids may be supportive of both physical and cognitive health. To further evaluate these claims, the PURPOSE of this study was to identify relationships between physical and cognitive function and omega-6: omega-3 ratio in the habitual diets of older adults. **METHODS:** In 28 older adults, (13F, 15M, 80±8y), 3-day diet records were analyzed for omega-6: omega-3 fatty acid ratio. Physical activity level (Community Healthy Activities Model Program for Seniors, CHAMPS), physical function (Short Physical Performance Battery, SPPB), and cognitive function (Addenbrooke's Cognitive Examination-Revised, ACE-R) were also assessed. Pearson product-moment correlations were run between variables while controlling for age, body mass index (BMI), and sex. Significance was set to  $p < 0.05$ . **RESULTS:** The mean value± standard error for variables of interest were: total physical activity: 2,285±231 kcal·wk<sup>-1</sup>, SPPB 9.4±2.1 out of 12; ACER: 90.3±5.2 (<88=suggestive of dementia onset), and omega-6: omega-3 ratio: 7.5±1.8. When controlling for age, sex, and BMI, both SPPB ( $r = -0.52$ ,  $p < 0.05$ ) and ACER ( $r = -0.42$ ,  $p < 0.05$ ) were inversely correlated with the omega-6: omega-3 ratio obtained through diet. SPPB was positively correlated with ACER ( $r = 0.29$ ,  $p < 0.05$ ). Physical activity level was correlated with SPPB ( $r = 0.32$ ,  $p < 0.05$ ), but not ACER. **CONCLUSIONS:** These preliminary data suggest that dietary omega 6:3 ratio is inversely associated with physical and cognitive function in older adults. Thus, consuming a diet with a lower omega-6: omega-3 ratio may promote the maintenance of physical and cognitive function in aging. Longitudinal randomized, controlled trials are needed to confirm the potential influence of lower omega-6: omega-3 ratio on cognitive function in older adults.

1547 Board #200 June 2, 9:00 AM - 10:30 AM  
**Water Turnover, Urinary Markers Of Hydration, And Mood In Men And Women**

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 (No relationships reported)

**PURPOSE:** Past research has identified relationships between daily total water intake (TWI) measured by diet diary with dimensions of mood in free living, and laboratory confined men and women. However, diet records have been associated with subjective errors and thus these findings should be confirmed in objective of body water turnover (WTO).

**METHODS:** 49 women (42±14y, 164±6cm, 71±16kg) and 46 men (40±14y, 177±7cm, 81±16kg) volunteered for WTO measurement via deuterium oxide dilution technique over two consecutive weeks. Total water intake (TWI) was calculated as WTO (L·d<sup>-1</sup>) - metabolic water production. The Profile of Mood State questionnaire (POMS) was administered in the morning on the 4th day of each week. Physical activity was assessed with the International Physical Activity Questionnaire. The influence of the prior days, and acute hydration status (via urine osmolality) on mood was considered with; a) 24h urine collections comprised of the full day leading up to, and, b) single urine samples collected immediately prior to completion of the POMS. Measurements were averaged between weeks. Multivariate linear regression was completed to assess if WTO or either of the hydration markers predicted any of the 6 POMS sub-scales or the composite mood measurement of total mood disturbance, over and above the influence of age, body mass index, and MET minutes of physical activity completed during the week.

**RESULTS:** The vigor sub-scale of was significantly associated with WTO, (Fchange[1,94]=5.00, R2change=0.05, Beta=0.23, P=0.03). This finding was not apparent in relationships with 24h urine osmolality (Fchange[1,94]=2.58, R2change=0.03, Beta=0.16, P=0.11) or single sample urine osmolality (Fchange[1,94]=2.65, R2change=0.03, Beta=-0.17, P=0.10). No other sub-scales or TMD were significantly related to WTO, or hydration indices, after accounting for the covariates.

**CONCLUSIONS:** This study confirms a positive relationship between mood and fluid intake using direct measurement of WTO. The lack of significance to urinary hydration markers is indicative of the multi-faceted composition of urine concentration (i.e., kcal, protein intake, etc.). However, daily WTO is modestly associated with mood and should be further explored in controlled laboratory conditions to further elucidate this relationship.

1548 Board #201 June 2, 9:00 AM - 10:30 AM  
**Mental Engagement During Cognitive And Psychomotor Tests: Effects Of Task Type, Processing Demands, And Practice**

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Autonomic nervous system (ANS) activity, indexed by measures of heart rate variability (HRV), typically decreases during cognitive testing when compared to rest. Executive processing (EF) tasks are purported to modulate ANS activity more than non-executive (NEF) tasks.

**PURPOSE:** To determine if healthy young adults' mental engagement is driven by task type, processing demands, or practice. Data obtained from measures of HRV and subjective task workload provided indices of mental engagement.

**METHODS:** Twenty-four (22±3 yrs, 75% F) participants were randomized to either an EF task or a NEF task condition. On each of three sessions, those in the EF condition completed a cognitive Groton Maze Task and a psychomotor bi-manual star-tracing task; those in the NEF condition performed a cognitive face-discrimination task and a psychomotor manual tapping task. Heart rate was measured continuously and sampled 5-min before and during each task, which lasted approximately 5 min. Recordings were captured and analyzed according to Task Force Standards. Workload ratings were recorded via the NASA-Task Load Index (TLX) following each task. Separate mixed-model repeated-measures ANOVAs were conducted on indices of HRV (LnSDNN and LnLF/HF) and Workload (TLX) scores.

**RESULTS:** Compared to baseline, HRV decreased significantly for both EF and NEF groups when performing cognitive and psychomotor tasks. Significant interactions revealed that HRV (e.g., LnSDNN) declined more during NEF (M= 1.82 SE=.04 vs. M= 1.69 SE=.04) tasks than EF (M= 1.85 SE=.05 vs. M= 1.79 SE=.05) tasks and that, over sessions, HRV increased during EF but not NEF tasks. Subjective ratings of mental demands mirrored HRV data: TLX scores indicated that over sessions mental engagement lessened during EF but not NEF tasks ( $p = .03$ ).

**CONCLUSIONS:** Mental engagement is affected by task type. Unique to this study was greater mental engagement during non-executive than executive function tasks. Practice significantly decreased mental engagement over three sessions, with greatest reduction in mental engagement occurred for EF tasks. Specific processing demands, regardless of test type, appear to drive mental engagement.

1549 Board #202 June 2, 9:00 AM - 10:30 AM  
**Low-Intensity Exercise Counters Cognitive Deficits from Sleep Deprivation**

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The premise of the cognitive reserve theory is that cognitive performance (CP) depends on a balance between available cognitive resources and the demands on those resources, termed cognitive load (Stern, 2009). Sleep deprivation (sleep dep) is expected to decrease cognitive resources. In contrast, acute exercise is expected to increase these available resources. However, little is known about how exercise might be used to improve CP after sleep dep. **PURPOSE:** Our purpose was to examine CP following sleep dep and to assess the extent to which low-intensity exercise counteracts the expected impairments.

**METHODS:** Young healthy adults (n=13) were randomized to treatments (control, exercise). Cognitive testing included a 5-min psychomotor vigilance task (PVT), three memory tasks of increasing cognitive load (CTL, LTR, PLUS), and a 2nd PVT. On morning one, cognitive testing followed a normal night's sleep. Following 24-hrs of

sustained wakefulness, cognitive testing occurred prior to and after treatment. The exercise group performed low-intensity cycling (~40%HRR) for 15-min. The control group sat quietly on the bike for 15-min.

**RESULTS:** Sleep dep resulted in a moderate decrement on the initial PVT ( $d = -0.49$ ). After memory tests, the effect of sleep dep on PVT was greater ( $d = -1.71$ ). The effect of sleep dep on memory was moderated by cognitive load such that there were moderate benefits for CTL ( $d = 0.32$ ), a small decrease for LTR ( $d = -0.11$ ), and a moderate decrease for PLUS ( $d = -0.48$ ). Low-intensity exercise resulted in a large benefit to the PVT prior to memory tasks ( $d = 1.17$ ). After memory tasks, the effect was reduced ( $d = 0.11$ ). Low-intensity exercise resulted in moderate benefits for CTL ( $d = 0.59$ ) and small effects for LTR ( $d = 0.22$ ) and PLUS ( $d = 0.33$ ).

**CONCLUSIONS:** Results show that CP is compromised with sleep dep, but low-intensity exercise counters these deficits to varying degrees dependent on cognitive load. In general, sleep dep negatively affects vigilance and memory with the magnitude of the negative effect increasing with added cognitive load. Importantly, low-intensity exercise benefits vigilance and memory following sleep dep such that the greatest effects are at the lowest cognitive load with smaller, but still beneficial, effects with increasing cognitive load.

1550 Board #203 June 2, 9:00 AM - 10:30 AM

### Doing Better But Not Feeling It: Self-efficacy And Ambulation Ability In Incomplete Spinal Cord Injury

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Self-efficacy reflects a person's belief in one's ability to perform a specific behavior now coupled with expectations that the behavior will achieve desired results later. *Perceived* rather than *actual* ability may even be a better predictor of future performance. One expectation for rehabilitation is that individuals will be confident in their ability to function and that their beliefs will match the objective facts of performance. However, expectations can change over time as circumstances change. **PURPOSE:** We wanted to determine how well confidence and physical performance mirrored each other after task-specific performance-based locomotor training (LT) to improve walking individuals with incomplete spinal cord injury (iSCI). **METHODS:** 4 males with iSCI (24.75±7.80 years, AIS C, injured at C4, C5, or C6 at least 6 months prior to training) completed at least one 15-week round of a novel LT program, comprised of structured exercise and movement drills based on components of the gait cycle. Sessions were conducted for 90 minutes twice a week. Data were obtained from the OPTIMAL Confidence, the Berg Balance (BBS) and the Spinal Cord Injury Functional Ambulation Inventory (SCI-FAI) scales before and after each 15 weeks of participation. **RESULTS:** Despite objective and steady improvements in initial and subsequent ambulation abilities on the BBS (3-13 point increase) and SCI-FAI (2-9 point increase), 3 out of 4 participants had less confidence in their movement ability (9-18 point decline) after the first 15 weeks of participation than at the start of the program. Self-confidence trended toward baseline in subsequent 15-week measurement intervals. Post-participation debriefing indicated that subjects believed that: 1) LT was beneficial; 2) participation enlarged their sense of what was possible in the future and what ability level could be rated as "best" performance now; and 3) they would continue LT because they could do even better. **CONCLUSION:** Subjects appeared to have changed their framework for evaluating confidence in their abilities as their physical status improved. Despite common wisdom that less confidence now might hamper motivation, some individuals with iSCI may be motivated by gaps between their present perceived and actual performance abilities if they believe they can accomplish more in the future.

1551 Board #204 June 2, 9:00 AM - 10:30 AM

### Cancer Survivors Report Positive Affect during High-Intensity Group Based Exercise

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#### PURPOSE:

In rehabilitating populations, concerns arise with sustaining and adhering to popular group exercise programs of increased intensity due to the physically demanding requirements. Positive affect values like pleasure improve the likelihood of engaging in exercise behaviors. High-intensity functional training (HIFT) is a group-based exercise method of combined aerobic and resistance training functional exercises completed at relative high intensities. This study investigated effects of a HIFT program on cancer survivors' perceptions of pleasure to predict efficacy and adherence.

#### METHODS:

Eight cancer survivors (53.5±5.0y, 75% female) participated in a 5-week, 3 days/week HIFT intervention, consisting of 12 workouts (WODS). For three pre-selected WODs, participants self-reported changes in mood/pleasure via the Feeling Scale (FS) from -5 (very bad) to +5 (very good); arousal via the Felt Arousal Scale (FAS) from 1 (very lowly) through 6 (very highly) aroused; and Rating of Perceived Exertion (RPE) via the Borg scale from 6 (resting) to 20 (maximal) at 6 times (after the warm-up, after ¼, ½, and ¾ of the WOD, immediately after the WOD, and after cool-down). Heart rate (HR) was assessed with Polar Pro-trainers throughout. Repeated measures ANOVA was used to examine within-measurement differences over time. Correlation analysis was used to compare RPE and HR for 2 exercise sessions.

#### RESULTS:

Average FS ratings ranged 1.3 to 3.4 indicating that mood remained positive throughout the session. Average RPE peaked immediately after the WOD and ranged from 6.9 to 15.5. Average predicted HRmax% for age was 80.2±/ 0.9 % throughout the WOD. There was main effect for changes in FAS over time,  $F(2,1)=16.0$ ,  $p < .001$ , where the first measurement was significantly lower than all following measurements. There were significant main effects for changes in RPE,  $F(2,1)=43.2$ ,  $p < .001$ , and HR,  $F(5,1)=74.8$ ,  $p < .001$ , over time. Both were positively correlated,  $r = .97$ ,  $p = .001$  and had significantly greater values during the WOD than warm-up or cool-down.

#### CONCLUSIONS:

Improved FS during HIFT contrasts with previous research showing that pleasure decreases as physiological work demands reach high intensity. These data show that cancer survivors can sustain and even find high intensity exercise enjoyable.

1552 Board #205 June 2, 9:00 AM - 10:30 AM

### Sexual Dimorphic Association Between Cardiorespiratory Fitness And Cardiac Autonomic Responses To Mental Challenge

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Cardiovascular and autonomic reactivity to psychological or behavioral challenges have long been used as putative risk factors for disease pathophysiology, including coronary heart disease and essential hypertension. The model of stress reactivity has also been used in an attempt to clarify the underlying cardioprotective mechanisms of aerobic fitness. However, it remains unclear whether enhanced aerobic fitness attenuates cardiovascular and autonomic responses to stress and if these reductions are specific to distinct populations. In order to advance this area, it is critically important to understand individual differences in these complex psychobiological responses and, in particular, whether there are sex differences in the relationship between aerobic fitness and cardiac autonomic responses to stress. Gender or sex has been identified as an important determinant of psychological stress responses and recent studies have pointed to sexually dimorphic effects of aerobic fitness and acute exercise on a number of health outcomes. **PURPOSE:** To examine the sexual dimorphic patterns between cardiorespiratory fitness and cardiovascular and autonomic responses to laboratory stressors. **METHODS:** Fifty participants (24 females, age = 21.0 ± 1.1 years) initially completed a maximal aerobic fitness test for the determination of peak oxygen consumption ( $VO_2$  peak). On a subsequent day participants completed a laboratory-based stress reactivity protocol consisting of a 6-min serial subtraction task and a 6-min modified Stroop task with false feedback. Measures of heart rate (HR), autonomic balance (RSA and PEP), and systolic and diastolic blood pressure (SBP and DBP) were assessed during baseline, stress, and recovery periods. **RESULTS:** Findings revealed that higher cardiorespiratory fitness levels were associated with lower HR, DBP, and RSA responses to the laboratory stressors only for females,  $p < .05$ , with no such relation observed for males. **CONCLUSION:** These findings reveal new evidence that cardiorespiratory fitness is selectively related to more adaptive stress responses for college-aged females. Future research should explore these sexually dimorphic responses and examine both developmental influences as well as patterns of change across the menstrual cycle.

1553 Board #206 June 2, 9:00 AM - 10:30 AM  
**Influence of Menopause Transition and Physical Activity on Stress Perception: A MONET Group Study.**  
 Alyssa Biagè<sup>1</sup>, Eva Guérin<sup>2</sup>, Gary Golfield<sup>3</sup>, Éric Doucet<sup>1</sup>, Irène Strychar<sup>4</sup>, Denis Prud'Homme<sup>2</sup>. <sup>1</sup>University of Ottawa, Ottawa, ON, Canada. <sup>2</sup>Institut de recherche de l'Hôpital Montfort, Ottawa, ON, Canada. <sup>3</sup>The Children's Hospital of Eastern Ontario Research Institute, Ottawa, ON, Canada. <sup>4</sup>University of Montreal, Montreal, QC, Canada.  
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**PURPOSE:** The transition to menopause is a natural process and a period of significant physical, hormonal and psychological changes that create sources of stress with which women must cope. Lifestyle factors, such as time spent engaging in physical activity of various intensities, may play a role in moderating the psychological impact of menopause. The purpose of this study was to investigate the following two objectives: 1) the longitudinal effect of the transition to menopause on perceived stress, and 2) the association between the volume/intensity of physical activity and stress perceptions during the menopause transition.

**METHODS:** This secondary analysis was performed on the results obtained of a 5-year observational, longitudinal study on the effects of menopausal transition on body composition and cardiometabolic risk factors. The sample at baseline (year 1) consisted of 102 premenopausal women (age, 49.9 ± 1.9 y; body mass index, 23.3 ± 2.2 kg/m<sup>2</sup>). Time spent in physical activity of varying intensities (sedentary, light, moderate, vigorous) was determined using accelerometer measurement over a 7-day period. Stress perception was assessed with Cohen's Stress Perception Scale consisting of 14 self-reported items.

**RESULTS:** Linear mixed model regression analyses revealed no significant effect of time, menopausal status (MS) or interaction between time and MS on women's stress perception ( $p > .05$ ). There were no significant associations between volume of physical activity and stress perception across time and MS. Yearly trends in the data were observed: at year 2 (where the majority of women were perimenopause), time spent in sedentary behavior was associated with higher levels of stress ( $r = 0.24, p < .05$ ).

**CONCLUSIONS:** These results suggest that the change in menopause status had no effect on stress perceptions. Although our analysis revealed no influence of physical activity on stress in this sample of healthy mid-life women, strategies to diminish sedentary time early in the transition to menopause may be worthy of exploration. Additional lifestyle, emotional and psychosocial risk factors of stress should be examined.

1554 Board #207 June 2, 9:00 AM - 10:30 AM  
**Effects of Carbohydrate and Protein Supplementation on Mood, Affect and Discomfort Perception during Endurance Exercise**  
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**PURPOSE:** To investigate the effect of carbohydrate and protein supplementation on mood, affect and discomfort perception during endurance exercise.

**METHODS:** Ten well trained, healthy Chinese males (Age: 27.33±4.40 yr, height: 172.89±3.86 cm, weight: 63.50±5.12 kg, body fat percentage: 8.97±4.30 %, VO<sub>2</sub>max: 62.93±5.66 ml·kg<sup>-1</sup>·min<sup>-1</sup>) participated in the study with a double-blind counterbalance crossover design. Three types of nutritional treatments were implemented in three trials: 1) CHO+PRO: CHO-electrolyte solution (6.6% CHO, 26mg·L Na<sup>+</sup>, 8mg·L K<sup>+</sup>) with 24g whey protein isolate; 2) CHO-electrolyte solution (6.6% CHO, 26mg·L Na<sup>+</sup>, 8mg·L K<sup>+</sup>) with 24g sugar; 3) Sweetened electrolyte solution (26mg·L Na<sup>+</sup>, 8mg·L K<sup>+</sup>). All of the treatments were matched in sweetness with a zero-calorie sweetener and 5ml·kg was ingested before exercise and 2ml·kg ingested every 15 minutes during exercise. The Chinese version of 24-item Brunel Mood Scale (BRUMS), Rating of Perceived Exertion (RPE), Pain intensity scale, Felt Arousal Scale (FAS) and Feeling Scale (FS) were applied in this study. Gas analysis was conducted every 30 minutes. Three-way ANOVA (time x treatment x stage) were applied for comparing the difference among treatments and time point.

**RESULTS:** Blood glucose in CHO+PRO was higher than in the control group (5.35±0.81 vs. 4.45±1.03 mmol·L,  $P < 0.05$ ) at 90 min. RPE, FAS and pain intensity scale increased along with time; no difference was found among treatments. There was no difference among scores of dimensions in Depression, Anger, Confusion, Fatigue, Tension and Vigor among different time points of exercise. However, the score of Vigor dimension in CHO+CHO is higher than two other groups (2.10±2.07 vs. 4.10±1.52 vs. 2.40±2.27,  $P < 0.05$ ).

**CONCLUSIONS:** Exercise could induce a higher level of arousal, muscle pain and perceived exertion; however, pleasure-displeasure and the overall mood state were not affected. Ingestion of CHO+PRO drink did not induce stomach discomfort and overall mood disturbance during exercise, compared with CHO+CHO or placebo drink. In comparison with CHO+PRO, positive mood of Vigor could stay higher after ingesting an energy-matched amount of CHO in the present study.

1555 Board #208 June 2, 9:00 AM - 10:30 AM  
**Effects of Aerobic Exercise Modality on Cognitive Outcomes among Breast Cancer Survivors**  
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Breast cancer has relatively high incidence and high survival rates, demonstrating that there is an ever-increasing population of survivors in the United States. These women frequently suffer from ongoing cognitive dysfunction, which hinders memory, work performance, and ability to complete activities of daily living. Exercise has been shown to improve results on objective cognitive tests in several clinical populations, but this has not been studied among recent breast cancer survivors. **PURPOSE:** This study was conducted to determine whether aerobic exercise is an effective intervention for improving cognition among recent breast cancer survivors. **METHODS:** Twenty breast cancer survivors who completed their primary treatment in the past 3 months were randomly assigned to 12 weeks of an aerobic exercise intervention (INT) or a sedentary control group (CON). The intervention group attended moderately intense exercise classes, 3 days each week, while the control group maintained their normal, inactive lifestyle. All participants completed pre/post cognitive testing utilizing the Trail Making Test (TMT-A), Controlled Oral Word Association Test (COWAT), and Design Fluency Trials 1-3 (DF1, DF2, DF3). Data was analyzed with repeated measures ANOVA. **RESULTS:** Executive function increased in INT vs. CON on scaled scores (SS) from DF1 (CON 11.71±3.5 vs. 10.86±3.0; INT 11.69±4.3 vs. 13.92±3.7,  $p=0.44$ ). There was also a trend toward greater improvement in INT vs. CON on DF1+DF2 SS (CON 11.29±2.6 vs. 11.57±2.6; INT 12.23±3.4 vs. 14.38±3.4,  $p=0.178$ ) and on DF1+DF2+DF3 SS (CON 11.43±2.4 vs. 11.86±2.7; INT 12.46±3.3 vs. 13.92±3.3,  $p=0.364$ ). Education adjusted scores of attention and processing speed on TMT-A did not improve significantly in either group, but showed a slight trend toward greater speed in INT vs. CON (CON 25.12±8.6 vs. 24.39±9.8; INT 25.49±7.5 vs. 22.28±5.5,  $p=0.459$ ). COWAT scores of verbal fluency did not appear to be affected by aerobic exercise (CON 37.43±14.8 vs. 36.43±15.8; INT 47.69±16.5 vs. 51.46±18.3,  $p=0.264$ ). **CONCLUSIONS:** Aerobic exercise can improve several domains of cognitive function in breast cancer survivors when compared to usual care. Given a longer time-frame and larger sample size, these benefits would likely be more pronounced.

1556 Board #209 June 2, 9:00 AM - 10:30 AM  
**Effect Of Strenuous Exercise On Cognitive Control Efficiency**  
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During exercise, optimal performance depends on the subject's ability to simultaneously deal with cognitive and physical demands. Cognitive efficiency is best measured by complex decision making-tasks, such as Simon task. Subjects are requested to press either a left- or right-hand button according to the color of a visual stimulus presented either to the left or to the right of a fixation point. Performance is measured in term of mean reaction time (RT) and error rate (ER). It was classically observed that RT for ipsilateral stimulus-response associations (i.e. congruent trial, CO) was shorter than RT for contralateral stimulus-responses associations (i.e. incongruent trial, IN). This result is explained by the dual-route model of information processing. In this model, the side of the stimulus triggers an automatic and rapid response impulse whereas the color of the stimulus triggers a slower and deliberately controlled response. In IN associations, both responses are in conflict.

**PURPOSE:** to assess the effects of strenuous exercise on cognitive control efficiency and error monitoring.

**METHODS:** 16 healthy subjects (30.6±8.6y, 11 males, mean VO<sub>2</sub>max 47.3±7.8 ml/kg/min) performed a Simon task while cycling 25 min at rest (15W) or above the first ventilator threshold +5%. Partial errors (PE), which are suppressed incorrect action impulses before they result in an overt error, were recorded by EMG of the response effectors. Correction rate (CR) was calculated by dividing the number of PE by the number of incorrect activations (IA, partial errors plus errors).

RESULTS: exercise was associated with shorter RT, higher ER and lower CR in IN and CO associations. Lower IA was observed in CO associations only. For the shortest trials, ER was higher for IN associations whatever the condition (i.e. exercise versus control).

CONCLUSION: this study demonstrated that the ability to detect and correct IA was impaired by strenuous exercise for CO situations. Strenuous exercise reduced the occurrence of fast-guesses, the net behavioral result being reflected in an increase in error commission for IN associations.

1557 Board #210 June 2, 9:00 AM - 10:30 AM  
**Visceral Adiposity Predicts Subclinical White Matter Hyperintensities in Middle-Aged Adults**

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**PURPOSE:** Growing prevalence of neuropathology and cognitive impairment are emerging consequences of the obesity epidemic. Adiposity indices used in examining the relationships between obesity, cognition, and neuropathology vary substantially in the literature leading to incongruent findings. Therefore, our aim was to determine the anthropometric measures most reflective of visceral adiposity and isolate the strongest associations with early white matter disease and cognitive function at midlife.

**METHODS:** Multiple adiposity indices were used to quantify obesity in 126 adults aged 40-62 who completed a magnetic resonance imaging (MRI) scan to quantify white matter disease, and performed a cognitive test battery. Anthropometric indices of obesity were compared to direct estimates of visceral adipose tissue with dual-energy x-ray absorptiometry (DEXA) in their ability to detect white matter disease and cognitive function.

**RESULTS:** Multiple adiposity indices were used to quantify obesity in 126 adults aged 40-62 who completed a magnetic resonance imaging (MRI) scan to quantify white matter disease, and performed a cognitive test battery. Anthropometric indices of obesity were compared to direct estimates of visceral adipose tissue with dual-energy x-ray absorptiometry (DEXA) in their ability to detect white matter disease and cognitive function.

**CONCLUSIONS:** Of the anthropometric indices observed, only WC was capable of predicting subclinical white matter disease in cognitively normal adults at midlife. Obesity may independently insidiously affect cerebral white matter prior to detectable cognitive changes necessitating early intervention

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1558 Board #211 June 2, 9:00 AM - 10:30 AM  
**Impact Of An Affect-based Exercise Prescription On Aerobic Fitness And Exercise Adherence**

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Feelings experienced during exercise have been identified as a primary factor in the decision to terminate exercise. The Feeling Scale (FS) has been used to regulate intensity of single exercise bouts. However, chronic use of FS in exercise prescriptions is limited.

**PURPOSE:** To compare an affect-based exercise prescription (Feeling Scale) to an intensity-based exercise prescription (Rating of Perceived Exertion Scale) on changes in aerobic fitness and exercise adherence.

**METHODS:** Participants were assigned to either an FS prescription (n = 18) or an RPE prescription (n = 11) for a 6-week cardiovascular exercise program consisting of at least 3 days per week of at least 30 minutes of exercise. The FS prescription instructed participants to work so they felt 'good' and the RPE prescription instructed participants to work 'somewhat hard'. A Forestry Step Test was used to assess aerobic fitness. Exercise adherence was measured through one week activity logs taken during the 6-week intervention and one month following.

**RESULTS:** A 2 (time) x 2 (group) ANOVA with repeated measures on the time factor revealed a significant main effect for time on estimated VO<sub>2</sub> (F(1, 27) = 11.904, p = .002). Analysis of minutes per week revealed no significant differences between the groups (FS (n = 7) time 1 = 140.56 (63/61), FS time 2 = 98.29 (64.85), RPE (n = 9) time 1 = 118.19 (18.19), and RPE time 2 = 132.29 (74.24)). At the one month follow-up, all members of the FS group reported completing some exercise while 1 member of the RPE group reported 0 minutes of exercise and 2 members dropped out.

**CONCLUSIONS:** As expected, no between-group differences in fitness were found following the 6-week intervention. One month following the intervention, all members

of the FS group were still performing some exercise, while 3 members of the RPE group had stopped exercising or dropped out of the study. It appears that the Feeling Scale has promise in promoting exercise adherence.

1559 Board #212 June 2, 9:00 AM - 10:30 AM  
**Thirty Minutes of Sub-Maximal Cycling Improves Cognitive Function Despite Diesel Exhaust Exposure**

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**PURPOSE:** While physical activity is linked to improvements in cognition, exposure to air pollution has been associated with impaired brain health. The purpose of this study was to examine how sub-maximal exercise in air pollution affects cognitive function.

**METHODS:** Using a double-blind, randomized, crossover study design seven 24-34 year-old participants (6M; 1F) were exposed to the following two conditions: diesel exhaust (DE) vs. filtered air (FA); and cycling exercise vs. rest. On screening visits, all participants were diagnosed with exercise-induced bronchoconstriction based on a 10% fall in forced expiratory volume in one second (FEV<sub>1</sub>) following 6-min of eucapnic voluntary hyperpnea. On exposure visits, participants sat on a chair in the air pollution exposure laboratory for 60 min. Following this rest period, participants cycled for 30 min at 50% of their peak resistance (mean (standard deviation) = 170W (±26.95)) achieved on the screening visit. During rest and cycling conditions, participants breathed either DE (PM<sub>2.5</sub> = 300µg/m<sup>3</sup>) or FA. Cognitive function was assessed at baseline, 20-min, and 100-min following exercise using the NIH Toolbox: Flanker Inhibitory Control and Attention (Flanker), List Sorting Working Memory (LSWM), Pattern Comparison Processing Speed (PCPS), and Picture Sequence Memory Test (PSMT). Raw and fully adjusted scores from all cognitive function tests were analyzed using repeated measures ANOVAs.

**RESULTS:** Cognitive function tests at baseline did not differ between DE and FA exposures (p > 0.5). Immediately following exercise, inhibitory control and attention (fully adjusted Flanker score) was significantly improved (109.3 (7.35), p = 0.29) compared to baseline (106.9 (8.38)). Additionally, the speed of information processing (raw PCPS score) was significantly greater (100.6 (17.46), p = 0.018) 100-min following exercise, compared to baseline (92.58 (19.85)). Information processing and storage (LSWM), and episodic memory (PSMT) were unaffected by exercise. None of the cognitive function tests were affected by the exposure to DE.

**CONCLUSIONS:** Thirty minutes of submaximal, constant-intensity cycling exercise appears to positively affect inhibitory control, attention and information processing speed, even when breathing increased levels of diesel exhaust.

1560 Board #213 June 2, 9:00 AM - 10:30 AM  
**Effects Of Moderate-intensity Aerobic Exercise On Cognition And Arousal In Extrovert/introvert Personality Types**

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(No relationships reported)

Aerobic exercise has been demonstrated to benefit cognitive function in many different exercise-cognition studies, however, results have been mixed. One potential moderating factor may be personality type, since differing baseline levels of cognitive arousal between Extrovert (E) and Introvert (I) personality types have been demonstrated using Eysenck's Personality Questionnaire-Revised, as well as differing responses to physiological arousal from exercise. **PURPOSE:** To examine whether or not there are differences in cognitive function between E and I personality types during performance of an executive function task at rest (R) and during exercise (EX). **METHODS:** A flanker task was selected to evaluate cognitive function using the event-related potentials (ERP); specifically, N100 amplitude (AMP, µV) and latency (LAT, ms) as well as behavioral measures, including accuracy (ACC, % correct) and reaction time (RT, ms). Task modality was defined as easy or congruent (CON) or more difficult or incongruent (INC). Healthy students, ages 18-30 (22F and 7M), participated in the study (15E and 14I). Cognitive effort was measured at R and during 20 minutes of moderate-intensity EX performed on a stationary bicycle ergometer. Mixed-design ANOVAs were conducted to measure differences between E and I groups and across R and E conditions. **RESULTS:** There were no significant differences between E and I groups for any ERP or behavioral measures. Examining differences in R and E conditions revealed the following significant findings: AMP CON: R -3.54 µV ± 1.53 vs E -2.57 µV ± 1.55, p < .001; AMP INC: R -3.86 µV ± 1.83 vs E -2.93 µV ± 1.93, p < .05; RT CON: R 389.31 ms ± 44.69 vs E 362.76 ms ± 42.07, p < .001; and RT INC: R 460.87 ms ± 49.14 vs E 419.47 ms ± 47.58, p < .05. For the entire sample, cognitive

benefits were more pronounced during EX for INC than CON, shown by 8.9% faster RT for INC compared to only 6.8% faster RT for CON,  $p < .001$ . Regarding the main effect of condition, there were significant improvements during exercise, with significantly decreased AMP:  $R -3.70 \mu V \pm 0.32$  vs  $EX -2.75 \mu V \pm 0.27$   $p < .001$ , concurrent with significantly reduced RT:  $R 425.18$  ms  $\pm 8.39$  vs  $EX 391.02$  ms  $\pm 8.18$ ,  $p < .001$ . **CONCLUSION:** In summary, an acute bout of 20 minutes of aerobic exercise can result in significant gains in cognitive function independent of E or I personality type.

1561 Board #214 June 2, 9:00 AM - 10:30 AM  
**Exercise-Induced Changes in Brain Activation During a Simple Motor Task: An fMRI Study**

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The beneficial effects of exercise on brain health and cognitive function have been well established. However, the effects of acute exercise on cortical activation during the performance of a motor task are less well known. Understanding these effects have implications for acute interventions on cognitive health and cognitive performance. **PURPOSE:** To examine the blood oxygen level dependent (BOLD) signal, measured by fMRI, in the motor and/or supplementary cortices in response to a finger tapping task performed after acute aerobic exercise, and to determine if these effects are exercise intensity-related. **METHODS:** On two separate visits, 14 healthy young (24.1 $\pm$ 4.1 yrs) subjects completed two baseline fMRI scans during which a simple motor task was performed. The task was a block designed flashing green and black checkerboard at a frequency of 3 Hz, alternating between 30 second intervals of flashing (stimulus) and black screen (control). Subjects had to tap their right index finger to match the flashing rate. Following the baseline scan, subjects completed a 30-minute exercise condition of either low (LI) (30-40% HRR) or moderate (MI) (50-60% HRR) intensity exercise (counterbalanced). Immediately following each exercise session, subjects completed the same fMRI task. Changes in brain activation during the task reflected the difference between the stimulus and control blocks and were quantified by the BOLD signal. **RESULTS:** Following MI, activation in the left anterior cingulate was decreased ( $p < 0.002$ ) and activation was increased in the left middle and superior frontal gyri ( $p < 0.005$ ). Following LI, activation in the left-precentral gyrus increased ( $p < 0.005$ ). Only one brain region changed significantly following both conditions, the left middle frontal gyrus ( $p < 0.005$ ); a decrease in BOLD signal following LI, and an increase in BOLD signal following MI. **CONCLUSION:** Acute exercise results in changes in neural activation during the performance of a simple motor task, and these changes are intensity-dependent. The brain regions affected by exercise may indicate a positive influence by acute exercise on attention, awareness, motor readiness, and motor performance. These findings suggest LI exercise may be optimal to enhance brain activation during simple motor function.

**C-39 Free Communication/Poster - Physical Activity Interventions in Adults - Part I**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
 Room: Exhibit Hall A/B

1562 Board #215 June 2, 8:00 AM - 9:30 AM  
**Health Improvement Programmes for Local Communities Delivered in 72 Professional Football (Soccer) Clubs**

Andy Pringle, Stephen Zwolinsky. Leeds Beckett University, LEEDS, United Kingdom.  
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**Reported Relationships:** A. Pringle: Contracted Research - Including Principle Investigator; Research Supported by Football League Trust. First author led the research.

Professional sports clubs are important conduits for delivering on the Exercise is Medicine agenda, especially in hard-to-reach (HTR) populations. In the UK, Football League Club Community Trusts (FLCT) deliver physical activity (PA) interventions with far reaching Public Health potential. However, at present, little is known/understood about the mechanics and outcomes for such programming. **PURPOSE:** This research provides the first audit of health improvement services delivered by FLCT in the 72 Professional Football League Clubs in England. **METHODS:** Data were collected using: (I) A review of FLCT websites ( $n=72$ ). (II) An online survey completed by the FLCT managers ( $n=34/47.2\%$ ). (III) Semi-structured interviews ( $n=12/35.2\%$ ) with a sub-sample of these FLCT managers.

**RESULTS:** All 72 FLCT provided health improvement services across all ages. Survey results show that every FLCT delivered PA interventions, 91.2% ( $n=31/34$ ) provided dietary interventions and 55.9% ( $n=19/34$ ) provided interventions on alcohol/smoking. Further, specialist weight management services were delivered by 73.5% ( $n=25/34$ ) of FLCT, mental health intervention by 82.4% ( $n=28/34$ ) and education was provided by 64.7% ( $n=22/34$ ). Male specific interventions were provided by 97.1% ( $n=33/34$ ) of FLCT, yet female specific sessions were only provided by 41.2% ( $n=14/34$ ). Furthermore, 64.7% (22/34) of FLCT worked with socially disadvantaged groups, 64.7% ( $n=22/34$ ) worked with the educationally excluded and 38.2% ( $n=13/34$ ) with other HTR groups. At present, the majority of FLCT evaluated interventions, 88% ( $n=30/34$ ) and 76.5% ( $n=26/34$ ) used Public Health guidance to underpin their interventions. Interviews reported the importance of 'meeting the needs of communities', 'using soccer to connect to underserved groups' and 'working as part of a strategic collaboration'. Challenges include 'short-term funding', 'the influence of FLCT to mainstream interventions after initial funding' expired and 'short thinking from funders'.

**CONCLUSION:** FLCT currently deliver valuable health improvement services to a range of underserved groups. However, until robust evaluation and adherence to Public Health guidance becomes mainstream, FLCT - and professional soccer clubs will face challenges in influencing the Public Health agenda.

1563 Board #216 June 2, 8:00 AM - 9:30 AM  
**An Eight-Month Study of Employee's Participation And Engagement In A Health Promotion Initiative**

Karen Doyle, Tim Schoof, Mark Pfefer, Rebecca Burkhalter. Cleveland University-Kansas City, Overland Park, KS. (Sponsor: Dr. Jeff Roitman, FACSM)  
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 (No relationships reported)

**PURPOSE:**

To examine university employee participation and engagement in an 8-month health promotion initiative.

**METHODS:**

Cleveland University - Kansas City (CU-KC) employees (105) were invited to participate in an 8-month health promotion program (Feb - Oct 2015). CU-KC purchased a self-report tracking system and a fitness tracking device for all participants. Participants were awarded points for tracking physical activity (PA), nutrition (N), mental (M), social (S), annual health exams (A) and activities of the month (MA). Participation was stratified by number of categories participants reported on the tracking system. Minimal level required participation in (1) category, moderate (3) and maximal (6). Each category listed three or more activities. Engagement was measured by the total number of activities recorded from all categories. CU-KC wellness team motivated participants with monthly specialty events, emails, newsletters, and trimester challenges. Gift cards were awarded to employees for challenges and overall participation.

**RESULTS:**

Initial employee participation was 62 (59%). The majority reached the highest level of participation with 32 (51.62%) participating at the maximum level, 29 (46.77%) moderate level and 1 (1.61%) minimal level. Participation decreased by 19 (30.64%) after the first month with 16 (25.40%) choosing to dropout and 4 (6.35%) leaving the institution. The majority of those who stopped participating were at moderate and minimal levels the first month. Participation increased for those who remained. In October, 40 (93.02%) employees showed a maximum level of participation. Engagement increased by 62.86% from Feb. ( $M=8.51$ ) to Oct. ( $M=13.86$ ). Almost two-thirds (64.52%) completed 12+ activities in Feb. and in Oct., 12+ activities were recorded by most participants (95.35%). MA scored the highest participation (59.05%), while S scored the highest engagement (83%). S recorded the lowest participation (49.52%) and MA scored the lowest engagement (27.88%).

**CONCLUSION:**

Current findings indicated an 8-month health promotion program was sustainable on a modest budget at a small Midwest university. Employees active after 1 month remained at a maximal level of participation with increased engagement.

1564 Board #217 June 2, 8:00 AM - 9:30 AM  
**Using a Learning Community Approach to Improve Health and Wellness among University Faculty and Staff**

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 (No relationships reported)

Learning communities are an effective model for enhancing professional development of multidisciplinary university faculty, but historically focus on improving teaching

pedagogy. As such, a learning community model was implemented to increase faculty retention in a worksite wellness program, as these programs typically attract and retain more university staff than faculty.

**PURPOSE:** To determine if participation in a yearlong wellness-focused learning community would improve health-based parameters in university faculty and staff. **METHODS:** University employees in education-related programs (n=7 faculty, n=4 staff, age 55±12 years) joined an academic yearlong "Wellness Learning Community." Participation requirements included the desire to pursue a healthier lifestyle and willingness to attend monthly educational sessions (75-90 min). Co-facilitators were peer faculty, an exercise physiologist and a registered dietitian. Monthly sessions included goal setting, cooking and exercise demonstrations, grocery store and fitness facility tours, meditation and mindfulness, recipe exchange, and wellness app exploration. Members could opt to participate in a biweekly fitness program and team-oriented wellness challenges, such as "Maintain Don't Gain" over the holidays. Baseline and follow-up testing included anthropometrics, body composition, and lipid profile, as well as elicited program feedback. **RESULTS:** Faculty retention was 57% at mid-point and 29% at completion, compared to staff retention of 100%. Weight (77.9±16.1 to 73.8±15.4 kg), body mass index (29.0±5.4 to 27.5±5.4 kg/m<sup>2</sup>), and waist circumference (97.1±12.8 to 92.2±12.5 cm) decreased between baseline and follow-up (p<.05 for all). Body composition and lipid profile did not change. Despite extremely positive feedback on the overall format, faculty expressed substantial challenges in attending due to complex obligations of their faculty positions. **CONCLUSION:** A wellness-focused learning community, facilitated by peers, demonstrated health benefits for university faculty and staff. While faculty recruitment was successful and interest was high, retention presented considerable difficulty. Future programs should consider alternate strategies to maintain faculty participation.

1565 Board #218 June 2, 8:00 AM - 9:30 AM  
**An Evaluation of a Healthy Eating Course Using the Theory of Planned Behavior**  
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*(No relationships reported)*

One of the major contributors to the obesity epidemic is unhealthy eating. Establishing healthy eating habits is an important step in obesity prevention. **PURPOSE:** The purpose of this study was to investigate the impact of a 6-week healthy eating course on intention among college women to eat a healthy diet utilizing the theory of planned behavior (TPB) as a framework. **METHODS:** Using a 2 x 2 mixed factorial design, the responses by experimental (n = 29) and control (n = 40) groups to a questionnaire administered before and after the course were compared. **RESULTS:** Results revealed that attitudes, subjective norms, and intention to eat healthy did not change among either group pretest to posttest; however, a significant interaction was found [F(1,67) = 5.65, p = .02] for the perceived behavioral control (PBC) variable, where PBC increased pretest to posttest for the experimental group (Mpre = 3.49, SDpre = 0.84 versus Mpost = 3.76, SDpost = 0.52), while it declined slightly for the control group (Mpre = 3.54, SDpre = 0.82 versus Mpost = 3.46, SDpost = 0.81). **CONCLUSION:** The healthy eating course, therefore, is useful in establishing greater perception of control of eating healthy among college women, which may add to a greater likelihood of performing this behavior.

1566 Board #219 June 2, 8:00 AM - 9:30 AM  
**Cardiovascular Response of Running on a Normal and Lower Body Positive Pressure Treadmill**  
 Deborah Van Langen, James Hokanson, Erik Lind, Larissa True.  
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*(No relationships reported)*

Individuals facing obesity could increase physical activity by using a lower body positive pressure (LBPP) treadmill. Although cardiovascular response to exercise is positive, the additional increase in blood pressure (BP) on a LBPP treadmill is a concern. Preliminary determination was conducted on healthy individuals to examine if differences in BP exist between normal and LBPP treadmill running. **PURPOSE:** To determine if differences in BP and related measures exist between normal treadmill running and LBPP treadmill running. **METHODS:** Subjects (n = 16) completed four running sessions: normal treadmill and LBPP treadmill at 85, 60, 40% of total body weight; all trials were run at 3.13 m•s<sup>-1</sup>. Heart rate (bpm) and blood pressure (mmHg) were collected from which pulse pressure, mean arterial pressure, and rate pressure product were calculated. **RESULTS:** One-way repeated measures ANOVAs were used to determine if there were statistically significant differences in outcome measures at the four different weighted conditions. The weighted condition elicited statistically significant differences as follows: HR, F(3, 45) = 51.319, p < .005, with HR increasing consistently and significantly across the four weighted conditions (40%, M = 130.25; 60%, M = 139.56; 85%, M = 160.25; 100%, M = 170.13). SBP, F(3, 45) = 2.703, p =

.057; post-hoc analysis indicated that SBP was significantly lower at 40% than at 100% (Mean difference = 6.625, p = .026). DBP, F(3, 45) = .109, p = .746. MAP, F(3, 45) = 4.717, p = .006; post hoc analysis indicated that MAP was significantly lower at 60% than at 100% (Mean difference = 4.063, p = .043) and significantly lower at 85% than at 100% (Mean difference = 7.708, p = .004). RPP, F(3, 45) = 46.277, p < .005, partial η<sup>2</sup> = .755; post hoc analysis indicated that RPP increased consistently and significantly across the four weighted conditions (40%, M = 188.60; 60%, M = 205.20; 85%, M = 235.71; 100%, M = 258.16). **CONCLUSION:** The major finding of the study was that MAP was significantly lower at 60 and 85% compared to 100%. In addition, SBP was significantly lower at 40 than 100%. This could suggest the increase in LBPP in the lower extremities (40%) increases BP to a level too high for obese individuals. These results provide evidence that there may be specific body weight percent of LBPP that should be considered for obese individuals.

1567 Board #220 June 2, 8:00 AM - 9:30 AM  
**The Effects of a Medical Fitness Community Wellness Program Employing a Health Coaching Model**  
 Brad A. Roy<sup>1</sup>, Cathy Lisowski<sup>1</sup>, Miranda P. Kaye<sup>2</sup>, Gary Sforzo, FACSM<sup>3</sup>. <sup>1</sup>Kalispell Regional Medical Center, Kalispell, MT. <sup>2</sup>Penn State University, University Park, PA. <sup>3</sup>Ithaca College, Ithaca, NY.  
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Community medical fitness programs and health coaching are emerging trends in health care but very little information is available on the effects of combining the two. Fitness programs are generally acknowledged as beneficial; when health coaching is available and used regularly is there an enhanced program effect? **PURPOSE:** To determine the health impact of a coaching component integrated within a community-based medical fitness program. **METHODS:** Journey to Wellness (J2W) program enrollees (N = 1,306) were predominately female (76%; 24% male) aged 12-87 y (53.54±14.34). Over a 3-mo intervention, J2W emphasized exercise participation, offered nutrition counseling, community (social/emotional) events, and health coaching. Health coaches were trained using an 18-week educational program. Coaching participation averaged 4.4±2.5 sessions with 0-22 range and was analyzed at three levels (0-3; 4-6; 6+ sessions). Pre and post measures were Patient Health Questionnaire (PHQ), Lifestyle Nutrition Behavior (LNB), General Anxiety Disorder (GAD), Dartmouth Quality of Life (QoL), exercise minutes, weight, waist circumference, systolic and diastolic blood pressure. A series of 2x3 ANOVA were used to examine data after adjusting alpha. **RESULTS:** J2W intervention significantly (p < .01) improved all outcomes with > 250% increase in exercise minutes. Between 20-43.17% improvements were observed for health scores (PHQ, GAD, QoL) while LNB improved 7.5%, and biometrics (weight, waist, blood pressures) between 1-2.2%. Moreover, significant interactions (p < .01) indicated greater participation in health coaching further enhanced the J2W effect for PHQ and QoL (weight and GAD approached significance; p < .05 and < .1, respectively). **CONCLUSION:** By all accounts J2W was an extremely effective community wellness intervention. When participants performed health coaching regularly the beneficial effects of this medical fitness program were enhanced. Health and wellness coaches working in conjunction with a medical fitness program provide a powerful community-based health intervention.

1568 Board #221 June 2, 8:00 AM - 9:30 AM  
**Movement-to-music (m2m) As An Alternative Form Of Exercise Rehabilitation For An Individual With Multiple Sclerosis**  
 Hui-Ju Young, Cassandra L. Herman, James H. Rimmer, FACSM. *University of Alabama at Birmingham, Birmingham, AL.* (Sponsor: James H. Rimmer, FACSM)  
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*(No relationships reported)*

Multiple sclerosis (MS) is characterized by the demyelination and axonal loss of the central nervous system, which progressively results in neurological dysfunction. Individuals with MS often have lower limb muscle spasticity and weakness that lead to poor balance and unsteady gait. **PURPOSE:** This case report describes a novel exercise intervention named movement-to-music (M2M) that is designed for individuals with MS. The aim of the M2M intervention is to improve physical functionality in individuals with MS using combinations of various dance forms (e.g., ballet, jazz, and contemporary dance) that are converted into specific training elements and adapted to the individual's functional level. **METHODS:** A 46-year-old Caucasian female (body mass index = 22.0) who was diagnosed with MS 16 years ago participated in a 12-week M2M intervention that consisted of 36 one-hour movement classes. Participant reported a score of 5 on the Patient Determined Disease Steps scale (PDDS, Late Cane category) and used a cane for ambulation. Each class incorporated a comprehensive movement routine accompanied with music targeting four main training components: range of

motion, muscle strength, cardiorespiratory endurance and balance. Dynamic balance and walking ability were assessed using the Limits of Stability Test (LOS) from a standardized balance system, repeated 5-time chair stand, and timed 20-foot walk before and after the intervention.

**RESULTS:** Participant completed 33 total classes. Total score on the LOS increased from 23 to 30 (maximum score =100) with the time taken to complete the test decreasing from 54 to 43 seconds. Participant was unable to complete the repeated chair stand test without using hands prior to intervention. After 12 weeks, the time to complete the test without using hands was 24.7 seconds. Walking speed improved from 0.39 m/s to 0.58 m/s.

**CONCLUSIONS:** The findings of this case study suggest that combinations of rhythmic movement performed to music can improve balance and mobility in individuals with MS. A larger randomized controlled trial is underway to confirm the effects of this intervention on the health, fitness and quality of life in individuals with MS. Supported by NIDILRR #90DP0059-01-00.

1569 Board #222 June 2, 8:00 AM - 9:30 AM  
**Impact of Moderate-intensity Exercise on Metabolic Health and Aerobic Capacity in Persons with Chronic Paraplegia**

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 (No relationships reported)

Spinal cord injury (SCI) creates a complex pathology which can result in increased sedentary behaviors and reduced aerobic capacity. The Consortium for Spinal Cord Medicine has concluded that the current evidence is insufficient to determine whether exercise improves risk factors for type-2 diabetes mellitus in this population.

**PURPOSE:** To determine the effect of a home-based moderate-intensity exercise intervention (INT) on insulin sensitivity and aerobic capacity in individuals with a SCI. **METHODS:** Twenty inactive (physical activity level < 1.6) individuals with chronic (> 1 yr) paraplegia were allocated to the INT group (n = 12, 46 ± 6 yrs, 76.9 ± 13.7 kg) or control (CON) group (n = 8, 48 ± 10 yrs, 76.8 ± 11.3 kg). Participants assigned to the CON group maintained their normal lifestyle, whilst participants in the INT group completed 4 x 45 min moderate-intensity (60-65% peak oxygen uptake [VO<sub>2</sub> peak]) arm-crank exercise sessions per week for 6 weeks, in their own home. Compliance was monitored with a wrist mounted accelerometer and recorded heart rate. Aerobic capacity and the plasma glucose and serum insulin response to a 75-g oral glucose load (OGTT) were determined before and 36 hrs after the INT. The Homeostasis Model Assessment (HOMA) of insulin resistance (IR) and β-cell function (β) were calculated along with the insulin sensitivity index (ISI<sub>Matsuda</sub>).

**RESULTS:** Eleven out of twelve participants completed all 24 exercise sessions. One participant missed two non-consecutive sessions. Serum fasting insulin was reduced by 14% (P = 0.04) and HOMA-β by 23% (P = 0.02) at follow-up in the INT group, with moderate effect sizes of d = -0.54 and -0.58, respectively. These variables were unchanged in the CON group. There were no significant changes within or between groups in HOMA-IR or ISI<sub>Matsuda</sub>. VO<sub>2</sub> peak increased significantly (P < 0.001) by 19% in the INT group but remained the same in the CON group.

**CONCLUSION:** These findings suggest that a home-based moderate-intensity exercise program, with excellent compliance, can improve aspects of metabolic control and aerobic capacity in persons with chronic paraplegia. Changes in fasting insulin and HOMA-β, but not in ISI<sub>Matsuda</sub> (derived from postprandial measurements) might indicate that 6 weeks of exercise training improves hepatic (but not peripheral) insulin sensitivity.

1570 Board #223 June 2, 8:00 AM - 9:30 AM  
**Active Gaming as a Method to Improve Pressure Pain Sensitivity**

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 (No relationships reported)

An acute bout of moderate to vigorous exercise temporarily reduces pain sensitivity in healthy adults, a phenomenon termed exercise-induced hypoalgesia (EIH). Recently, active gaming (AG), which allows an individual to be physically active during video game play, has been rising in popularity as a means of light to moderate exercise. While evidence has shown that AG elicits positive cardiovascular and balance outcomes, no research has investigated active gaming as a modifier of pain. **PURPOSE:** To determine whether an acute bout of active gaming increases pressure pain thresholds (PPT) in healthy adults. **METHODS:** Thirteen subjects (Age=23±5 years) were tested for pressure pain thresholds at the upper trapezius and forearm immediately before and after a 15-minute AG session or control session. Subjects played 4 different active games on separate days, including two different boxing games and two different tennis games. Heart rate was measured during game play. PPTs for the forearm and trapezius were analyzed with 2(time) X 5 (session) repeated measures

ANOVA. Bivariate correlations examined the relationship between average percentage of Heart Rate Reserve (HRR%) during game play and magnitude of EIH (pre-post). **RESULTS:** Average HRR% for each game was: Boxing1=46.5±13, Tennis1 = 22.9±11, Boxing2= 45.5±16, Tennis2=20.1±9. The analysis revealed a significant Time x Session interaction for the PPTs at the forearm (p<.001) and trapezius (p=.014). PPTs significantly decreased from the pre to posttest for the control session (pre=3.75±.32, post=3.3±.23), but significantly increased from pre to post during the Boxing1 session (pre=3.58±.45, post=3.9±.39). PPTs at the trapezius significantly increased from pre to post during the Boxing1 (pre=3.35±.4, post= 3.7±.45) and Boxing2 (pre=3.7±.4, post 4.1±.5) sessions. EIH at the trapezius and forearm was significantly correlated with average HRR% (trapezius r=.33, forearm r=.28). **CONCLUSION:** These results suggest that an active gaming session played at a moderate intensity is capable of temporarily reducing pain sensitivity.

1571 Board #224 June 2, 8:00 AM - 9:30 AM

**Effects of Moderately Intense Acute Exercise on Cognitive Performance and Cerebral Metabolism**

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 (No relationships reported)

It is frequently reported that acute bouts of moderate intensity exercise can result in short term improvement of many different cognitive functions immediately following exercise, including working memory and executive function. However, the extent to which local changes in brain metabolism correspond to these cognitive changes is not well understood.

**PURPOSE:** To determine if an acute bout of moderate intensity exercise improves cognitive functioning and changes cerebral metabolism in the anterior cingulate cortex.

**METHODS:** A sample of 19 college students aged 18-28 years (M = 23.3, SD 2.9) completed two separate days of a study involving measures of cardiovascular and cognitive health as well as brain imaging. On day one, VO<sub>2</sub> max was measured with a cycle ergometer. On day two, participants received two MRI scans utilizing Proton Magnetic Resonance Spectroscopy (MRS) of the anterior cingulate cortex (ACC). MRS data were acquired using a 3T Siemens Skyra MRI scanner. The first scan was done before a ten minute bout of moderately intense exercise (60-75% heart rate max), and the second scan began immediately following a five minute cool down period. Immediately preceding the MRS data acquisition at both time points, participants completed two five minute blocks of the 2-back working memory task. Paired samples t-tests were run to determine if cognitive performance and cerebral metabolism were significantly changed from baseline to post exercise.

**RESULTS:** A paired samples t-test showed that percent correctness on 2-back performance significantly increased from baseline (M=80.2, SD = 11.24) to post exercise (M = 84.8, SD = 11.76) conditions; t(16) = -2.701, p < 0.05. Reaction time in milliseconds for correct trials of the n-back significantly decreased from baseline (M = 855.07, SD = 316.52) to post exercise (M = 757.51, SD = 273.60) conditions; 3.307(16), p < 0.05. No significant differences were reported in the measured concentrations of Glu/Cr, ml/Cr, NAA/Cr, or Cho/Cr in the ACC from baseline to post exercise conditions.

**CONCLUSION:** While cognitive performance on a working memory task improved from baseline to post exercise, no significant changes in cerebral metabolism in the anterior cingulate cortex were found. This study did not provide evidence that moderate intensity exercise changes frontal lobe metabolism.

1572 Board #225 June 2, 8:00 AM - 9:30 AM

**Cerebrovascular and Autonomic Responses to Thai Traditional Massage in Patients with Ischemic Stroke**

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 (No relationships reported)

Thai traditional massage therapy has shown potential in improving vascular and autonomic functions but the potential benefits of massage for patients with ischemic stroke are yet to be explored.

**Purpose:** To determine acute effects of Thai traditional massage on cerebral blood flow velocity and heart rate variability in patients with ischemic stroke.

**Methods:** Thirteen patients (55±3 years) with a single episode of ischemic stroke due to thrombosis of cerebral arteries (onset ≤2 years) were randomly assigned into either Thai traditional massage (TTM; n=6) or sham control (CON; n=7) group. TTM consisted of petrissage, friction, and passive stretching on the whole body for 60 minutes. Cerebral blood flow velocity (CBFV) in the middle cerebral artery using the

transcranial Doppler ultrasound and heart rate variability (HRV) using the frequency domain analysis were measured before and 0, 60, 120 min, and 24 hr after TTM or sham.

**Results:** CBFV increased ( $p < 0.05$ ) 60 min after TTM. This measure returned to baseline values within 120 min. High frequency (HF) component of HRV increased 0, 60, and 120 min after TTM (all  $p < 0.05$ ). There were no significant changes in total power (TP) and low frequency (LF) components as well as the LF:HF ratio of HRV. CBFV was positively associated with TP ( $r = 0.74$ ) and LF ( $r = 0.63$ ) components of HRV (all  $p < 0.05$ ) at 60 min post-TTM. No significant changes in these variables were observed during the sham control condition.

**Conclusions:** Our study demonstrated that one session of Thai traditional massage acutely improves cerebral blood flow in patients with ischemic stroke possibly through increases in parasympathetic nervous activity.

**Acknowledgments:** This study was supported by Government Research Budget Chulalongkorn University 2015 and The 90<sup>th</sup> Anniversary Research Fund, Chulalongkorn University, Thailand.

1573 Board #226 June 2, 8:00 AM - 9:30 AM

**Effects of External Counterpulsation Therapy on Physiological Fitness Indicators in Healthy Adults**

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(No relationships reported)

External counterpulsation therapy (ECP), a non-invasive treatment approved for use by the U.S. Food and Drug Administration for management of refractory angina and as therapy for heart failure patients, has shown effectiveness in relieving symptoms related to angina, acute myocardial infarction and chronic heart failure by increasing coronary blood flow and oxygen supply. Numerous studies have shown positive effects of ECP in exercise tolerance in patients with coronary heart diseases but studies on the effect of ECP in similar physiological fitness indicators of exercise in the general population are still unavailable. **PURPOSE:** To examine the effects of ECP on cardiovascular fitness indicators in healthy adults.

**METHODS:** Twenty-five participants (age,  $44.8 \pm 8.0$  years) participated in a randomised, double-blinded exploratory study and underwent 30 ECP sessions, each lasting 0.5 hours, with at least two sessions a week. A submaximal treadmill test was administered to the participants prior to the start of the first ECP treatment and following the final session of ECP. Oxygen consumption, heart rate and lactate levels were taken at every stage of the treadmill test. Related physiological fitness indicators such as the predicted maximal oxygen consumption ( $VO_{2max}$ ), ventilatory breakpoint (Vpt) and lactate threshold (LT) were calculated from the variables measured. Repeated-measures analysis of variance was used to examine the effects of ECP on each of the physiological variables.

**RESULTS:** Time taken to Vpt has shown significant increase ( $p = 0.032$ ) from pre-ECP ( $29.8 \pm 23.8$  minutes) to post-ECP ( $34.7 \pm 20.6$  minutes). Percentage of maximal oxygen consumption at Vpt also increased significantly ( $p = 0.014$ ) from pre-ECP ( $70.9 \pm 8.4\%$ ) to post-ECP ( $75.6 \pm 7.4\%$ ).

**CONCLUSIONS:** Results indicated that 30 sessions of ECP increased the time taken to reach Vpt and  $\%VO_{2max}$  at Vpt in healthy adults. ECP has some positive effects on cardiovascular fitness indicators as participants took a longer time to reach Vpt and were able to exercise at higher  $VO_{2max}$  levels at Vpt. ECP may have induced central and peripheral physiological adaptations to increase the participants' fitness levels. Supported by Renew Group Private Limited in collaboration with the Institute for Sports Research, Nanyang Technological University, Singapore.

**C-40 Free Communication/Poster - Predictive Modeling**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
Room: Exhibit Hall A/B

1574 Board #227 June 2, 9:00 AM - 10:30 AM

**Pitching Speed and Related Physical Conditioning: A Pilot Prediction Study**

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(No relationships reported)

**Purpose:** The purpose of this study was to determine the key physical conditions needed for a pitcher by studying the relationship between pitching speed (PS) and a set of selected physical conditioning variables which, in return, should help coaches design more effective training programs to improve pitchers' physical conditioning.

**Method:** Using a survey, 17 Chinese baseball coaches and experts were recruited to recommend and select key variables that determine a pitcher's physical conditioning. After three-round inquiry, 15 variables were identified. A total of 27 male baseball pitchers ( $22.97 \pm 4.01$  yr. old), who came from Shanghai, Jiangsu, Henan, Tianjin, Guangdong, Beijing, Sichuan teams in China, were tested by the 15 variables selected, as well as PS, after warm up. The correlations between PS and other 15 variables were computed.

**Result:** Decreptive statistics of PS and the selected variables, as well as their correlations, are summarized below (See the table, M = Meters, Num = Number; \* $p < .05$ ). A follow-up regression analysis found that, together, Baseball throw away, 30 seconds lung lift and 10 seconds pull elastic band explained 42.9% of the PS variance.

**Conclusion:** Pitchers' pitch speed was moderately related to their baseball throw away and somewhat correlated with 30 seconds lunge lift and 10 seconds pull elastic band. Therefore, to improve pitching speed, the focus of the training should be on improving pitchers' arm strength, lower body power, and upper body fast strength.

ID	Variables	M±SD	SD	Construct	r	p
PS	Pitch speed (km/h)	132.381	5.772	Speed <sup>a</sup>		
1	10-M sprint (s)	1.774	.069	Quickness	.069 <sup>a</sup>	
11	5 different direction sprint (s)	11.213	.688	Quickness	.125 <sup>a</sup>	
2	Reaction time (s)	.208	.020	Reaction speed	-.076 <sup>a</sup>	
3	Baseball throw away (M)	97.786	7.707	Arm strength	.628 <sup>a</sup>	
4	Standing long jump (M)	2.671	.095	Lower power	.141	
5	Standing triple jump (M)	8.538	.294	Lower power	.171	
8	30 seconds lunge lift (s)	40.119	3.749	Body fast strength	.369 <sup>a</sup>	
6	Medicine ball side throw (M)	14.107	1.102	Core power	-.106 <sup>a</sup>	
9	30 seconds twist crunches (Num)	31.548	2.769	Core strength	-.062 <sup>a</sup>	
7	10 seconds pull elastic band (Num)	33.714	1.701	Upper fast strength	-.312 <sup>a</sup>	
10	7 x 15 seconds plank (Point)	6.262	.701	Core stability	.174 <sup>a</sup>	
12	30 seconds double jump rope (Num)	58.357	5.170	Coordination	-.188 <sup>a</sup>	
13	Side toe standing (s)	25.691	10.547	Balance	-.103 <sup>a</sup>	
14	Squatting (Point)	2.500	.552	Functional movement	-.008	
15	Vertical splits (cm)	14.452	6.740	Core flexibility	.075 <sup>a</sup>	

1575 Board #228 June 2, 9:00 AM - 10:30 AM

**Correlation Between The Y-balance Test, Weight-bearing Lunge Test, And Balance Error Scoring System Limb Symmetries**

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(No relationships reported)

Y-balance anterior reach (ANT) limb asymmetries have been associated with an increased risk of injury in athletes. It is unclear if limb asymmetry identified on the ANT are related to limb asymmetries in other common injury screening outcomes such as the Weight-Bearing Lunge Test (WBLT) or the Balance Error Scoring System (BESS).

**Purpose:** To examine the correlation between Y-Balance ANT, WBLT, and BESS limb asymmetries.

**Methods:** Sixty-eight physically active adults (male=16; age=20.35±2.02yrs; height=166.31±32.58cm; weight=66.65±21.19kg) who were free from lower extremity injury and engaging in all desired physical activities participated. Subjects completed one data collection session in which all measures were collected on both limbs. The Y-Balance ANT involved subjects balancing on the stance limb while maximally reaching with the non-stance limb anteriorly. Four practice followed by three test trials were completed, normalized to leg length, and averaged for analysis (%). One trial of the WBLT was performed to assess maximal dorsiflexion (cm) using the knee to wall principle. One practice and one test trial of the eyes-closed BESS single-leg stance firm and foam conditions were completed. Errors were recorded during 20s trials. Asymmetry was calculated for ANT, WBLT, and BESS conditions by determining the absolute difference between scores for the left and right limbs. Separate Pearson correlations were completed to examine the relationship between ANT asymmetry and WBLT, BESS-Firm, and BESS-Foam asymmetry. Alpha-level was set a-priori at  $p \leq 0.05$ .

**Results:** There was a significant, weak correlation between ANT asymmetry ( $3.11 \pm 3.47\%$ ) and WBLT asymmetry ( $1.18 \pm 1.22$ cm,  $r = 0.26$ ,  $r^2 = 0.07$ ,  $p = 0.04$ ). There were no significant correlations between ANT asymmetry and BESS-Firm ( $1.68 \pm 1.60$ ,  $r = -0.122$ ,  $p = 0.32$ ) or BESS-Foam ( $1.47 \pm 1.31$ ,  $r = -0.19$ ,  $p = 0.12$ ) asymmetries.

**Conclusions:** Y-Balance ANT asymmetry was weakly correlated with WBLT and BESS asymmetries. These findings indicate that WBLT and BESS asymmetries may provide unique injury risk information if used in conjunction with ANT asymmetry in prospective injury surveillance studies. Further research is needed to determine the predictive nature of WBLT and BESS asymmetries and how these measures may work in concert to predict injury risk.

1576 Board #229 June 2, 9:00 AM - 10:30 AM  
**The Impact of Errors on PACER Test Healthy Fitness Zone Classification in Students**  
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 (No relationships reported)

**PURPOSE:** In light of the current disease trends (obesity, diabetes, etc.) in children and adolescents a greater effort has been made for physical education classes to move away from sports skill-based programming to health, wellness, and fitness-based approaches. Accompanying this transition has been the implementation of physical fitness assessments that utilize evidence-based standards that measure physical fitness levels as related to good overall health. The PACER Test (FITNESSGRAM®) is a common fitness assessment that assesses cardiorespiratory fitness/aerobic capacity in children and adolescents. While the protocol and test administration is relatively straight forward, in large groups/classroom settings there can be potential sources of measurement error leading to miss counts and recording of PACER laps. The extent to which these errors affect the health risk classification of students is unknown, therefore the purpose of this study was to examine the impact PACER test recording error has on the health risk classification of students.

**METHODS:** A sample of 528 students (272 males and 256 females), with an average age of 13.2 ± 2.5 yrs, and average BMI of 21.47 ± 4.7, from a large Midwestern school district participated in this project. Data from the PACER Test (FITNESSGRAM®) was adjusted by ±1 and ±2 laps to simulate counting and recording errors that may accompany PACER test administration.

**RESULTS:** Results indicated 64.96% of students were classified in a healthy fitness zone (HFZ), 18.18% were classified as needing improvement (NI), and 16.86% were classified as needing improvement and having health risks (NI-HR). When accounting for lap count error the NI-HR classification saw the greatest percent change (+1: -11.24%, +2: -21.35%, -1: 10.11%, -2: 20.22%).

**CONCLUSIONS:** The study showed that error in data collection of students affects those who need the most intervention to improve their physical fitness. This emphasizes the importance of accurate data collection of fitness tests in physical education classes.

1577 Board #230 June 2, 9:00 AM - 10:30 AM  
**Echogenicity Quantified By Ultrasonographic Panoramic Scans Compared To Still-images In Collegiate Men**  
 Alyssa N. Varanoske, David H. Fukuda, Carleigh H. Boone, Kyle S. Beyer, Kayla M. Baker, Jeffrey R. Stout, Jay R. Hoffman, FACSM. University of Central Florida, Orlando, FL.  
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Measuring the echo intensity (EI) of skeletal muscle via ultrasonography has been used to estimate muscle quality and diagnose pathological and neurological conditions. When assessing skeletal muscle, ultrasonographic (US) still-images do not always permit the entire muscle to be viewed in a single image, so panoramic US scans have been developed. In addition, homogeneity of fibrous tissue throughout a single muscle is often assumed for easy assessment, however, muscles may not be homogeneous. Many studies continue to use still-images to quantify EI without regard to the size or possible heterogeneity of the muscle.

**PURPOSE:** To determine if the EI quantified via US panoramic transverse scans (PTS) is related to the EI of US longitudinal still-images (LSI) taken of the vastus lateralis (VL) muscle in collegiate males.

**METHODS:** Twenty-four collegiate men (20.2 ± 1.6 y; BMI: 25.8 ± 3.3 kg·m<sup>-2</sup>) participated in this study. Muscle EI of the VL was assessed in the self-reported dominant limb (DOM) via three PTS and three LSI. PTS were captured using extended-field-of-view ultrasonography, and LSI were captured using B-mode ultrasonography. Intra-class correlations (ICC), standard errors of measurement (SEM), and minimal differences (MD) were calculated between each of the three images for both PTS and LSI. EI was quantified for each image using histogram analysis through an image analysis software.

**RESULTS:** ICCs, SEM, and MD reported for the EI of the PTS and for the EI of the LSI were ICC = 0.956, SEM = 1.640, and MD = 4.546, and ICC = 0.991, SEM = 1.059, and MD = 2.935, respectively. A significant positive correlation existed between the EI of the PTS and the EI of the LSI ( $r = 0.744, p < 0.001$ ). Significant differences between the EI of the PTS ( $\mu = 57.97; \sigma = 8.26$ ) and the EI of the LSI ( $\mu = 65.39; \sigma = 10.88$ ) were observed ( $p < 0.001$ ).

**CONCLUSION:** While there is a strong positive correlation between the EI values quantified by both PTS and LSI, the use of LSI yielded a slightly higher reliability measurement with a smaller SEM and smaller MD compared to PTS. In addition to the higher reliability and sensitivity, the LSI measurement also requires less time, and therefore may be more advantageous when assessing EI of the VL in collegiate males.

1578 Board #231 June 2, 9:00 AM - 10:30 AM  
**Prediction of Maximal Oxygen Consumption in Healthy Adult Skaters Using the Auggie-10 Single Stage Skate Test**  
 Anthony Clapp<sup>1</sup>, Claire Cripps<sup>1</sup>, John L. Walker, FACSM<sup>2</sup>.  
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Maximal oxygen consumption is the most accurate measure for indicating cardiovascular function. A variety of submax assessments have been proven viable alternatives. Both maximal and submax field tests for estimating VO<sub>2</sub>peak for cycling, walking, or running have been previously developed and validated. **PURPOSE:** To develop a submax skating test that would be suitable for estimating VO<sub>2</sub>peak in adult skaters. **METHODS:** Subjects were recruited during open public skating and agreed to participate. Subjects included 16 males and 24 females ranging in age from 19 to 59 years, who were self-classified as capable skaters (age = 35.5 ± 7.6 yrs, ht. = 66.3 ± 4.4 in, wt. = 140.7 ± 23.3 lbs). All completed a graded exercise test to fatigue with expired gas analysis (Medgraphics, VO2000). Participants performed on-ice and skated at a self-selected speed, 10 times around the rink in a large figure 8 routine. The center dot was the mid and the nets the ends. Heart rate and skating time was recorded as they finished. For males, mean VO<sub>2</sub>peak 47.3 ± 5.3 ml/kg/min, mean skate time 3.8 ± 0.5 minutes, mean heart rate 165.3 ± 21.0 b/min. For females, mean VO<sub>2</sub>peak 41.0 ± 5.1 ml/kg/min, mean skate time 4.5 ± 1.0 minutes, mean heart rate 167.0 ± 16.3 b/min. Regression analysis factors age, weight, height, gender, end heart rate, and skate time was performed in the multiple linear model to predict peak VO<sub>2</sub>. **RESULTS:** Skate time was significantly correlated with VO<sub>2</sub>peak,  $r = -.41, F(1,38) = 7.9, p = .008$ . Regression analysis also indicated that heart rate was a significant predictor,  $F(1,37) = 7.5, p = .009$ , after skate time was already included in the model. Gender was also a significant predictor,  $F(1,36) = 6.0, p = .019$ , after skate time and heart rate were in the model. Neither age  $F(1,35) = 1.9, p = .177$ , height  $F(1,35) = 2.5, p = .120$ , weight  $F(1,35) = 3.9, p = .057$ , accounted for no additional variation. The analysis created a regression equation to predict peak oxygen based on the Auggie-10 skate test: VO<sub>2</sub>peak (ml/kg/min) = 71.43 - (2.77 x skate time in minutes) - (0.11 x heart rate in b/min) + (4.22 x gender), (1 = male; 0 = female), R-squared = .41, SEE = 4.8 ml/kg/min. **CONCLUSION:** The derived model provides a useful field test for estimating VO<sub>2</sub>peak from skating. The accuracy of the derived model is similar to other submax field tests based on cycling, walking, or non-exercise models.

1579 Board #232 June 2, 9:00 AM - 10:30 AM  
**Relationship Between Dynamic and Isometric Force Measured at the Mid-Thigh and Deadlift Positions**  
 Kylie K. Malyszczek, RoQue A. Harmon, Dustin D. Dunnick, Pablo B. Costa, Jared W. Coburn, FACSM, Lee E. Brown, FACSM. California State University, Fullerton, Fullerton, CA.  
 (No relationships reported)

The isometric mid-thigh pull is commonly used to measure force and has been shown to correlate well with dynamic performance. However, little is known about the dynamic relationship with a deadlift position. **PURPOSE:** To compare dynamic performance via the countermovement vertical jump (CMJ) with isometric force between the mid-thigh (MTP) and deadlift (DL) positions, utilizing both an Olympic barbell (OB) and a hexagonal barbell (HB).

**METHODS:** Twenty resistance trained men (age=24.05±2.09 years, ht=178.07±7.05 cm, mass=91.42±14.44 kg) volunteered to participate and performed 3 CMJ trials on a force plate, while aiming for vanes on an EPIC jump device. After jump testing, they performed isometric pulls from the MTP position utilizing both an OB and HB, and from the DL position, also utilizing both bars. To perform the pulls, a power rack was positioned over a force plate and the bar was fixed in position. For MTP, a handheld goniometer ensured a 135 degree knee angle while for the DL, the bar was fixed at plate height from the floor. Participants were provided with lifting straps and were instructed to pull on the bar as hard and fast as possible. Joint angles were recorded via goniometer at all positions for ankle, knee, and hip. Peak ground reaction force (PGRF) variables were recorded.

**RESULTS:** Statistical analysis revealed significant correlations between CMJ impulse and isometric PGRF for all bars and lifts; however, correlations were stronger with DL (OB:  $r=0.85$ , HB:  $r=0.84$ ) than with MTP (OB:  $r=0.60$ , HB:  $r=0.66$ ). Joint angles were significantly more extended for MTP than DL for ankle (MTP OB=82.50±3.62, MTP HB=79.80±5.15; DL OB=76.15±5.42, DL HB=71.00±7.22) knee (MTP OB=135.00±0.00, MTP HB=134.85±0.67; DL OB=99.85±14.14, DL HB=97.10±13.17), and hip (MTP OB=129.20±12.82, MTP HB=123.70±12.62; DL OB=52.70±6.75, DL HB=49.70±10.24).

**CONCLUSIONS:** The increased correlations between CMJ and DL may be due to the similarity in joint angles between CMJ and DL. The MTP is initiated from a more upright position, while the DL and CMJ are initiated with more flexed joint angles.

1580 Board #233 June 2, 9:00 AM - 10:30 AM

**Comparison of Threshold Determinations between Blood Lactate Samples and Near Infrared Spectroscopy**

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Utilization of blood samples from the fingertip (LA) has become a standard protocol when conducting maximal ergometer tests in a laboratory setting due to the validity and reliability of the determination of lactate thresholds (LT1, LT2). Near Infrared Spectroscopy (NIRS) has shown to be a non-invasive wearable alternative to blood samples from finger pricks. The BSXInsight is a wearable NIRS device with a proposed testing procedure that measures the oxygen levels of the blood that correlate to traditional lactate threshold values (AT, LT). To our knowledge, no scientific research has been conducted independently testing the BSXInsight device. **PURPOSE:** The purpose of this study was to compare the predicted threshold powers at LT1 and LT2 via LA to AT and LT via BSXInsight device, respectively. **METHODS:** Five volunteer male subjects (21.2±0.84 years, 72.81±8.31 kg, 175.44±6.13 cm) completed a maximal step-wise test to volitional exhaustion. Before each test, the bike was fit to each individual using the recommended knee angles measured by a goniometer. A standardized warm-up of 5 min at 40W preceded each individual's step-wise test. The step-wise test began at 60W and increased 20W after each 3 min interval at a cadence of 70 rpm or greater. This protocol continued until the subject reached volitional exhaustion or until the cadence dropped below 60 rpm. **RESULTS:** A simple linear regression was used to predict the blood lactates, LT1 and LT2, based on the AT and LT of the BSXInsight. A significant regression for LT1 was found (F (1,3) = 40.30, p<0.01), with an R<sup>2</sup> of 0.931. The standard error of estimate is 17.722 watts based on 95% confidence intervals. A significant regression for LT2 was found (F (1,3) = 29.903, p<0.02), with an R<sup>2</sup> of 0.909. The standard error of estimate is 22.378 watts based on 95% confidence intervals. **CONCLUSIONS:** Based on the results, there is a strong positive relationship between the powers predicted by invasive blood lactate samples and the BSXInsight for lactate thresholds. This study showed that the BSXInsight device using NIRS technology may be an acceptable, non-invasive technique for determining LT1 and LT2; however, further testing must be done to examine the level of fitness of the subject for a successful prediction of lactate thresholds using the BSXInsight device.

1581 Board #234 June 2, 9:00 AM - 10:30 AM

**Correlation Between Isometric Deadlift with Olympic and Hexagonal Barbells to a Vertical Jump**

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(No relationships reported)

Isometric performance has been shown to correlate well with dynamic measures, but little is known regarding performance variables utilizing different bars and pulling positions. **PURPOSE:** To compare isometric deadlift with an Olympic barbell (OL), hexagonal barbell with low-handles (LH), and a hexagonal barbell with high-handles (HH) to a countermovement vertical jump (CMJ). **METHODS:** Twenty resistance trained men (age=24.05±2.09 yrs, ht=178.07±7.05cm, mass=91.42±14.44kg) volunteered to participate. Following a dynamic warm-up, each participant performed 3 CMJ trials on a force plate, using an EPIC vertical jump device as a target. They then performed isometric pulls from the deadlift position in a power rack positioned over the same force plate, with a bar fixed in the rack at plate height from the floor. Participants performed 3 trials for each condition: OL, LH, and HH. They were provided with lifting straps and instructed to pull as hard and fast as possible. Peak ground reaction force (PGRF) was recorded for the deadlift while peak power was recorded for the CMJ. The average of three trials was used for analysis. **RESULTS:** Correlation analysis revealed significant relationships between isometric PGRF and CMJ peak power for all bars: OL (r=0.70), LH (r=0.67), and HH (r=0.64). However, the correlation was greatest with the OL. **CONCLUSIONS:** Based on these results, strength of the correlation between isometric PGRF and CMJ peak power appears to depend on the bar used, as well as the height from the ground during the pull. This could be due to the similarity in knee joint angles between the OL deadlift and the deepest position of the counter-movement during the vertical jump.

1582 Board #235 June 2, 9:00 AM - 10:30 AM

**Arteriovenous Oxygen Difference is a Stronger Predictor of Aerobic Fitness than Stroke Volume in Female Youth Athletes**

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(No relationships reported)

The relationship between physical maturity and aerobic trainability is not completely understood. In addition, the predictors of aerobic capacity (VO<sub>2max</sub>) in youth females are poorly defined. **Purpose:** To define the predictors of aerobic capacity in adolescent female athletes. **Methods:** 44 adolescent female athletes (13-18 years) underwent maximal cycle ergometer testing for determination of maximal aerobic capacity (VO<sub>2max</sub>), stroke volume (SV<sub>max</sub>), heart rate (HR<sub>max</sub>), arteriovenous oxygen difference (a-vO<sub>2</sub>diff<sub>max</sub>). Variables were initially compared across Tanner stage (3-5). Participants were then stratified by Tanner stage and grouped by fitness level (high fit, low fit) based on VO<sub>2max</sub> median split. Variables were compared between groups and differences in VO<sub>2max</sub> between high and low fit groups were compared across Tanner stage. Finally, multivariate regression was used to determine the independent predictors of difference in VO<sub>2max</sub> between high and low fit groups, using differences in SV<sub>max</sub> and a-vO<sub>2</sub>diff<sub>max</sub> as covariates. **Results:** No significant differences were identified between Tanner 3, 4, and 5 with respect to VO<sub>2max</sub> (2.97 v 3.21 v 3.54 L/min, p=0.18), HR<sub>max</sub> (200.0 v 193.0 v 194.5 bpm, p=0.294), or a-vO<sub>2</sub>diff<sub>max</sub> (17.9 v 17.7 v 17.4 ml/dL, p=0.894), while increases across Tanner stage were noted in SV<sub>max</sub> (88.1 v 98.8 v 108.8 ml, p=0.006). Compared to low fit, high fit participants had significantly higher a-vO<sub>2</sub>diff<sub>max</sub> (19.9 v 15.7 ml/dl, p<0.001) but no significant differences in SV<sub>max</sub> (104.3 v 97.9 ml, p=0.078) or HR<sub>max</sub> (196 v 190 bpm, p=0.33). Differences in VO<sub>2max</sub> between high and low fit participants did not differ across Tanner stage (+1.34 v 0.75 v 0.53 L/min, p=0.143). After inclusion in the multivariable model, VO<sub>2max</sub> was independently associated with both a-vO<sub>2</sub>diff<sub>max</sub> (p<0.001) and SV<sub>max</sub> (p=0.001). The relative importance in the model was higher for a-vO<sub>2</sub>diff<sub>max</sub> than SV<sub>max</sub> (r<sup>2</sup>=0.68 v 0.32, respectively). **Conclusion:** SV<sub>max</sub> but not a-vO<sub>2</sub>diff<sub>max</sub> increases with physical maturity. In adolescent female athletes, differences in aerobic fitness are more strongly associated with maximal a-vO<sub>2</sub>diff<sub>max</sub> than SV<sub>max</sub>.

1583 Board #236 June 2, 9:00 AM - 10:30 AM

**Development And Validation Of A Pacer Prediction Equation For Vo2peak In 10-15 Year Old Youth**

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The PACER, a component of the FITNESSGRAM (FG), is a 20-m shuttle run used to predict peak oxygen consumption (VO2peak) in youth. Previous PACER equations were developed using VO2peak assessments during treadmill running; no equation has been developed using VO2peak assessed during the PACER. **PURPOSE:** To develop and validate a prediction equation to estimate VO2peak from the PACER in 10-15 year-old youth. **METHODS:** A sample of 101 youth (56 boys; 12.4±1.6 y) were recruited to develop a prediction equation. A separate validation sample was composed of 63 youth (41 boys; 12.1±2.0 y). VO2peak was measured on all youth using a portable metabolic unit during the PACER for both parts of the study. Regression analysis yielded a prediction equation that used total laps achieved during the PACER, body mass index (BMI), and the interaction between gender and age. Correlations and pairwise comparisons between the estimated VO2peak from the new prediction equation and the commonly used FG equation [VO2peak = 41.77 + 0.49\*(laps) - 0.0029\*(laps)<sup>2</sup> - 0.62\*(BMI) + 0.35(gender\*age); 0=female, 1=male] were analyzed. Gender comparisons were also analyzed. **RESULTS:** The following prediction equation was generated: [Scott Equation VO2peak=52.934 +.256\*(laps) -.924\*(BMI) +.468\*(age\*sex); R<sup>2</sup>=0.752]. The correlation between measured and predicted VO2peak using the Scott equation was r=0.716 (p<0.001) and r=0.711 (p<0.001) for the FG equation. The standard error of estimates (SEE) were 4.60 ml·kg<sup>-1</sup>·min<sup>-1</sup>(Scott) and 4.53 ml·kg<sup>-1</sup>·min<sup>-1</sup> (FG). Predicted VO2peak from the Scott equation differed significantly from the FG estimates (p<0.001) although neither differed from measured VO2peak; Scott equation 95% CI (-1.879, 3.236), p=1.000 and FG equation 95% CI (-4.915, 0.288), p=0.097. The FG equation tended to overestimate VO2peak in males (55.6±1.6 vs. 51.6±1.0 ml·kg<sup>-1</sup>·min<sup>-1</sup>; p=0.001) but worked relatively well for females (39.8±1.3

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vs.  $40.1 \pm 2.2$  ml·kg<sup>-1</sup>·min<sup>-1</sup>;  $p=0.824$ ). The Scott equation revealed no significant differences ( $p=0.70$ ) between the males ( $50.6 \pm 1.6$  vs.  $51.6 \pm 0.9$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) and females ( $39.8 \pm 2.3$  vs.  $39.9 \pm 1.3$  ml·kg<sup>-1</sup>·min<sup>-1</sup>).

**CONCLUSIONS:** The Scott equation resulted in a more accurate estimate of VO<sub>2</sub>peak. Additionally, it appears that the Scott equation performed equally well in males and females for our sample.

1584 Board #237 June 2, 9:00 AM - 10:30 AM  
**Relationships between Fitness Assessments, Fitness Levels and Coronary Heart Disease Risk Markers in Police Officers**

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**PURPOSE:** To examine correlations between several markers of cardiovascular (CV) and muscular fitness among police officers. **METHODS:** Sixty-five local police officers were recruited (8 female, average age  $35.6 \pm 9.0$  yrs, height  $70.5 \pm 2.8$  in, weight  $91.8 \pm 18.7$  kg, VO<sub>2</sub>  $33.0 \pm 5.3$  mL/kg/min). Data was taken from their annual health screening, which included a graded exercise test (GXT; Bruce protocol), pushups completed in 1 minute, situps completed in 1 minute, handgrip strength, DEXA scan, and bloodwork. Maximal oxygen uptake (VO<sub>2</sub>max) was estimated using the Foster equation. Coronary heart disease risk (CHD risk) was calculated using the online NIH 10-year heart attack risk calculator. Significance was determined using an alpha level of 0.05. **RESULTS:** There was no significant correlation between VO<sub>2</sub>max and CHD risk ( $r = -0.166$ ). Apart from risk markers included in the risk calculation, CHD risk was significantly correlated with waist-hip ratio ( $r = 0.247$ ), and LDL cholesterol ( $r = 0.391$ ). VO<sub>2</sub>max was significantly negatively correlated with fat mass ( $r = -0.518$ ), body fat percentage (%BF;  $r = -0.643$ ), total cholesterol (TC;  $r = -0.337$ ), and LDL cholesterol ( $r = -0.267$ ). Positive correlations were found between VO<sub>2</sub>max and other measures of fitness such as pushups ( $r = 0.543$ ), situps ( $r = 0.328$ ), and handgrip strength ( $r = 0.320$ ). Percent body fat was significantly positively correlated with TC ( $r = 0.302$ ), systolic blood pressure ( $r = 0.288$ ), LDL cholesterol ( $r = 0.265$ ), and fasting glucose ( $r = 0.265$ ), but negatively correlated with fitness markers such as pushups ( $r = -0.586$ ), situps ( $r = -0.436$ ), and handgrip strength ( $r = -0.324$ ). Lean mass was significantly correlated with handgrip strength ( $r = 0.718$ ), though not pushups, situps or VO<sub>2</sub>max. Waist circumference was significantly negatively correlated with HDL cholesterol ( $r = -0.392$ ). Additionally, 62 of the participants (7 female) completed both a 1.5 mile run and GXT, allowing for a comparison of two commonly used assessments of CV fitness. Time to complete 1.5 miles was significantly correlated to GXT VO<sub>2</sub>max, with a Pearson correlation coefficient of  $-0.796$ . **CONCLUSION:** Relationships found between health markers and fitness variables in this sample were generally in line with previous research on CHD risk factors and the assessment of CV and muscular fitness.

1585 Board #238 June 2, 9:00 AM - 10:30 AM  
**Vertical Jumping And Leg Power Normative Data For Colombian Schoolchildren Aged 9-17.9 Years: The Fuprecol Study**

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**Purpose:** The Vertical Jump Test became of the most convenient tests used to evaluate anaerobic capacity and the effectiveness of anaerobic training programs for a variety of power sports. However, its use and interpretation as an evaluative measurement into physical activity tests are limited because there are few published reference values derived for children and adolescents. Therefore, the aims of the present study were to generate normative vertical jump height and predicted peak power (Ppeak) data for 10- to 17.9-year-olds and to investigate between-sex and age group differences in these measures.

**Methods:** The sample comprised 7614 healthy Colombian schoolchildren [boys  $n=3258$  and girls  $n=4356$ , mean (standard deviation) age 12.8 (2.3) years old]. Each participant performed two countermovement jumps, and jump height was calculated using a Takei 5414 Jump-DF Digital Vertical®, Japan. The highest jump was used for analysis and in the calculation of predicted Ppeak. Centile smoothed curves, percentile and tables for the 3rd, 10th, 25th, 50th, 75th, 90th and 97th percentile were calculated using Cole's LMS method.

**Results:** The one-way ANOVA tests showed that maximum jump height (cm) and predicted Ppeak (W) was higher in boys than in girls ( $p<0.01$ ). Post hoc analyses within

sexes showed yearly increases in jump height and Ppeak in all ages. In boys, the maximum jump height and predicted Ppeak 50th percentile ranged from 24.0 to 38.0 cm and 845.5 to 3061.6 W, respectively. In girls, the 50th percentile ranged from jump height was 22.3 to 27.0 cm and predicted Ppeak was 710.1 to 2036.4 W. For girls, jump height increased yearly from 9 to 12.9 years before reaching a plateau aged 13 to 16.9 years old.

**Conclusions:** Our results provide, for the first time, sex- and age-specific vertical jump height and predicted Ppeak reference standards for Colombian schoolchildren aged 9-17.9 years.

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1586 Board #239 June 2, 9:00 AM - 10:30 AM  
**Normative Reference Values For Handgrip Strength In Colombian Schoolchildren: The Fuprecol Study**

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**PURPOSE:** There is increasing evidence that muscular fitness (MF) is an important health marker in youth. The MF values for children and adolescents from various countries have been published, but there is a scarcity of reference values for Latin-American adolescents using handgrip (HG) strength. The aim of this study was to evaluate patterns of HG strength in relation to sex and age and to determine the relative proportion of Colombian children and adolescents that fall into established Health Benefit Zones (HBZ).

**METHODS:** The sample comprised 7268 healthy Colombian schoolchildren [boys  $n=3129$  and girls  $n=4139$ , mean (standard deviation) age 12.7 (2.4) years old]. HG was measured using a hand dynamometer with an adjustable grip (TKK 5401 Grip D; Takey, Tokyo, Japan). Centile smoothed curves, percentile and tables for the 3rd, 10th, 25th, 50th, 75th, 90th and 97th percentile were calculated using Cole's LMS method. **RESULTS:** HG peaked in the sample at 22.2 (8.9) kg in boys and 18.5 (5.5) kg in girls. The increase in HG was greater for boys than for girls, but the peak HG was lower in girls than in boys. Although absolute strength was greater in boys than in girls, the HBZ data indicated that a higher overall percentage of boys than girls at each age group fell into the "Needs Improvement" zone, with differences particularly pronounced during adolescence.

**CONCLUSIONS:** Our results provide, for the first time, sex- and age-specific HG reference standards for Colombian schoolchildren aged 9-17.9 years. These values are especially important in public health and educational settings and suggest the consideration of HBZ information in conjunction with HG to improve surveillance data interpretation and intervention planning among Colombian schoolchildren. Funding COLCIENCIAS (Contract N° 671-2014 Code 122265743978).

1587 Board #240 June 2, 9:00 AM - 10:30 AM  
**Interval TRIMP Scores Predict Improvement in Maximal Oxygen Consumption in middle-aged, sedentary Individuals**

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**PURPOSE:** The optimal training strategy to maximize increases in VO<sub>2</sub> max is unclear. We sought to compare the contribution of different training loads from an exercise program combining interval and continuous training on improvements in VO<sub>2</sub> max. Training load was objectively quantified by the Training Impulse (TRIMP).

**METHODS:** We studied 30 healthy sedentary participants ( $53.21 \pm 4.70$  years, 14 males). Each participant was prescribed a progressive exercise prescription consisting of endurance and interval training. Between month 1 and 6, the exercise progressed to reach a peak phase, which was maintained for 3 months (weekly prescription: interval x2; one 60 min base pace; one 30 min base pace; one recovery). VO<sub>2</sub>max was measured at baseline and after completion of the peak phase of training via Douglas Bag method and incremental treadmill protocol. The training load for each continuous (TRIMPC =  $t \cdot k_1 \cdot x$ ) and interval exercise session (TRIMPI = ) was calculated using the relevant equation. Total TRIMP scores (for all exercise), TRIMPC and TRIMPI scores were summed for the peak phase of training. Regression analysis was performed to determine correlation between these scores and percent change in VO<sub>2</sub>max.

**RESULTS:** VO<sub>2</sub>max increased from  $28.73 \pm 4.8$  ml/kg/min at baseline to  $34.43 \pm 5.6$  ml/kg/min after training ( $P < 0.01$ ). Total TRIMP score was  $4411 \pm 1127$  for the peak phase, while TRIMPC score was  $2353 \pm 699$  and TRIMPI score was  $2059 \pm 638$ . Total TRIMP score did not correlate with increase in relative VO<sub>2</sub>max ( $R^2 = 0.04$ ,  $P = 0.31$ ), nor did

TRIMPC score ( $R^2=0.00$ ,  $P=0.92$ ). However, TRIMPI score correlated with increased  $VO_{2max}$  ( $R^2=0.14$ ,  $P=0.05$ ). Moreover, there was a significantly greater percent increase in relative  $VO_{2max}$  in individuals whose TRIMPI scores were in the top third of the group compared to those in the bottom third ( $24.70\% \pm 9.10$  vs  $15.11\% \pm 7.33$ ,  $P=0.0188$ ).

**CONCLUSIONS:** Our data suggests that interval TRIMP scores predict changes in relative  $VO_{2max}$  in middle-aged, sedentary individuals undergoing exercise training. In conclusion, interval training may provide a greater stimulus for aerobic adaptation than continuous endurance training.

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### Accuracy of Polar Heart Rate Monitors to Predict $VO_{2max}$

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Currently, there are affordable heart rate monitors on the market that estimate  $VO_{2max}$  from resting conditions. Although these heart rate monitors are safer, less expensive, and more accessible than an actual  $VO_{2max}$  test, there is limited evidence to show these  $VO_{2max}$  estimates are accurate. **PURPOSE:** The purpose of this study was to compare actual  $VO_{2max}$  values (AMax) to predicted  $VO_{2max}$  values (PMax) obtained from the V800, M400, and FT60 Polar heart rate monitors. These monitors predict  $VO_{2max}$  based upon gender, age, height, weight, resting heart rate variability, and self-reported training range (hours trained per week). **METHODS:** Seventeen females (BMI =  $22.1 \pm 2.4$ , age =  $21.2 \pm 1.2$  yrs) and 18 males (BMI =  $24.4 \pm 3.2$ , age =  $21.4 \pm 2.1$  yrs) reported to the lab and were fitted with heart rate monitor straps upon completion of a DXA scan. PMax values were obtained from the Polar monitors for the six different training ranges that can be programmed into the watches. These training ranges are based upon the number of self-reported training hours per week; Low (0-1hrs/wk), Moderate (1-3 hrs/wk), Frequent (3-5 hrs/wk), Heavy (5-8 hrs/wk), Semi-Pro (8-12 hrs/wk), and Pro (12+ hrs/wk). After the PMax values were obtained, participants then completed a Modified Bruce Treadmill  $VO_{2max}$  test. PMax was defined as the  $VO_{2max}$  estimate that matched their self-reported training range. Due to potential errors associated with self-reported training ranges, AMax also was compared to the PMax estimate that matched the training range that was one category higher (PMax+1) and one category lower (PMax-1) than self-reported training range. **RESULTS:** Overall, AMax was significantly correlated with PMax based upon self-reported training range ( $r=0.718$ ,  $p<0.01$ ). In females, AMax was not correlated with PMax ( $r=0.403$ ,  $p=0.122$ ) but was significantly correlated with the PMax+1 ( $r=0.569$ ,  $p=0.027$ ). In males, AMax was significantly correlated with PMax ( $r=0.560$ ,  $p=0.019$ ) and with the PMax-1 ( $r=0.565$ ,  $p=0.035$ ). **CONCLUSION:** The PMax value based upon self-reported training range obtained from the Polar V800, M400, and FT60 provide a good estimate of AMax in males. In females, the PMax value associated with the next higher training range (PMax+1) provides a better estimate of AMax than the PMax based upon their actual self-reported training range.

1589 Board #242 June 2, 9:00 AM - 10:30 AM

### Validity of Innovative Smartphone Sport-supported Calculator and Gas Analysis Indirect Calorimetry in Energy Expenditure Estimation

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**PURPOSE:** To apply innovative Smartphone Sport-supported Fat & Glucose Calculator (SSFGC) in endurance exercise and evaluate validity of innovative SSFGC and Gas Analysis Indirect Calorimetry in fat and glucose consumption estimation during cycling endurance exercise.

**METHODS:** Twelve healthy male cyclists (age:  $31.8 \pm 3.2$  yr, height:  $171.6 \pm 7.9$  cm, weight:  $71.2 \pm 5.0$  kg, peak oxygen uptake ( $VO_{2peak}$ ):  $46.2 \pm 5.6$  mL/min/kg. The maximum for power:  $240 \pm 50$  watt, progressive exercise load (15watts/min, graded exercise testing, GXT) exhaustive time:  $982 \pm 197$  sec, RER:  $1.1 \pm 0.1$ ) were recruited and conducted to measure the maximal oxygen uptake capacity and basic physiological data before the study. During 1 Hr endurance exercise (30%  $VO_{2peak}$ -80%  $VO_{2peak}$ ), endurance exercise, subjects were required to comply with SSFGC. All data are expressed as mean  $\pm$  standard deviation (SD). The level of significance was set at  $p \leq 0.05$ .

**RESULTS:** The study found that there is a high positive correlation between SSFGC and Gas Analysis Indirect Calorimetry in glucose ( $r = .994$ ,  $p < .05$ ) and fat (30%  $VO_{2peak}$ -50%  $VO_{2peak}$ :  $r = .888$ ,  $p < .05$ ; 60%  $VO_{2peak}$ -80%  $VO_{2peak}$ :  $r = .817$ ,  $p < .05$ ) consumption estimation during cycling endurance exercise.

**CONCLUSIONS:** Innovative SSFGC can be stability used for fat and glucose metabolism measurement, and provide a theoretical basis for future further applications.

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### Andersen Test Results Correlates Poorly With Measured Maximal Oxygen Uptake In 6-yr Old Children

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The Andersen test (Andersen, Andersen, Andersen, Anderssen, 2008) is widely used for testing cardiorespiratory fitness among children and adolescents 9 yr and older. **PURPOSE:** To investigate the feasibility of using this test for fitness evaluation in 6-yr old children. **METHODS:** 185 children from 1st grade in Horten Municipality volunteered to perform the Andersen test and a treadmill test to voluntary exhaustion measuring oxygen uptake with a metabolic cart. Results sorted by sex were compared with Winks SDA 7 statistical software (TexaSoft, TX, USA). A significance level of  $p \leq 0.05$  was set. **RESULTS:** 101 pupils showed acceptable test performance in both tests, and were included in the analysis. The Pearson's correlation coefficient  $r$  between absolute maximal oxygen uptake (L·min<sup>-1</sup>) and distance run in the Andersen test was low, .22 for boys and .16 for girls. Even if the boys' result was statistical significant, the explained variance was low, less than 5%. Using oxygen uptake scaled to body mass did not improve the association. Another fitness measure, maximal handgrip strength did better correlate with absolute maximal oxygen uptake than running performance;  $r = .56$  (boys),  $.49$  (girls),  $p < .05$ . **CONCLUSION:** In this sample of 6-yr old children, the association between cardiorespiratory fitness, expressed as maximal oxygen uptake, and Andersen test performance was low. This is contradictory to results from samples of older subjects (i.e. Aadland, Terum, Mamen, Andersen, Resaland, 2014). An explanation may be that both tests are difficult to perform for such young children. The Andersen test was run only once, and this may also partly explain the discrepancy. The association between absolute maximal oxygen uptake and handgrip strength may be a result of body size, as there was very low correlation when oxygen uptake was scaled to body size.

Grants/conflict of interest: None.

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1591 Board #244 June 2, 9:00 AM - 10:30 AM

### Determining Validity Of A Self-Paced $VO_{2max}$ Test For Estimating Anaerobic Capacity

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Recent evidence has shown that self-paced  $VO_{2max}$  treadmill tests (SPV) can produce similar  $VO_{2}$ -power relationships as traditional incremental treadmill tests. The endspurt during the last stage of SPV may be a surrogate for a supramaximal test. Pairing the SPV  $VO_{2}$ -power relationship and endspurt may allow for the calculation of a correlated measure to maximal accumulated oxygen deficit (MAOD) and the potential to determine aerobic power and anaerobic capacity in a single task. **Purpose:** To determine if SPV can produce a correlated measure to MAOD using data available only from the SPV test. **Methods:** Seventeen male subjects (age  $25 \pm 5$  years,  $VO_{2max}$   $62.3 \pm 9.2$  ml\*kg<sup>-1</sup>\*min<sup>-1</sup>) completed four submaximal exercise tests to determine a  $VO_{2}$ -power relationship. MAOD was measured during a supramaximal exercise bout. An SPV was completed on an automated treadmill with  $VO_{2}$ -power relationship determined from stages 2-4. For both relationships, y-intercept was set at  $5.1$  ml\*kg<sup>-1</sup>\*min<sup>-1</sup>. Accumulated oxygen deficit (AOD) was determined for SPV stage 5 as the sum of each 15 second O<sub>2</sub> deficit until estimated O<sub>2</sub> demand fell below O<sub>2</sub> uptake. Peak power was taken as the highest 15 second average throughout.  $VO_{2}$  was calculated using 15 second averages. **Results:** Eight subjects produced an endspurt during stage 5 of SPV and were included in the analysis. The supramaximal exercise test lasted  $2.48 \pm 0.40$  min and MAOD averaged  $39.2 \pm 7.1$  ml\*kg<sup>-1</sup>.  $VO_{2}$ -power relationship slopes for submaximal stages ( $0.2507 \pm 0.0203$ ) and SPV stages ( $0.2597 \pm 0.0200$ ) were significantly different ( $p = 0.043$ ) and significantly correlated ( $r = 0.828$ ,  $p = 0.011$ ). However, SPV stage 5 AOD ( $104.9 \pm 114.8$  ml\*kg<sup>-1</sup>) and peak power ( $271 \pm 25$  watts) were not correlated with MAOD ( $r = 0.637$ ,  $p = 0.090$ ;  $r = 0.519$ ,  $p = 0.187$ , respectively). **Conclusions:** Not all subjects choose to produce their maximal

power upon initiation of stage 5 and thus do not produce an endspurt. Measures from stage 5 of SPV hypothesized to estimate anaerobic capacity did not correlate with MAOD. It is possible that the ability to alter power output throughout SPV, akin to overland running, may have altered the VO<sub>2</sub>-power relationship enough to reduce the validity of the accumulated oxygen deficit measure. Accordingly, it appears that anaerobic capacity cannot be estimated using a single SPV treadmill test.

1592 Board #245 June 2, 9:00 AM - 10:30 AM  
**Resistance Training Does Not Alter Accuracy Of The Army-175 Test To Estimate 1RM Bench Press**  
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 (No relationships reported)

The military continues to search for physical performance tests that will aid in assessing the combat readiness of troops. Previous investigations have offered support for a bench press repetition test to estimate upper-body strength (1RM). However, question remains concerning the ability of the Army175 test to differentiate between trained and untrained personnel. **PURPOSE:** To determine the accuracy of the Army175 repetition test to estimate 1RM bench press strength in untrained (UT) and trained (TR) men.

**METHODS:** UT (n = 19) and TR (n = 20) college men were evaluated for 1RM and maximum repetitions with 79.5 kg (Rep175) in the supine bench press. 1RM was predicted from Rep175 using seven commonly used prediction equations. Untrained subjects had no previous resistance training experience, while the TR group had completed training 3X/wk for 12 weeks utilizing a linear periodization model. **RESULTS:** Untrained and trained men were not significantly different in age (19.7 ± 1.0 vs 19.6 ± 1.1 yrs), height (178.2 ± 6.1 vs 176.8 ± 5.9 cm), body mass (78.1 ± 11.5 vs 75.7 ± 8.4 kg), 1RM (89.8 ± 9.3 vs 93.2 ± 8.8 kg), or Rep175 (4.4 ± 3.4 vs 5.2 ± 2.9). Only two of the seven repetition prediction equations produced significant differences between predicted and actual 1RM values. A previous equation developed specifically using Army175 repetitions significantly underestimated 1RM in both UT (-5.6 ± 3.2 kg) and TR (-7.0 ± 4.7 kg) in the present study. An exponential prediction equation significantly overestimated UT (3.5 ± 3.7 kg) but not TR (1.8 ± 5.0 kg). All other equations produced a predicted 1RM that was not significantly different from the actual 1RM and were within ±4.2% of actual 1RM. The best equation for the composite group was the Wathen equation, producing an average error of <1.0% (90% CI = -6.0 to 7.8%).

**CONCLUSIONS:** It appears that the Army175 test may be an adequate predictor of upper-body pushing strength, which does not appear to be affected by short-term resistance training. Subsequent analysis using a larger cohort of active duty and reserve military personnel should be performed to verify the current results.

1593 Board #246 June 2, 9:00 AM - 10:30 AM  
**Unique Balance Domains for Balance Error Scoring System (BESS) and Y-Balance Tests**  
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**Reported Relationships:** L.J. Davis: Employee of an ACCME Defined Commercial Interest; Orthocare Innovations Biomechanics Laboratory.

Balance is a critical element of athletic performance, and errors in balance may contribute to injury risk and hinder athletic success. Several tests of balance have been developed, but each represents a complex construct of essentially static movements where excessive movements are ranked as errors. These tests may evaluate covariate domains of balance that are complementary or they may represent unique domains of balance. **PURPOSE:** To compare the Y-Balance test to the Balance Error Scoring System (BESS) test for recreational adult athletes. **METHODS:** 16 healthy, recreationally active adult athletes gave informed consent to participant in this IRB-approved protocol. Over a 10-day period, each participant completed the BESS and the Y-Balance protocol 4 times following a standardized warm up. The total error score on the BESS test for both firm and foam surfaces was compared to the total distance achieved in the anterior, posteriolateral and posteromedial directions on the Y-Balance test using simple linear regression. It was hypothesized that the R<sup>2</sup> would be in the 0.25 to 0.50 range, indicating some overlap in balance construct domains evaluated by the Y-Balance and BESS tests. **RESULTS:** Contrary to the hypothesis, the combined data over all 4 days produced an R<sup>2</sup> = 0.000013, with a slope of -0.00007 (n = 60; P = 0.99). Individual day comparisons produced similar results. Day 1: R<sup>2</sup> = 0.0295; Day 2: R<sup>2</sup> = 0.0290; Day 3: R<sup>2</sup> = 0.0039; Day 4: R<sup>2</sup> = 0.040. **CONCLUSION:**

These data suggest that there was no construct covariance between these two tests in this small cohort of recreationally active adults. The range of motion achieved on the Y-Balance test and the requirement to remain stable at the extreme end range of motion in all three directions appears to have little relationship to the BESS error scores during static standing balance on firm and foam surfaces. The Y-Balance test is likely to have a much larger strength component, especially for the knee and ankle. Greater quadriceps strength may improve performance in Y-Balance test scores but may not be a factor for the BESS test errors.

1594 Board #247 June 2, 9:00 AM - 10:30 AM  
**The Validity Of A Protocol As An Alternative To The Sit And Reach Test**  
 Mark G. Cullum, Kenneth R. Turley, FACSM. *Harding University, Searcy, AR.* (Sponsor: Kenneth R. Turley, FACSM) Email: mcullum@harding.edu  
 (No relationships reported)

**INTRODUCTION:** As one of the five health-related components of fitness, an individual's flexibility has implications for their efficiency of movement and susceptibility to injury and low-back pain. The Sit and Reach test is a common protocol used to assess the flexibility of an individual at their hips and lower back, but the test requires equipment not commonly available to the average person as well as another individual to administer the test.

**PURPOSE:** The purpose of this study is to assess the validity and reliability of a novel protocol as an alternative to the Sit and Reach test.

**METHODS:** Fifty-seven males participated in the research project. Upon arrival at the laboratory the subjects signed the informed consent form and were measured for height and weight. Subjects then performed, in a random order, the standard Sit and Reach test, with the typical measurement instrument, and the new protocol. This procedure had subjects stand with a 12-inch ruler extended from between their hands, bend over at the waist, and allow the floor to push the ruler into their hands as far as possible. The remaining length beyond their fingertips was recorded as their score. The results from the two protocols were compared by Pearson Correlation. A separate group of 18 subjects performed both tests on two occasions to establish the test-retest reliability of the measurements, also determined by Pearson Correlation.

**RESULTS:** The Pearson Correlation analysis comparing the two protocols yielded an r value of 0.79. For the test-retest analysis, the two trials for the Sit and Reach test yielded a mean and standard deviation of 16.2 ± 3.3 inches and 16.2 ± 3.7 inches, while the values for the new protocol were -4.2 ± 3.0 inches and -4.5 ± 2.4 inches. The r values for the test-retest analysis were 0.92 for the Sit and Reach test and 0.94 for the new protocol.

**CONCLUSIONS:** The strong correlation between the new protocol and the sit and reach test, as well as the high test-retest reliability of the new protocol, suggest that a valid measurement of an individual's hip and lower back flexibility can be obtained with this simple protocol.

1595 Board #248 June 2, 9:00 AM - 10:30 AM  
**Energy Expenditure Overestimation Bias in Elliptical Trainer Machine**  
 Kelsey McLaughlin<sup>1</sup>, Bethany Noack<sup>1</sup>, Jorge Z. Granados<sup>1</sup>, Rick Sperling<sup>2</sup>, Mark Roltsch<sup>2</sup>, Stephen F. Crouse, FACSM<sup>1</sup>. <sup>1</sup>Texas A&M University, College Station, TX. <sup>2</sup>St. Mary's University, San Antonio, TX. (Sponsor: Dr. Stephen F. Crouse, FACSM)  
 (No relationships reported)

Elliptical trainers are a common mode of aerobic exercise in recreationally active populations. Those with a weight loss goal might rely upon the energy expenditure (EE) estimation that many elliptical brands provide to keep track of calories (kcal) burned and make nutritional decisions. For this reason, it is important to evaluate the accuracy of the algorithms used by elliptical trainers to estimate EE. **PURPOSE:** To compare EE estimates by a common brand of elliptical trainer to that measured using open circuit spirometry, at different combinations of resistance and pedal speed. **METHODS:** Twenty subjects (10 male, 10 female; 34 ± 12 yr; 175.3 ± 10.7 cm; 77.1 ± 14.1 kg) consented to participate. Each completed three 15-min bouts of elliptical exercise on the same elliptical trainer, with at least 24 hr between exercise bouts. Pedal rates were held constant throughout each bout at 50, 60, or 70 RPM, and resistance was increased incrementally every 5 min from level 5 to 10 to 15. The different cadences were completed in a randomized order between participants. Expired gases were collected continuously throughout the 15 min. Heart rate, distance (mi), and EE from the elliptical readout were recorded every 1 min. RPE was collected twice per resistance level. A two-tailed paired samples t-test was used to compare elliptical EE to measured EE. A linear regression model was used to evaluate the ability of the elliptical EE to predict measured EE. Significance for all statistical measures was held at an alpha level of 0.05.

**RESULTS:** The difference between EE estimates from the elliptical and measured VO<sub>2</sub> was significant (p < 0.0001), with the elliptical machine overestimating EE during a 15

minute session by an average of 10.21 kcals. Measured EE in kcals as derived from open circuit spirometry was significantly predicted by elliptical EE according to the equation:

$$\text{Measured EE} = 0.95 * (\text{Elliptical EE}) - 3.161$$

**CONCLUSIONS:** The elliptical trainer used demonstrated a bias to overestimate EE. This should be taken into account by health/fitness professionals using these estimations to program for clients. There may be some variation in the EE correction regression depending on elliptical model, and proper machine calibration should be ensured.

1596 Board #249 June 2, 9:00 AM - 10:30 AM

**Tethered Swimming Test: Reliability And The Association To Swimming Performance And Land-based Anaerobic Performance**

Jacquelyn A. Nagle<sup>1</sup>, John Abt<sup>2</sup>, Kim Beals<sup>3</sup>, Chris Connaboy<sup>3</sup>, DeverDennis Dever<sup>3</sup>, Alyssa Olenick<sup>4</sup>, Elizabeth F. Nagle, FACSM<sup>3</sup>. <sup>1</sup>John Carroll University, Cleveland, OH. <sup>2</sup>The University of Kentucky, Lexington, KY. <sup>3</sup>The University of Pittsburgh, Pittsburgh, PA. <sup>4</sup>Eastern Kentucky University, Richmond, KY. (Sponsor: Elizabeth Nagle, FACSM)  
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(No relationships reported)

The accurate and reliable assessment of various components of performance is vital, specifically anaerobic power (Fpeak) and capacity (Fmean). It has been suggested that the estimation of peak power output enables accurate prediction of maximum swimming speed due to the greater demand for increased power output as velocities increase. Therefore it is necessary to establishing validity and reliability of a tethered swimming test (TST). **PURPOSE:** The purpose of this study is to investigate the validity and reliability of a TST. **METHODS:** Thirty-eight subjects completed 4 sessions: Wingate cycle ergometer anaerobic test (WAnT), a performance swim (PS) session (average velocity of 25yd, 50yd, 100yd max freestyle swim), and 2 TST sessions where subjects completed 2 TST per session (TST1/TST2, TST3/TST4). The TST has been described in previous studies and includes a fully tethered 30 second maximal freestyle swim. Reliability was determined using an Intraclass Correlation (ICC (2, 1)) for Fpeak, Fmean, and fatigue index (FI) obtained during the 4 TST trials. In addition, a Bland-Altman plots were used to compare the means of the trials to discern any patterns in the data not revealed in the correlation. Criterion validity of the TST was determined using Pearson's Correlation analysis among Fpeak, Fmean, and FI obtained during the TST, and Fpeak, Fmean, and FI obtained during the WAnT, and the swimming velocity obtained during the 25yd, 50yd, and 100yd PS. **RESULTS:** The intersession (TST1-TST3) ICC was 0.871 for Fpeak, and 0.976 for Fmean. The intrasession (TST1-TST2) ICC was 0.861 for Fpeak, and 0.958 for Fmean. Significant correlations were found between the TST and WAnT for Fpeak (r=0.741; p<0.001), and Fmean (r= 0.656; p<0.001). Additionally, significant correlations were found between TST (Fmean) and swim velocity during the 25yd (r= 0.664; p<0.001), 50yd (r= 0.669; p<0.001), and 100yd (r=0.565; p=0.003) PS. **CONCLUSIONS:** The TST may be considered a valid and reliable test for measuring anaerobic power and capacity in swimmers. Due to its moderate association with swimming velocity, the TST may serve as a potential tool for assessing swimming performance. The results of this study provide quality assurance for future data collection utilizing this as a portable tool in sports medicine research.

1597 Board #250 June 2, 9:00 AM - 10:30 AM

**Is the Bruce Protocol Effective for Determining Maximal Oxygen Consumption in Trail Runners?**

Luke Haile, Curt B. Dixon, FACSM, Alyssa A. Olenick, Heather J. Porter. Lock Haven University of Pennsylvania, Lock Haven, PA.  
(No relationships reported)

**Purpose**

To test the ability of the Bruce protocol to elicit maximal oxygen consumption (VO<sub>2</sub>max) according to physiological criteria in high-active adult trail runners.

**Methods**

Eleven trail runners (7 men, 4 women; 35.9 ± 7.4 yr; 374 ± 133 min running per week) performed the Bruce treadmill protocol to volitional exhaustion. Pulmonary ventilation, VO<sub>2</sub>, and VCO<sub>2</sub> were collected using a ParvoMedics TrueOne 2400 metabolic measurement system. Heart rate (HR) was monitored using a Schiller AT-102 electrocardiogram. Following termination of the test, the highest 15-second average VO<sub>2</sub> was identified for each subject. The highest VO<sub>2</sub> was considered a true maximal value (VO<sub>2</sub>max) if the subject demonstrated any two of the following physiological criteria: (1) a VO<sub>2</sub> plateau (< 2.1 ml/kg/min) with increasing workload, (2) a HR within 10 beats/min of age-predicted maximal HR (HRmax: 220 - age), and/or (3) a respiratory exchange ratio (RER) ≥ 1.15.

**Results**

Mean time until test termination was 13.5 ± 1.3 minutes. The highest 15-second average VO<sub>2</sub> for the overall sample was 57.5 ± 9.2 ml/kg/min, ranging from 40.7 - 54.4 ml/kg/min in the women and 58.2 - 75.3 ml/kg/min in the men. Although 9 of 11 subjects (7 men, 2 women) ranked above the 95<sup>th</sup> percentile for VO<sub>2</sub>max by age and gender based on their highest VO<sub>2</sub>, only 4 subjects (3 men, 1 woman) achieved a true VO<sub>2</sub>max according to the designated criteria. The table shows the number of men and women who achieved each physiological criterion.

	VO <sub>2</sub> plateau	HRmax	RER ≥ 1.15	VO <sub>2</sub> max
Men (n = 7)	1	4	3	3
Women (n = 4)	0	1	4	1

**Conclusion**

In this sample of high-active adult trail runners, the Bruce protocol was not effective in producing VO<sub>2</sub>max according to suggested physiological criteria. It is recommended that a more aggressive uphill walking or running protocol be used for this athletic population.

1598 Board #251 June 2, 9:00 AM - 10:30 AM

**Velocity At VO<sub>2</sub>peak (vVO<sub>2</sub>peak) And OBLA (vOBLA) As Predictors Of Performance In Junior Cross-country Skiers**

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(No relationships reported)

It is well documented that maximal oxygen consumption and lactate threshold predict performance in cross-country skiing; the sport requires athletes to perform at the upper range of these physiological variables. Velocity at each of these measures, which considers economy as well, has been found to better predict performance in endurance events and thus may also relate to cross-country skiing race potential. **PURPOSE:** To determine if the speed variables of vVO<sub>2</sub>peak and vOBLA predict performance in junior cross-country skiers. **METHODS:** Fourteen male and female junior cross-country skiers participated in the study (boys: n = 6, age = 16 ± 2 yr; girls: n = 8, age = 16.9 ± 0.6 yr). Each participant performed an incremental treadmill test to determine VO<sub>2</sub>peak and vVO<sub>2</sub>peak. Blood lactate was measured at each stage to assess onset of blood lactate accumulation (OBLA, 4 mmol/L) and vOBLA. The results from three regional cup races were used to rank the participants. **RESULTS:** For the boys, VO<sub>2</sub>peak (r = -.845), vVO<sub>2</sub>peak (r = -.832), OBLA (r = -.843), and vOBLA (r = -.878) all significantly correlated with performance (p < 0.05). For the girls, only VO<sub>2</sub>peak (r = -.742), vVO<sub>2</sub>peak (r = -.757), and vOBLA (r = -.709) significantly correlated with performance (p < 0.05). OBLA was not a significant predictor variable for the girls (r = -.543, p > 0.05). **CONCLUSION:** vOBLA (p = 0.011) and vVO<sub>2</sub>peak (p = 0.015) were the strongest predictors of performance for the boys and girls, respectively. These speed variables should be considered along with the traditional predictors of maximal oxygen consumption and lactate threshold when assessing performance of junior cross-country skiers.

1599 Board #252 June 2, 9:00 AM - 10:30 AM

**Stroke By Stroke Analysis Of Rowing: A New And Cost-effective Measure Of Rowing Performance?**

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(No relationships reported)

**Purpose:** At present, assessment of rowing performance has been relatively limited to time or distance performance. Recently coaches have begun to include power testing, however, the method for performing and analyzing the data are currently not defined. Here we sought to test and analyze peak power and power development across a 20 sec test in youth rowers pre- and post a plyometric training intervention.

**Methods:** 16 adolescent male rowers were assigned to complete 4 weeks of either plyometric training (plyo, n=8), or steady state cycling (control, n=8), for 30 minutes before on water training three days a week. Each group was matched for training volume. Peak power was assessed via a 20 sec maximal rowing ergometer test on a Concept2 rowing ergometer. Using the Ergdata mobile app, which provides real time feedback of stroke by stroke data, peak power (PP), peak stroke force (PF), average stroke force (AF), and drive speed (DS) were calculated. These values were recorded in real time video for later offline stroke by stroke analysis. On an individual basis, PP was identified and both the sum and slope to PP were calculated.

**Results:** Baseline PP (546.0 v. 574.1 watts) and the stroke at which PP was achieved (6.5 v. 7.75) were not different between groups (control v. plyo, p>0.05). At this point, PF (239.1 v. 239.3 lb), AF (153.1 v. 158.5 lb), DS (2.51 v. 2.53 m/s), sum to PP (2702 v. 3532 watts), and slope to PP (77.8 v. 60.7 watts/stroke) were not different between groups (control v. plyo, respectively, p>0.05). After 4 weeks of training, PP (568.8

v. 621.4 watts,  $p=0.12$ ) and the stroke at which PP was achieved ( $6.75 \pm 7.0$ , control v. plyo) were not different between groups. At this point, PF (232.0 v. 251.5 lb), AF (154.1 v. 180.9 lb), DS (2.55 v. 2.64 m/s), sum to PP (2844 v. 3386 watts), and slope to PP (77.40 v. 73.94), were not different between groups (control v. plyo, respectively,  $p>0.05$ ).

Conclusion: Here we present a novel method of performance assessment, specifically for peak power and power development in rowers. Additionally, 4 weeks of plyometric training performed in conjunction with the on the water training tended to increase power and power development as assessed with the current methodology. This assessment is an innovative and cost-effective method of evaluating power characteristics in rowers.

1600 Board #253 June 2, 9:00 AM - 10:30 AM  
**Pulse Oximetry As A Non-Invasive Method of Predicting Respiratory Compensation During Graded Exercise**

Craig P. Flanagan, Emily K.W. Flanagan, Laura Q. Jimenez, Wesley N. Smith, *University of Miami, Coral Gables, FL.*  
 (Sponsor: Arlette Perry, FACSM)

(No relationships reported)

Respiratory compensation (ResComp) during exercise is associated with an increase in work of breathing, decrease in economy, and initiation of the slow component of  $\dot{V}O_2$  kinetics. Therefore, ResComp may be ideal for gauging an athlete's training status. Acute metabolic acidosis at ResComp fosters weaker oxyhemoglobin association, reflected by a dip in arterial oxygen saturation (SaO<sub>2</sub>). Pulse oximetry, used to measure SaO<sub>2</sub>, may serve as an inexpensive, non-invasive method to predict ResComp. PURPOSE: The purpose of this study was to explore the validity of using SaO<sub>2</sub> as a simple, non-invasive predictor of oxygen consumption ( $\dot{V}O_2$ ), heart rate (HR), and respiratory exchange ratio (RER) at ResComp using different graded exercise test (GXT) protocols.

METHODS: Sixteen active, healthy college students ( $n=16$ ) performed a GXT to maximum on a motorized treadmill using either a three minute ( $n=7$ ), one minute ( $n=4$ ), or thirty second ( $n=5$ ) graded protocol. Using indirect calorimetry, ResComp was determined separately by the V-slope method (V-slope), the ventilatory threshold method in which an a-linear increase in ventilatory equivalent for O<sub>2</sub> corresponded with a decrease in peak end-tidal CO<sub>2</sub> (PetCO<sub>2</sub>), and by detecting an a-linear decrease in SaO<sub>2</sub> using pulse oximetry. Mixed-design repeated measures ANOVAs were used to analyze differences in the  $\dot{V}O_2$ , HR, and RER at ResComp across the three methods, and three GXT protocols.

RESULTS: There were no significant differences in  $\dot{V}O_2$  at ResComp;  $3.2 \text{ l/min} \pm 0.9$  (V-Slope),  $3.2 \text{ l/min} \pm 0.9$  (PetCO<sub>2</sub>), and  $3.3 \text{ l/min} \pm 0.9$  (SaO<sub>2</sub>); HR at ResComp;  $177.1 \text{ bpm} \pm 6.6$  (V-Slope),  $177.1 \text{ bpm} \pm 5.3$  (PetCO<sub>2</sub>), and  $180.7 \text{ bpm} \pm 4.8$  (SaO<sub>2</sub>); and RER at ResComp;  $1.1 \pm 0.1$  (V-Slope),  $1.1 \pm 0.1$  (PetCO<sub>2</sub>), and  $1.1 \pm 0.1$  (SaO<sub>2</sub>). There was a significant correlation in  $\dot{V}O_2$  between PetCO<sub>2</sub> and SaO<sub>2</sub> methods used to determine ResComp ( $r^2 = 0.93$ ,  $p < 0.01$ ). There were no significant differences among ResComp measurement methods and GXT protocols in predicting ResComp HR ( $p=.243$ );  $\dot{V}O_2$  ( $p=.199$ ); and RER ( $p=.117$ ).

CONCLUSION: Monitoring a drop in SaO<sub>2</sub> using pulse oximetry may be a simple, non-invasive method of predicting ResComp, thereby serving as a useful tool for endurance programming and assessment.

1601 Board #254 June 2, 9:00 AM - 10:30 AM  
**Cumulative Training Dose Augments The Interrelationships Between Common Training Load Models During Basketball Activity**

Vincent J. Dalbo<sup>1</sup>, Jordan L. Fox<sup>1</sup>, Nattai R. Borges<sup>1</sup>, Ben J. Dascombe<sup>2</sup>, Kaelin C. Young<sup>3</sup>, Aaron T. Scanlan<sup>1</sup>. <sup>1</sup>Central Queensland University, Rockhampton, Australia. <sup>2</sup>University of Newcastle, Ourimbah, Australia. <sup>3</sup>Edward Via College of Osteopathic, Auburn, AL.

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(No relationships reported)

Purpose: The influence of training-related factors on training load (TL) responses in basketball has received limited attention. This study aimed to examine the temporal changes and influence of cumulative training dose on TL responses and interrelationships during basketball activity. Methods: Ten state-level Australian male basketball players completed 4 x 10-min standardized bouts of simulated basketball activity using a circuit-based protocol. Internal TL was measured using the session rating of perceived exertion (sRPE), summated heart rate zones (SHRZ), Banister's training impulse (TRIMP), and Lucia's TRIMP models. External TL was assessed via measurement of mean sprint and circuit speeds. Temporal TL comparisons were performed between each 10-min bout, while Pearson correlation analyses were conducted cumulatively across training doses (0-10, 0-20, 0-30, and 0-40 min). Results: sRPE TL increased ( $P < 0.05$ ) and mean sprint speed decreased ( $P < 0.05$ ) following the first 10-min bout of basketball activity. sRPE TL was significantly related

only to Lucia's TRIMP ( $r = 0.66-0.69$ ;  $P < 0.05$ ) across 0-10 and 0-20 min. Similarly, mean sprint and circuit speed were significantly correlated across 0-20 min ( $r = 0.67$ ;  $P < 0.05$ ). In contrast, SHRZ and Banister's TRIMP were significantly related across all training doses ( $r = 0.84-0.89$ ;  $P < 0.05$ ). Conclusions: Limited convergence exists between common TL approaches across basketball training doses lasting beyond 20 min. Thus, the interchangeability of internal and external TL approaches appears dose-dependent during basketball activity, with various psychophysiological mediators likely underpinning temporal changes in responses.

1602 Board #255 June 2, 9:00 AM - 10:30 AM  
**The Relationship Between Dolphin Kick Movement And Underwater EMG Of Lower Leg Muscles In Competitive Swimmers**

Tadashi Wada<sup>1</sup>, Noriyuki Yamamoto<sup>2</sup>, Yoshimitsu Shimoyama<sup>3</sup>, Yukinoti Shintaku<sup>4</sup>, Hirofumi Jigami<sup>1</sup>, Masaki Wada<sup>1</sup>, Fumihiko Iwahara<sup>5</sup>, Yu Kashiwagi<sup>6</sup>. <sup>1</sup>Kokushikan University, Tokyo, Japan. <sup>2</sup>Japanese Red Cross Hokkaido College of Nursing, Kitami, Japan. <sup>3</sup>Niigata University of Health and Welfare, Niigata, Japan. <sup>4</sup>Biwako Seikei Sport College, Ohtsu, Japan. <sup>5</sup>Japan Sport Council, Tokyo, Japan. <sup>6</sup>Nippon Sport Science University, Tokyo, Japan.

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(No relationships reported)

Improvement in swimming performance is not only associated with stroke technique but also with the gliding movement during the start and turn phases. The underwater dolphin kick movement during the start and turn phases is important for improving total race time in modern swimming.

PURPOSE: The study was designed to analyze the findings of underwater electromyography of lower limb muscles during the underwater dolphin kick movement in competitive collegiate swimmers.

METHODS: Six healthy male collegiate swimmers volunteered to participate in this study. The subjects performed underwater gliding movement at maximum speed after pushing off from the start wall. In addition, three types of underwater dolphin kick movement [Control (C): maximum effort kick; Build-up (BU): small-to-large kick; and Dynamic (D): large kick] were performed with maximum effort. The subjects were monitored through an underwater video camera with a sampling frequency of 60 Hz in the sagittal plane to measure the angular displacement of their different joints. A wireless electromyography system (Biolog DL-5000, S&ME, Japan) was used to collect the muscle activities from the vastus lateralis, hamstrings, tibialis anterior, and gastrocnemius. Speed Meter (Vine Co., Japan) was used to measure swimming speed, and a motion analysis system (Frame-DIAS4; DKH, Japan) was used to digitize body landmarks.

RESULTS: Among the underwater dolphin kick movement types, the BU kick was the fastest (BU: 1.67 m/s; C: 1.65 m/s; and D: 1.65 m/s). The rectified EMG findings showed that gastrocnemius and hamstrings muscle activities of elite swimmers were higher than non-elite swimmers during these movements. However, elite swimmers had no muscle activity in the tibialis anterior.

CONCLUSIONS: The present study results suggested that the angular displacement of the knee joints gradually increases during underwater dolphin kick movement. In addition, the muscle activity of the hamstrings and gastrocnemius increase during underwater dolphin kick movement. However, the muscle activity of tibialis anterior was inhibited during these movements. Our results also suggested that swimmers experienced a large propulsion force and a small resistance force with the help of these movements.

C-41 Free Communication/Poster - Protein Metabolism II

Thursday, June 2, 2016, 7:30 AM - 12:30 PM

Room: Exhibit Hall A/B

1603 Board #256 June 2, 8:00 AM - 9:30 AM  
**Leucine Stimulates Peroxisome Proliferator Activator Receptors in Skeletal Muscle**

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Purpose: Leucine has been shown to stimulate anabolic and catabolic processes in skeletal muscle, however little is known about the effects of leucine on peroxisome

proliferator-activated receptor (PPAR) activity. This work characterized the effects of leucine on myotube expression of the PPAR superfamily, as well as related downstream targets that regulate cellular energetics and inflammation. Methods: C2C12 myotubes were treated with leucine or valine (control) at 2mM for 24 hours. Protein expression of the PPAR superfamily and associated metabolic and inflammatory targets were measured via western blot and qRT-PCR. Results: Leucine significantly increased PPAR $\alpha$  and PPAR $\beta/\delta$  expression (53.3%  $\pm$  28.2% and 55.9%  $\pm$  15.1%, respectively). Leucine also stimulated markers of mitochondrial biogenesis (PGC-1 $\alpha$ , NRF1, and TFAM) leading to increased cytochrome C (61.9%  $\pm$  28.6%) and GLUT4 content (129.1%  $\pm$  9.2%). Surprisingly, leucine simultaneously increased PPAR $\gamma$  expression (42.0%  $\pm$  15.1%) promoting significantly elevated FAS (743.6%  $\pm$  304.0%) but not SREBP-1c expression. Leucine also significantly induced TLR4 expression (707.1%  $\pm$  36.3%), however p-P65-NF $\kappa$ B expression was significantly suppressed (by 59.1%  $\pm$  7.2%) leading to reduced IL6 and enhanced IL10 mRNA expression. Finally, we explored the effects of leucine on other targets of TLR4 and found increased p-P38MAPK compared with valine controls with unaltered p-CREB content. Conclusion: Leucine induces PPAR expression, GLUT4 content, and mitochondrial biogenesis in vitro, suggesting leucine may increase substrate oxidation. Leucine-mediated enhanced glucose uptake may stimulate a compensatory response for cells to dissipate energy by (a) substrate oxidation (b) substrate/lipid storage, and (c) protein synthesis, thus providing a possible explanation for the simultaneous induction of the entire PPAR superfamily (anabolic and catabolic). Moreover, increased Akt and mTOR activity by leucine may promote TLR4 expression potentially sensitizing cells to inflammatory signals (such as cytokines), while concurrent increases in PPAR $\gamma$  may lead to reduced cellular inflammation (a hypothesis which requires further investigation).

1604 Board #257 June 2, 8:00 AM - 9:30 AM  
**Post-Exercise Protein Ingestion Increases Whole Body Leucine Balance in a Dose-Dependent Manner in Healthy Children**

Kimberly A. Volterman<sup>1</sup>, Daniel R. Moore<sup>2</sup>, Peter Breithaupt<sup>1</sup>, Elizabeth Offord-Cavin<sup>3</sup>, Leonidas G. Karagounis<sup>3</sup>, Brian W. Timmons<sup>1</sup>. <sup>1</sup>McMaster University, Hamilton, ON, Canada. <sup>2</sup>University of Toronto, Toronto, ON, Canada. <sup>3</sup>Nestle Research Centre, Lausanne, Switzerland. (Sponsor: Dr. Stuart Phillips, FACSM)

(No relationships reported)

**PURPOSE:** Post-exercise protein ingestion increases whole body protein balance in healthy children early in recovery (i.e., 9 h), although the optimal single meal protein dose has yet to be determined. Therefore, we employed, for the first time in active children, a primed constant [<sup>13</sup>C]leucine infusion to determine with greater accuracy and time resolution the effect of variable protein ingestion on post-exercise whole body leucine metabolism.

**METHODS:** Thirty-five active children (26 males; 9-13 y, 44.9  $\pm$  10.6 kg; means  $\pm$  SD) underwent a 5-day adaptation diet (0.95 g protein $\cdot$ kg<sup>-1</sup> $\cdot$ d<sup>-1</sup>) before performing an acute bout of exercise (3x20min cycling) with concurrent primed constant infusion of [<sup>13</sup>C]leucine. After exercise, participants consumed an isoenergetic (140 kcal) carbohydrate beverage containing a variable amount of milk-protein [0g, CONT; 5g, LP; 10g, MP; and 15 g, HP] enriched with [<sup>2</sup>H<sub>3</sub>]leucine to a level of 4 % of beverage leucine content (assuming 10% leucine content of protein). Blood and breath samples were taken over 3h of recovery to determine whole body leucine oxidation (Leu<sub>ox</sub>) and net balance (Leu<sub>bal</sub>).

**RESULTS:** Total leucine intake (drink + infusion) was: 6.2  $\pm$  0.2 mg $\cdot$ kg<sup>-1</sup> (CONT); 18.4  $\pm$  2.5 mg $\cdot$ kg<sup>-1</sup> (LP); 29.0  $\pm$  4.2 mg $\cdot$ kg<sup>-1</sup> (MP); 40.8  $\pm$  8.8 mg $\cdot$ kg<sup>-1</sup> (HP). Leu<sub>bal</sub> showed a main effect for condition [HP (24.2  $\pm$  8.2 mg $\cdot$ kg<sup>-1</sup>) > MP (11.6  $\pm$  4.3 mg $\cdot$ kg<sup>-1</sup>) > LP (5.7  $\pm$  1.9 mg $\cdot$ kg<sup>-1</sup>) > CONT (-3.0  $\pm$  1.7 mg $\cdot$ kg<sup>-1</sup>); all  $P$  < 0.01], with all conditions different from zero (all  $P$  < 0.001). Linear correlation ( $r^2=0.69$ ,  $P$  < 0.001) indicated Leu<sub>bal</sub> became positive at  $\sim$ 10 mg $\cdot$ kg<sup>-1</sup> leucine intake. Bi-phase regression analyses ( $r^2=0.68$ ) revealed Leu<sub>ox</sub> reached a plateau at  $\sim$ 34 mg $\cdot$ kg<sup>-1</sup> $\cdot$ 3h<sup>-1</sup> leucine intake, which could suggest leucine intakes above this level represented a nutrient overload in our population over the 3h post-exercise period.

**CONCLUSION:** During the 3h post-exercise recovery period, Leu<sub>bal</sub> (a surrogate for net protein balance) was negative in the absence of protein ingestion. Consumption of high quality protein increased Leu<sub>bal</sub> in a dose-dependent manner; however, 5-10g may be optimal to promote post-exercise whole body protein recovery as an apparent saturation in the oxidative disposal of leucine suggests leucine intakes above  $\sim$ 34mg/kg in healthy children may provide no further benefit. Study funded by Nestec Ltd.

1605 Board #258 June 2, 8:00 AM - 9:30 AM  
**Running Induces Gut Injury but Does Not Modulate Postprandial Release of Dietary Protein Derived-amino acids**

Nicholas A. Burd<sup>1</sup>, Justin T. Parel<sup>1</sup>, Michael Mazzulla<sup>2</sup>, Sidney About Sawan<sup>2</sup>, Joseph W. Beals<sup>1</sup>, Evan L. Shy<sup>1</sup>, Stephan van Vliet<sup>1</sup>, Daniel R. Moore<sup>2</sup>. <sup>1</sup>University of Illinois at Urbana-Champaign, Urbana, IL. <sup>2</sup>University of Toronto, Toronto, ON, Canada. (Sponsor: Jeffrey Woods, FACSM)  
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(No relationships reported)

Resistance exercise has been shown to induce intestinal injury that can impair dietary protein digestion and absorption kinetics during recovery from exercise in young men. Although, endurance exercise can induce pronounced intestinal ischemia and gut injury, the effect of this exercise modality on the subsequent postprandial appearance of dietary protein-derived amino acids has yet to be examined. **PURPOSE:** We aimed to determine the effects of treadmill running on markers of intestinal injury and the subsequent release of dietary protein-derived leucine in circulation during recovery from exercise in trained athletes. **METHODS:** In crossover trials, six trained men (27 $\pm$ 2 y; BMI= 24 $\pm$ 0.9 kg/m<sup>2</sup>; VO<sub>2peak</sub>=62 $\pm$ 4 ml/kg/min) received a primed continuous infusion of L-[1-<sup>13</sup>C]leucine and ingested 19 g of intrinsically L-[5,5,5-<sup>2</sup>H<sub>3</sub>]leucine labeled egg protein with 60 g carbohydrates at rest and after 1 h of treadmill running at 70%VO<sub>2peak</sub>. Blood samples were drawn every 0.5-1 h during the infusion protocols to determine amino acid concentrations, leucine enrichments, and intestinal fatty acid binding protein (I-FABP) as an estimate of small intestine injury. **RESULTS:** I-FABP increased throughout exercise with values peaking immediately after exercise (156% above baseline) but returning to baseline within 30 min of recovery. I-FABP was stable before and after protein ingestion in the resting condition ( $P$ >0.05). Postprandial release of dietary protein derived leucine did not differ between the rest and exercise conditions ( $P$ =0.33). **CONCLUSION:** Running induces small intestinal injury but does not affect splanchnic extraction of leucine from dietary protein during recovery from endurance exercise in trained athletes. These data suggest that endurance exercise-induced gut injury does not compromise protein delivery of a mixed meal during post-exercise recovery.

Supported by the UIUC Center on Health, Aging, and Disability and the Faculty of Kinesiology and Physical Education Research Grants

1606 Board #259 June 2, 8:00 AM - 9:30 AM  
**A Transitory Elevation of Circulating Matrix Metalloproteinases Following a Single Bout of Exercise in Smokers**

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(No relationships reported)

**PURPOSE:** The current study examined the acute changes in matrix metalloproteinases (MMP-1, 2, and 9) following a single bout of exercise at low- and high-intensity exercise in habitual cigarette smokers.

**METHODS:** Eight physically inactive (defined as physical activity performed < 2 days per week) male smokers (N=8, carbon monoxide  $\geq$  16 ppm, smoking history > 2 years, smoking > 10 cigarettes per day) and non-smokers (N=10), the ages between 20 and 30, participated in the study. The participants performed a single bout of exercise on a treadmill (3 miles) at two different intensities in random order (low-intensity: 55% and high-intensity: 75% of VO<sub>2max</sub>) on a separate occasion. Overnight fasting blood samples were collected before (PRE), immediately post-exercise (IPE), and 1-hr PE to examine the changes in MMP-1, -2, and -9. All data were analyzed by a 3-way factorial ANOVA with repeated measure. If necessary, the Sidak's pairwise multiple comparisons and a follow-up simple effects test were employed as post-hoc tests ( $p$  < 0.05).

**RESULTS:** Only smokers significantly increased MMP-1 at IPE (1.88 $\pm$ 0.19 ng/mL) by 22.08% from PRE (1.54 $\pm$ 0.16 ng/mL,  $p=0.014$ ), which then returned to the baseline value at 1-hr PE (1.45 $\pm$ 0.15 ng/mL,  $p=0.001$ ). MMP-2 at IPE (43.71 $\pm$ 5.65 ng/mL) was significantly higher than PRE (25.68 $\pm$ 3.27 ng/mL,  $p=0.011$ ) and 1-hr PE (28.04 $\pm$ 3.34 ng/mL,  $p=0.036$ ), respectively. Additionally, smokers had significantly higher MMP-9 (45.77 $\pm$ 6.48 ng/mL,  $p=0.037$ ) as compared with non-smokers (31.17 $\pm$ 3.41 ng/mL).

**CONCLUSION:** A single bout of exercise transiently increased MMP-1, in particularly smokers, and MMP-2, which then returned to baseline values at 1-hour post exercise. A significantly higher level of circulating MMP-9 found in smokers suggests that habitual cigarette smokers are more susceptible to structural damage on the extracellular matrix, inflammation, and atherosclerotic events.

1607 Board #260 June 2, 8:00 AM - 9:30 AM  
**Effects of Different Intensities of Exercise on Serum Levels of Matrix Metalloproteinases in Obese Men**  
 Jonathan Jaoude, Stanly Ly, Jin K. Park, Yunsuk Koh. *Baylor University, Waco, TX.*  
*(No relationships reported)*

**PURPOSE:** To examine the acute responses of serum matrix metalloproteinase -1, -2, and -9 (MMP-1, -2, and -9) following different intensities of exercise (low vs. high) in obese men.

**METHODS:** Fifteen (N=15, age=21.73±0.47 years) physically inactive (physical activity < 2 days/week) obese men (BMI > 30 kg/m<sup>2</sup>) participated in the study. As a cross-over design, participants performed the same volume (300 kcal of energy expenditure) of a single bout of cycling exercise at two different intensities in random order (low: 50% of HRmax and high: 80% of HRmax). Overnight fasting blood samples were collected at baseline (PRE), immediate post-exercise (IPE), 1-hr PE, and 24-hr PE for each exercise intensity. An analysis of variance (ANOVA) with repeated measures was used to determine the mean differences in intensity and time on MMP-1, -2, and -9. If necessary, the Sidak's multiple pairwise comparisons and a follow-up Simple effects test were employed as a post-hot test ( $p < 0.05$ ).

**RESULTS:** MMP-1 did not significantly change in response to exercise. However, MMP-2 at 24-hr PE (72.68±6.43 ng/mL) was significantly lower than IPE (87.23±8.02 ng/mL,  $p=0.008$ ) and 1-hr PE (92.01±7.99 ng/mL,  $p=0.011$ ), respectively, during the low-intensity exercise trial. MMP-9 at IPE (54.19±9.16 ng/mL) significantly increased by 78% from PRE (30.48±5.86 ng/mL,  $p=0.008$ ), and was higher than 1-hr PE (34.82±5.08 ng/mL,  $p=0.040$ ) and 24-hr PE (31.03±4.82 ng/mL,  $p=0.006$ ), respectively, during the high-intensity exercise trial. Additionally, MMP-9 at 24-hr PE (31.32±4.82 ng/mL) was significantly lower than PRE (41.43±5.86 ng/mL,  $p=0.009$ ) during the low-intensity exercise trial.

**CONCLUSION:** MMP-2 and -9, but not MMP-1, were transiently elevated immediately following exercise, which then returned to baseline values at 1 hour post exercise. This exercise-induced change in MMP-2 and MMP-9 was dependent upon exercise intensity. MMP-2 changed with only low-intensity exercise, while MMP-9 was altered by high-intensity exercise. In addition, low-intensity exercise decreased MMP-9 after 24 hours of exercise. Thus, the current study suggests that exercise-induced changes in MMP-2 and -9 depend on exercise intensity, and low-intensity exercise may favorably influence inflammation and cardiovascular health by lowering MMP-9 in obese men.

1608 Board #261 June 2, 8:00 AM - 9:30 AM  
**mTOR Activation occurs Independent of Changes in Skeletal Muscle LAT1 Protein Content after Protein Ingestion**  
 Stephan van Vliet<sup>1</sup>, Russell S. Emmons<sup>1</sup>, Justin T. Parel<sup>1</sup>, Joseph W. Beals<sup>1</sup>, Luc J.C. van Loon<sup>2</sup>, Scott A. Paluska, FACSM<sup>1</sup>, Micheal De Lisio<sup>1</sup>, Nicholas A. Burd<sup>1</sup>. <sup>1</sup>University of Illinois, Urbana-Champaign, Urbana, IL. <sup>2</sup>Maastricht University, Maastricht, Netherlands. (Sponsor: Scott Paluska, FACSM)  
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*(No relationships reported)*

Activation of the mammalian target of rapamycin complex 1 (mTORC1) after protein ingestion has been shown to be obligatory to augment the postprandial muscle protein synthetic response. The delivery of dietary protein derived amino acids into skeletal muscle tissue is facilitated by amino acid transporters. In particular, the system L amino acid transporter (LAT1/solute-linked carrier (SLC)7A5) transports large neutral amino acids such as phenylalanine, tyrosine, and leucine across the muscle cell membrane and may also serve as an intracellular sensor for mTORC1 signaling.

**PURPOSE:** We aimed to examine variations in skeletal muscle LAT1 (55 kDa) protein content and phosphorylation of mTORC1 (Ser2448) in relation to dietary protein digestion and absorption kinetics after ingestion of single meal containing ample amounts of protein.

**METHODS:** Seven healthy, young men (24±1 y; BMI= 24.8±1.2 kg/m<sup>2</sup>) received a primed continuous infusion of L-[ring-2H5]phenylalanine, L-[ring-2H2]tyrosine, and L-[1-13C]leucine and ingested 38 g of intrinsically L-[1-13C]phenylalanine and L-[1-13C]leucine labeled milk protein. Blood samples were drawn every 0.5-1 h during the infusion protocol. Biopsies from the vastus lateralis were collected before and after protein ingestion at 1, 2, 3, and 5 h of the postprandial period.

**RESULTS:** Postprandial release of dietary protein derived phenylalanine rapidly increased in circulation after protein ingestion and remained elevated throughout the 5 h postprandial period (Time effect:  $P < 0.001$ ). mTORC1 phosphorylation was increased (18±6%) throughout the postprandial phase (time effect:  $P < 0.05$ ). However, protein ingestion did not modulate LAT1 protein content during the postprandial period ( $P=0.53$ ). **CONCLUSIONS:** We conclude that the increase in mTORC1 phosphorylation after protein ingestion occurs without modulations in overall skeletal muscle LAT1 protein content.

1609 Board #262 June 2, 8:00 AM - 9:30 AM  
**Supplementing An Energy Adequate High Protein Diet With Additional Protein Is Not Necessary For Recovery Of Lean Body Mass After Short-term Starvation**  
 John J. Sepowitz<sup>1</sup>, Holly L. McClung<sup>1</sup>, Claire E. Berryman<sup>1</sup>, Nicholes J. Armstrong<sup>1</sup>, Army A. Ferrando<sup>2</sup>, Harris R. Lieberman<sup>1</sup>, James P. McClung<sup>1</sup>, Stefan M. Pasiakos<sup>1</sup>. <sup>1</sup>U.S. Army Research Institute of Environmental Medicine, Natick, MA. <sup>2</sup>University of Arkansas for Medical Sciences, Little Rock, AR.  
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*(No relationships reported)*

Energy deficits during military operations can reach near complete starvation and result in significant reductions in lean body mass (LBM). Inadequate recovery of LBM may compromise subsequent performance. Consuming supplemental high-quality protein may accelerate LBM recovery by leveraging the anabolic properties of amino

acids. **PURPOSE:** To characterize the effects of severe energy deficit on body composition and determine whether supplemental protein enhances LBM accretion during recovery. **METHODS:** Body composition (dual energy x-ray absorptiometry) and cross-sectional area (CSA) of the thigh (peripheral quantitative computed tomography) were measured before (BASELINE) and after (POST) a 7-d, near complete starvation caused by Survival, Evasion, Resistance, and Escape School (SERE) in 63 male U.S. Marines (mean ± SD, 25 ± 2 y, 84 ± 9 kg). POST SERE, volunteers were randomized to receive supplements high in carbohydrate (975 kcal, 224 g CHO, 3 g PRO; n=21), moderate in protein (910 kcal, 123 g CHO, 87 g PRO; n=24), or high in protein (1055 kcal, 106 g CHO, 139 g PRO; n=18) during a 27-d recovery period (REC). Supplements were consumed daily, in addition to their self-selected, ad libitum diet. Dietary intake was calculated using 24-hr recalls and body composition measurements were repeated at the end of REC.

**RESULTS:** For all participants, total body mass (TBM) (7.2 ± 1.0%; 5.8 ± 1.0 kg;  $P < 0.05$ ) and CSA (5.9 ± 2.2%;  $P < 0.05$ ) was lower POST SERE compared to BASELINE. The decline in LBM (4.7 ± 2.5%; 3.1 ± 1.6 kg;  $P < 0.05$ ) accounted for 53% of the TBM loss. During REC, no differences were observed in total energy intake when self-selected diets and supplement intake were combined (4498 ± 1191 kcal/d;  $P > 0.05$ ); however, per study design, protein intake was significantly different between groups (high carbohydrate: 1.9 ± 0.6 g/kg/d; moderate protein: 3.1 ± 0.9 g/kg/d; high protein: 3.4 ± 0.9 g/kg/d;  $P < 0.01$ ). At REC, and independent of group assignment, all participants regained TBM (8.0 ± 2.8%), LBM (5.7 ± 2.9%), and CSA (7.4 ± 3.2%) from POST SERE deficits, resulting in no differences between BASELINE and REC measures ( $P > 0.05$ ). **CONCLUSION:** These data suggest that supplementing energy adequate high protein (~2.0 g·kg<sup>-1</sup>·d<sup>-1</sup>) diets with additional protein does not enhance LBM recovery from short-term starvation.

1610 Board #263 June 2, 8:00 AM - 9:30 AM  
**Energy Not Protein Or Carbohydrate Intake Attenuates Whole-body Protein Loss During 4-d Arctic Military Training**  
 Lee M. Margolis<sup>1</sup>, Nancy E. Murphy<sup>1</sup>, Svein Martini<sup>2</sup>, Yngvar Gundersen<sup>2</sup>, John W. Castellani<sup>1</sup>, J Phillip Karl<sup>1</sup>, Christopher T. Carrigan<sup>1</sup>, Hilde K. Teien<sup>2</sup>, Elisabeth H. Madslie<sup>2</sup>, Scott J. Montain, FACSM<sup>1</sup>, Stefan M. Pasiakos<sup>1</sup>. <sup>1</sup>U.S. Army Research Institute of Environmental Medicine, Natick, MA. <sup>2</sup>Norwegian Defense Research Establishment, Kjeller, Norway.  
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*(No relationships reported)*

Soldiers often experience severe energy deficits during military operations that diminish whole-body protein balance, even when dietary protein is consumed within recommended levels (1.5-2.0 g·kg<sup>-1</sup>·d<sup>-1</sup>). **PURPOSE:** To determine whether increasing total protein intake above current recommendations or increasing energy intake equally mitigate protein loss during energy deficit. **METHODS:** 73 Norwegian Soldiers participating in a 4-d arctic military training program (AMT, 51 km ski march) were randomized to one of three dietary groups; control (CON; n = 18, 3 combat rations per day), protein (PRO; n = 28, 3 rations plus 4, 20 g protein, 250 kcal protein-based snack bars per day), and carbohydrate (CHO; n = 27, 3 rations plus 4, 48 g carbohydrate, 250 kcal carbohydrate-based snack bars per day). **METHODS:** Energy expenditure (D<sub>2</sub><sup>18</sup>O) and energy intake were measured daily. Nitrogen balance (NBAL) and whole-body protein turnover were determined at baseline (BL) and on day 3 of AMT using 24 h urine collections and [<sup>15</sup>N]-glycine. **RESULTS:** Protein and carbohydrate intake were highest ( $P < 0.05$ ) for PRO (mean ± SE, 2.0 ± 0.1 g·kg<sup>-1</sup>·d<sup>-1</sup>) and CHO (5.8 ± 0.3 g·kg<sup>-1</sup>·d<sup>-1</sup>) but only CHO (3131 ± 122 kcal·d<sup>-1</sup>) statistically increased ( $P < 0.05$ ) energy intake above CON (2506 ± 99 kcal·d<sup>-1</sup>). Energy expenditure (6155 ± 60 kcal·d<sup>-1</sup>) and energy deficit (3313 ± 93 kcal·d<sup>-1</sup>) were similar across groups. Whole-body net protein balance (-0.24 ± 0.11 g·d<sup>-1</sup>) and NBAL (-77.1 ± 10.9 mg·kg<sup>-1</sup>·d<sup>-1</sup>) were negative at the

conclusion of AMT in all groups. In a combined cohort, consuming more energy was associated with higher ( $P < 0.05$ ) net protein balance ( $r = 0.57$ ) and NBAL ( $r = 0.60$ ), independent of macronutrient intake. Soldiers consuming the most energy ( $3754 \pm 94$  kcal·d<sup>-1</sup>) also consumed more ( $P < 0.05$ ) protein ( $2.1 \pm 0.1$  g·kg<sup>-1</sup>·d<sup>-1</sup>) and carbohydrate ( $6.6 \pm 0.3$  g·kg<sup>-1</sup>·d<sup>-1</sup>) than those who consumed the least amount of energy ( $1783 \pm 113$  kcal·d<sup>-1</sup>,  $1.2 \pm 0.1$  g protein·kg<sup>-1</sup>·d<sup>-1</sup> and  $3.3 \pm 0.3$  g carbohydrate·kg<sup>-1</sup>·d<sup>-1</sup>), and achieved net protein balance and NBAL during AMT. **CONCLUSION:** These data reinforce the importance of consuming sufficient energy during periods of high energy expenditure to mitigate the negative consequences of the energy deficit and attenuate whole-body protein loss. Funding Supported by MRMC and FFI.

**C-42 Free Communication/Poster - Rehabilitation and Therapeutic Modalities**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
Room: Exhibit Hall A/B

1611 Board #264 June 2, 8:00 AM - 9:30 AM  
**Restoration Of Quadriceps Strength Symmetry Following Anterior Cruciate Ligament Reconstruction: Allograft Versus Patella Tendon Autograft**  
Kyungmi Park, Christopher M. Powers, FACSM. *University of Southern California, Los Angeles, CA.*  
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(No relationships reported)

Although patella tendon (PT) autograft is commonly used for anterior cruciate ligament reconstruction (ACL-r), disruption of the extensor mechanism has been reported to delay the recovery of quadriceps strength and may contribute to post-surgical anterior knee pain. The allograft procedure results in minimized disruption to the extensor mechanism, and as such, may promote earlier recovery of quadriceps function.  
**PURPOSE:** To determine the influence of graft type for ACL-r on the side-to-side quadriceps strength ratio (SQSR) at different time points following surgery.  
**METHODS:** 262 subjects who had undergone ACL-r were grouped based on the graft type (allograft vs. PT autograft) and time from surgery (3-6 months, 6-9 months, and 9-13 months). Quadriceps strength (peak isometric torque at 60° knee flexion) was measured bilaterally. The SQSR was calculated as the ratio of the involved knee to the uninvolved knee. A 2-way ANCOVA was used to compare the SQSR between groups across the 3 time points. **RESULTS:** There was no significant interaction between graft type and time post-surgery ( $p > 0.05$ ). In addition, there was no significant main effects for graft type or time post-surgery. When averaged across time points, the SQSR was similar between the allograft and PT autograft groups respectively ( $0.90 \pm 0.01$  vs.  $0.86 \pm 0.02$ ,  $p > 0.05$ ). When averaged across graft types, the SQSR ratio was similar across the 3-6, 6-9 and 9-13 month time points respectively ( $0.85 \pm 0.02$  vs.  $0.88 \pm 0.02$  vs.  $0.92 \pm 0.02$ ,  $p > 0.05$ ). **CONCLUSION:** The choice of graft for ACL-r does not appear to influence the SQSR ratio post-surgery.

1612 Board #265 June 2, 8:00 AM - 9:30 AM  
**Physical Activity Levels One Year after an Acute Lateral Ankle Sprain**  
Tricia Hubbard Turner, FACSM<sup>1</sup>, Kyeongtak Song<sup>2</sup>, Chris Burcal<sup>1</sup>, Erik Wikstrom, FACSM<sup>2</sup>. <sup>1</sup>*University of North Carolina @ Charlotte, Charlotte, NC.* <sup>2</sup>*University of North Carolina @ Chapel Hill, Chapel Hill, NC.*  
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(No relationships reported)

Acute lateral ankle sprains (LAS) are the most common musculoskeletal injury. It is currently unclear the impact an acute LAS has on physical activity levels. **PURPOSE:** To examine the physical activity levels before and one year after an acute LAS. **METHODS:** Twelve college students subjects (6 males and 6 females, age=21.7±2.7yr., mass=79.4±20.4kg, ht=174.2±11.5cm) with an acute LAS participated in the study. Subjects reported to the lab within 3 days after spraining their ankle. Subjects were given the international physical activity questionnaire and NASA physical activity status scale to estimate their physical activity levels the week before they were injured. They completed the same questionnaires one year after the injury. **RESULTS:** The subjects scored significantly less on "average time spent performing vigorous physical activity" ( $p = .04$ ) and "average time spent performing moderate physical activity" ( $p = .02$ ) one year after injury compared to before the LAS (Table 1). Subjects with a LAS also spent significantly less time during an average day walking ( $p = .01$ ), and had significantly less days per week where they pursued vigorous activity ( $p = .02$ ) or moderate activity ( $p = .04$ ) one year after their sprain compared to before the injury occurred.

**Table 1: Mean (±SD) for dependent variables.**

	Before Injury	One Year Post Injury
Time spent walking (per day, in minutes)	89.12 ± 20.2*	52.10 ± 9.9
# days perform moderate activity (per week)	4.3 ± 0.9*	2.1 ± 1.2
Moderate activity (for a day they are moderately active, in minutes)	62.52 ± 13.2*	32.21 ± 10.2
# days perform vigorous activity (per week)	2.7 ± 0.6*	1.2 ± 0.5
Vigorous (for a day they are moderately active, in minutes)	31.44 ± 9.6*	18.10 ± 6.2

(\*Significantly different  $p < .05$ )

**CONCLUSION:** Based on current data, it appears one year after a LAS subjects are significantly less physically active. Further research is needed to understand why subjects have decreased physical activity, as this decreased activity could lead to the development of other chronic injuries and illness. Supported by NATA Research and Education Foundation

1613 Board #266 June 2, 8:00 AM - 9:30 AM  
**Knee Function, Strength, and Maintenance of Pre-Injury Sports Participation After Anterior Cruciate Ligament Reconstruction**  
Matthew P. Ithurnburn<sup>1</sup>, Mark V. Paterno<sup>2</sup>, Staci Thomas<sup>2</sup>, Timothy E. Hewett, FACSM<sup>3</sup>, Laura C. Schmitt<sup>1</sup>. <sup>1</sup>*The Ohio State University, Columbus, OH.* <sup>2</sup>*Cincinnati Children's Hospital Medical Center, Cincinnati, OH.* <sup>3</sup>*Mayo Clinic, Rochester, MN.*  
(No relationships reported)

Young athletes after anterior cruciate ligament reconstruction (ACLR) commonly demonstrate deficits in knee function and strength; however, the association between these deficits and the ability to maintain pre-injury sports participation is unknown. **PURPOSE:** To examine differences in knee function and strength at return to sport (RTS) between young athletes after ACLR who maintain pre-injury sports participation one-year post-RTS and those who do not. **METHODS:** At the time of RTS after ACLR, knee function and strength data were collected in 114 young athletes ( $17.1 \pm 2.4$  years; 76% females). Knee function was evaluated using the Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales and single-leg hop tests (normalized to height). Quadriceps and hamstring peak torques were measured on an isokinetic dynamometer (normalized to mass). The Tegner scale was used to evaluate pre-injury and one-year post-RTS level of sports participation. Participants were divided into groups based on whether they maintained pre-injury level of sports participation at one-year post-RTS. Group differences were compared using Mann Whitney U tests ( $\alpha = .05$ ). **RESULTS:** 56% of participants maintained pre-injury sports participation ( $n=64$ ), while 20% of participants ( $n=23$ ) sustained second ACL injuries prior to one-year post-RTS and were excluded from group comparisons. Participants who had maintained pre-injury sports participation ( $n=64$ ) demonstrated higher involved (IN) and uninvolved (UN) limb performance on the triple hop (IN:  $2.66 \pm .40$  vs.  $2.44 \pm .43$ ,  $p=.01$ ; UN:  $2.80 \pm .40$  vs.  $2.57 \pm 0.46$ ,  $p=.01$ ) and the crossover hop (IN:  $2.44 \pm .39$  vs.  $2.22 \pm .54$ ,  $p=.04$ ; UN:  $2.59 \pm .41$  vs.  $2.39 \pm .55$ ,  $p=.04$ ) at RTS compared to those who did not maintain pre-injury sports participation ( $n=27$ ), respectively. There were no group differences in the KOOS, the single hop, and all strength measures. **CONCLUSIONS:** A low proportion of young athletes maintained pre-injury sports participation one-year post-RTS after ACLR. Those who maintained pre-injury sports participation demonstrated higher involved and uninvolved functional performance. Further study of the interactions among function, strength, and sports participation after ACLR is needed. Supported by NIH grant F32-AR055844 and the NFL Charities Research Grants 2007, 2008, 2009, and 2011.

1614 Board #267 June 2, 8:00 AM - 9:30 AM  
**Resistive Hamstring Quadriceps Co-contraction Training After Acl Reconstruction**  
Gulcan Harput<sup>1</sup>, Burak Ulusoy<sup>1</sup>, Hamza Ozer<sup>2</sup>, Gul Baltaci<sup>3</sup>. <sup>1</sup>*Hacettepe University, Ankara, Turkey.* <sup>2</sup>*Gazi University, Ankara, Turkey.* <sup>3</sup>*Private Guven Hospital, Ankara, Turkey.* (Sponsor: GUL BALTACI, FACSM)  
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(No relationships reported)

Co-contraction training (CT) was shown to be an option for quadriceps strengthening after anterior cruciate ligament reconstruction (ACLR) without loading excessive stress on the healing graft **PURPOSE:** The aim of this study was to investigate the effects of resistive hamstring quadriceps co-contraction training on knee muscle strength recovery and knee function after ACLR.

**METHODS:** Fifty two patients (age: 27.5±7.6 years, body mass index: 24.9±3.7 kg/m<sup>2</sup>) who had ACLR with hamstring tendon autograft were randomly allocated into one of three trainings: 1) CT in open kinetic chain (OKC) with standard rehabilitation, 2) CT in closed kinetic chain (CKC) with standard rehabilitation and 3) only standard rehabilitation. Patients attended a baseline strength assessment for involved and uninvolved limb at 4 weeks after surgery, followed by an 8-week intervention, and they were reassessed at the end of the intervention and 12 weeks after the intervention. Knee physical functions were assessed by one leg hop distance test (OLHT) and IKDC score at 24 weeks after surgery. Repeated measures of ANOVA was used for statistical analysis

**RESULTS:** In involved limb, time by group interaction was found significant for quadriceps strength ( $F_{(4,98)} = 2.75, p=0.03$ ) but it was not significant for hamstring strength ( $F_{(4,98)} = 1.01, p=0.40$ ), quadriceps index ( $F_{(4,98)} = 0.94, p=0.47$ ) and hamstring index ( $F_{(4,98)} = 1.16, p=0.33$ ). Quadriceps strength in Group 1 and Group 2 was found greater than control group after intervention ( $p=0.003, p=0.04$ , respectively). However, only Group 1's quadriceps strength was greater than control group at 24 weeks after ACLR ( $p=0.03$ ). IKDC score was found greater in Group 1 when compared to the control group ( $p=0.02$ ) but OLHT score were not different among groups ( $p>0.05$ ).

**CONCLUSION:** The resistive hamstrings quadriceps CT in either CKC or OKC during early period of ACLR rehabilitation could be an option for the quadriceps muscle strengthening and improving knee physical function. However, this training might not be effective for hamstring strength recovery.

1615 Board #268 June 2, 8:00 AM - 9:30 AM  
**Do Knee And Hip Strength Correlate With Functional Outcomes After ACL Reconstruction?**

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**Purpose:** The purpose of this study was to investigate the correlation between hip and knee muscles strength and functional outcomes in ACL reconstructed (ACLR) individuals.

**Methods:** Sixty-two ACLR individuals (age 27.6 ± 7.8 yrs, BMI 24.4 ± 4.03kg/m<sup>2</sup>) were included in this study. All functional tests were performed at six months after surgery. Concentric and eccentric strength of the knee flexors, extensors, hip abductors and hip adductors at 900/s were measured by isokinetic dynamometer. Functional performance was evaluated by One Leg Hop Test (OLHT) and International Knee Documentation Committee (IKDC) Form. Limb Symmetry Indexes for muscle strength, hamstring quadriceps ratio (H/Q), hip abductor adductor ratio and hop performance were used for analysis. Pearson Correlation Test was used for statistical analysis.

**Results:** There were significant correlations between IKDC Score OLHT and concentric and eccentric quadriceps Index (QI) and eccentric hamstring Index (HI) ( $p<0.05$ ). However hip abductor and adductor indexes were not correlated with IKDC Score and OLHT. H/Q ratio was negatively correlated with IKDC Score ( $p=0.04, r=-0.29$ ) (Table 1).

**Conclusion:** Knee strength symmetry and the balance between hamstring and quadriceps strength are more important to evaluate the hop performance and self-reported knee function instead of hip strength symmetry in ACLR individuals.

Table 1: Correlation between knee strength and functional outcomes.

	Concentric_QI	Eccentric_QI	Eccentric_HI	H/Q Ratio
IKDC	$p=0.008, r=0.36$	$p=0.03, r=0.3$	—	$p=0.04, r=-0.29$
OLHT	$p=0.04, r=0.30$	$p=0.02, r=0.35$	$p=0.03, r=0.32$	—

1616 Board #269 June 2, 8:00 AM - 9:30 AM  
**External Supports Improve Knee Performance In Acl Reconstructed Individuals With Higher Kinesiophobia Levels**

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The use of external supports was shown to be an option for anterior cruciate ligament reconstruction (ACLR) individuals to overcome kinesiophobia during the return to sport phase of their rehabilitation.

**PURPOSE:** The aim of this study was to investigate the effects of a drytex hinged knee brace (KB) and Kinesiotaping (KT) on functional performance and self-reported function in individuals 6 months after ACLR who desired to return to their pre-injury activity level but felt unable to do so because of kinesiophobia

**METHODS:** Thirty ACLR patients (age: 25.1±7.8 years, body mass index: 23.9±3.5 kg/m<sup>2</sup>) 6 months post ACLR with Tampa kinesiophobia scores >37 were included. Individuals were tested under three conditions: No intervention, KB and KT in a randomized order. Isokinetic concentric quadriceps and hamstring strength tests, one leg hop test, star excursion balance test and global rating scale were assessed under the three conditions. A repeated measures of ANOVA was used for statistical analysis

**RESULTS:** The involved side showed that KT and KB significantly increased the hop distance ( $p=0.01, p=0.04$ ) and improved balance ( $p=0.01, p=0.04$ ) respectively, but only KB was found to increase the quadriceps and hamstring peak torques compared to no intervention ( $p<0.05$ ). Individuals reported having better knee function with KB when compared to no intervention ( $p<0.001$ ) and KT ( $p=0.03$ ).

**CONCLUSIONS:** Both KB and KT have positive effects in individuals post ACLR which may assist in reducing kinesiophobia when returning their pre-injury activity level, with the KB appearing to offer the participants better knee function compared to KT.

1617 Board #270 June 2, 8:00 AM - 9:30 AM  
**Functional Outcomes Of Primary Open Repair With Augmentation And Without Augmentation In Achilles Tendon Rupture**

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 (No relationships reported)

**PURPOSE**

The aim of this study was to compare the functional outcomes between two surgical techniques for Achilles tendon rupture: primary open repair (POR) versus open repair augmented with flexor hallucis longus tendon transfer (POR\_FHL).

**METHODS**

Twenty six patients (Age:44.7±8.6 years, Body Mass:83.4±14.5 kg, Height:177.7±23.4 cm, BMI:27.6±4.2 kg/m<sup>2</sup>, time after surgery to experiment: 3.13±1.96 yrs) who were operated either with POR (Group 1, n=14) or POR\_FHL (Group 2, n=12) for achilles tendon rupture were included in this study. For evaluating dynamic balance, Star Excursion Balance Test (SEBT) with anterior, posteromedial and posterolateral reach distances was used and for evaluating hop performance, One Leg Hop Test (OLHT) was used. To measure ankle dorsiflexion range of motion, Weight Bearing Lunge Test (WBLT) was performed and Functional Squat Test (FST) was used for evaluating lower extremity concentric and eccentric strength. Limb symmetry index was calculated for each test. Student t test was performed for statistical analysis.

**RESULTS**

The physical characteristics of the patients were not different between groups ( $p>0.05$ ). There were no differences between groups in SEBT anterior ( $p=0.46$ ), posteromedial ( $p=0.28$ ) and posterolateral reach distances ( $p=0.71$ ), OLHT ( $p=0.77$ ), WBLT ( $p=0.13$ ) and FST for concentric ( $p=0.96$ ) and eccentric ( $p=0.78$ ) strength.

**CONCLUSION**

The results of the study showed that primary open repair with and without augmentation techniques for achilles tendon repair had similar effect on dynamic balance, hop distance, ankle dorsiflexion motion and lower extremity strength in long term after surgery.

1618 Board #271 June 2, 8:00 AM - 9:30 AM  
**Are Laboratory And Field-based Hamstring Strength Tests Correlated?**

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Laboratory based isometric and isokinetic (concentric and eccentric) dynamometry is negatively associated with Hamstring strain injury (HSI) risk. A field-based posterior lower limb strength test assessing maximal isometric hamstring contraction via a portable force platform is sensitive to fatigue induced changes in hamstring strength following a soccer match, but it is not known if the posterior lower limb strength test reflects the more robust dynamometry strength measures.

**PURPOSE:** To investigate laboratory isometric ( $ISO_{dyno}$ ), concentric ( $CON_{dyno}$ ) and eccentric ( $ECC_{dyno}$ ) dynamometry strength measures relative to the field-based isometric posterior lower limb ( $ISO_{plat}$ ) test using a portable force platform.

**METHODS:** 21 amateur soccer players (Male, 24 ± 3.1 yrs, 75.5 ± 9.5 Kg, 178.2 ± 6.3 cm) were recruited and familiarised with  $ISO_{dyno}$ ,  $CON_{dyno}$ / $ECC_{dyno}$  and  $ISO_{plat}$  at least one week prior to experimental testing. The test order was standardised as part of a larger project. In week one players performed two maximum  $ISO_{plat}$  tests (supine, 30° Knee flexion, 5 sec), and ≥7 days later performed two maximum  $ISO_{dyno}$

(prone, 30° Knee flexion, 5 sec), followed by two CON<sub>dyno</sub>/ECC<sub>dyno</sub> (prone, 0-135° Knee Flexion 60°·S<sup>-1</sup>) tests using the dominant limb. At least 2-minutes rest between contractions was provided during each assessment. Pearson's correlations (*r*) between measures were performed with significance set at *p*<0.05. **RESULTS:** Average force measured 224.4 N (ISO<sub>plat</sub>), 125.5 Nm (ISO<sub>dyno</sub>) 131.1 N.m (ECC<sub>dyno</sub>) and 96.4 N.m (CON<sub>dyno</sub>). ISO<sub>dyno</sub> was positively associated with both CON<sub>dyno</sub> (*r*<sup>2</sup>= 0.57, *p*= <0.0001, 95% CI 0.485-0.896), and ECC<sub>dyno</sub> (*r*<sup>2</sup>= 0.53, *p*= 0.0002, 95% CI 0.430-0.882) but no other significant correlations were observed. **CONCLUSION:** Evidence has shown isometric and isokinetic dynamometry is related to HSI risk. The absence of any correlation between the isometric posterior lower limb hamstring test with these dynamometer strength measures suggests this test may not have a similar predicative capacity. These results could be explained by the anatomical position of the subject, or activation of hip extensor muscles that may have influenced the maximal force produced during ISO<sub>plat</sub>.

1619 Board #272 June 2, 8:00 AM - 9:30 AM  
**Short Arc Training Effects On Knee Strength, Pain, Functional Performance With Patellofemoral Pain Syndrome Patients**

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**PURPOSE:** The aim of this study was to investigate the effects of short arc training (SAT) in closed and open kinetic chain positions on knee strength, pain level and functional performance in patients with patellofemoral pain syndrome (PPFS). **METHODS:** Twenty eight female patients with PPFS (age: 43.5±7.5 yrs, BMI:25.9±5.3 kg/m<sup>2</sup>) were randomly divided into two groups. Group 1 (n=14) was trained with SAT in open kinetic chain position by using isokinetic system. Group 2 (n=14) was trained with SAT in closed kinetic chain position by using monitored functional squat system during 6 weeks. The trainings were performed at 0-45° knee flexion. Concentric quadriceps and hamstring strength were measured with isokinetic system at 180°/s and 60°/s angular velocities, pain levels during step up and down were evaluated with Visual Analog Scale and Time Up Go Test (TUG) was used for assessing the functional performance. The measurements were done before and after training and repeated measures of ANOVA was used for statistical analysis. **RESULTS:** There was no significant interaction between time and group in terms of quadriceps (180°/s: F(1,26)=0.51, *p*=0.48, 60°/s: F(1,26)=0.001, *p*=0.98), hamstring strength (180°/s: F(1,26)=0.91, *p*=0.35, 60°/s: F(1,26)=0.99, *p*=0.33), TUG test (F(1,26)=2.51, *p*=0.13) and pain levels during step up (F(1,26)=0.38, *p*=0.54) and down (F(1,26)=0.18, *p*=0.67). After training, both groups showed greater quadriceps and hamstring strength, decreased pain level during step up and down and increased functional performance (*p*<0.001). **CONCLUSIONS:** Short arc trainings in open and closed chain positions have positive and similar effect on knee strength and functional recovery in patients with PPFS. Each training can be added to PPFS treatments.

1620 Board #273 June 2, 8:00 AM - 9:30 AM  
**The Effect of Soft Tissue Oscillation Therapy On Delayed Onset Muscle Soreness**

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Numerous interventions have been used in attempt to treat delay onset muscle soreness (DOMS). Soft tissue oscillation therapy (STO) has the potential to alleviate the signs and symptoms of DOMS. However, there is a lack of scientific evidence supporting the effects of STO. **PURPOSE:** The purpose of this study was to investigate the effects of STO as a treatment for DOMS after an eccentric exercise protocol. **PURPOSE:** The purpose of this study was to investigate the effects of STO as a treatment for DOMS after an eccentric exercise protocol. **METHODS:** A total of 31 healthy, physically active volunteers (7 males, 24 females, age = 20.2±1.6 years, height = 168.1±10.3 cm, mass = 75.9±19.1 kg) were randomly assigned to either the STO (n = 16) or control (n = 15) group. Participants performed eccentric biceps curls with the non-dominant arm until fatigue at 80% of their estimated one-repetition maximum followed by either STO treatment or no treatment at 24, 48, 72, and 96 hours post-exercise. The main outcome measures included perceived soreness, self-reported functional ability, elbow range of motion, and upper arm circumference and were recorded at baseline, immediately after, 24, 48, 72, and 96 hours, and 7 days post-exercise. **RESULTS:** No significant effects of STO were evident on the recovery of perceived soreness (F(6, 162) = 0.25, *p* = .854, partial eta<sup>2</sup> = .009), self-reported functional ability (F(6, 162) = 0.24, *p* = .815, partial eta<sup>2</sup> = .008), elbow range of

motion extension (F(6, 162) = 0.96, *p* = .381, partial eta<sup>2</sup> = .034) and flexion (F(6, 162) = 0.65, *p* = .597, partial eta<sup>2</sup> = .024), and upper arm circumference (F(6, 162) = 0.31, *p* = .787, partial eta<sup>2</sup> = .011) when compared to the control group. **CONCLUSIONS:** It was concluded that STO is not an effective treatment for DOMS.

1621 Board #274 June 2, 8:00 AM - 9:30 AM  
**Changes in Sprint Kinetics and Kinematics Following Static or Dynamic Stretching**

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 (No relationships reported)

Pre-activity stretching is common practice among athletes, yet a lack of consensus exists as to which type of stretch should be performed. Various types of stretching have been utilized over time, though due to equivocal results in the literature, the criterion for choosing a stretch is often based on familiarity or tradition. **PURPOSE:** This study aimed to compare the effects of dynamic or static stretching on hip kinetics and kinematics during intermittent sprinting. Variables of interest included hip flexion torque production at baseline, post-stretch and post-sprint, hip angular velocity during the initial swing phase of gait, and sprint times throughout the repeated sprint protocol. **METHODS:** Participants included 10 male (age 25 ± 2.3 years) and 2 female (age 20 ± 1 years) experienced soccer players recruited from the Las Vegas community. Following written informed consent, participants were asked to report to the University of Nevada, Las Vegas Sports Injury Research Center twice. Each visit consisted of the following: 1) 5-minute treadmill warm up at a preferred pace, 2) baseline hip flexion torque measurements, 3) either a static or dynamic stretch, 4) post-stretch torque measurements, 5) a repeated sprint protocol, and 6) post-sprint torque measurements. Peak hip flexion torque values were analyzed in SPSS using a 2x3 repeated measures factorial ANOVA. Paired t-tests for average sprint time, difference between first and last sprint time, peak instantaneous velocity, and percent phase occurrence of peak velocity were computed with (*α*=0.05). **RESULTS:** No statistically significant differences were found for any variable among any level. **CONCLUSIONS:** A lack of statistical significance may be attributed to a low n and high variability among participants. Additionally, coupled with previous results in the literature, it may suggest that there is not a "one-size-fits-all" approach to pre-activity stretching.

1622 Board #275 June 2, 8:00 AM - 9:30 AM  
**A Comparison of Two Thermal Modalities on Passive Hip Flexion Range of Motion.**

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**PURPOSE:** To investigate the relationship between the use of diathermy and thermal ultrasound modality treatments and the effects on hamstring flexibility range of motion (ROM) in healthy college-aged participants. **METHODS:** Twenty-two healthy college students aged between 19 and 25 participated in this study. The participants had no history of any significant lower leg injuries. Participants' bi-lateral hip flexion ROM was evaluated by a Certified Athletic Trainer prior to treatment through goniometric measurement techniques. Then, the participants received diathermy @ 48 W continuous for 15 minutes on one hamstring group and thermal ultrasound @ 3.3 Mhz 1.5 W/cm<sup>2</sup> for 7 minutes to the other hamstring group. Following the treatments, hip flexion ROM was re-assessed at the following intervals: immediately following treatment, 2 minutes, 5 minutes and 10 minutes post treatment. **RESULTS:** The effects of diathermy and thermal ultrasound were analyzed utilizing a two-way analysis of variance (time x groups) indicated a significant relationship of time. Mauchly's sphericity was significant at the *p*<.05 level therefore Huynh-Feldt correction was utilized. F(3.553,149.232)= 9.100 *p*=.000. However, there was no significance between the type of treatment F(3.553, 149.232) = .574 *p* = .661 **CONCLUSIONS:** Results demonstrated that the use of both thermal ultrasound and shortwave diathermy produced a statistically significant effect on hamstring flexibility ROM over a period time. Specifically regardless of treatment intervention, the results suggested that flexibility exercise should be initiated immediately up to 2 minutes following the modality treatment for maximal benefit.

THURSDAY, JUNE 2, 2016

1623 Board #276 June 2, 8:00 AM - 9:30 AM  
**The Evaluation of Efficacy of KinesioTaping on Pain in Subacromial Impingement Syndrome**  
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**PURPOSE:** In this study, we aimed to evaluate the effect of kinesioTaping on pain in patients with subacromial impingement syndrome diagnosis.  
**METHODS:** 30 participants (12 male, 18 female, 58.56 ± 15.87) were included and randomly separated into two groups in this study. Conventional physiotherapy program which consist of TENS (Transcutaneous Electrical Nerve Stimulation), therapeutic ultrasound and structured exercises was applied to the control group. KinesioTaping was applied to kinesioTaping group additional to the conventional physiotherapy program. Before the treatment all participants' pain threshold scores were evaluated with an algometer and Constant-Murley Scores (CMS) were assessed. These evaluations repeated after treatment at both groups and after 24 and 72 hours at the kinesioTaping group.  
**RESULTS:** In the algometer evaluation of kinesioTaping group immediately, 24 and 72 hours after the treatment it's found that while pain thresholds scores were increased at immediately after the treatment versus before the treatment (p<0.05). There was no statistically significant difference in the algometer evaluation of control group at before and immediately after the treatment (p>0.05). In the assessment of subtitles of CMS; while statistically significant decrease at pain, increase at range of motion (ROM), functionality at activities of daily living (ADL) and the total CMS score (p<0.05).  
**CONCLUSIONS:** Pain threshold increases with an acute effect of kinesioTaping in patients with subacromial impingement syndrome, whereas the analgesic effect disappear 24 and 72 hours later. Besides physiotherapy program applied to subacromial impingement syndrome patients provides clinical improvement in pain, ROM and ADL at acute period and activates with additional kinesioTaping to programme. Pain control purposed application of kinesioTaping to subacromial impingement syndrome patients with pain symptom is considered as a clinically right orientation in this respect.

1624 Board #277 June 2, 8:00 AM - 9:30 AM  
**The Functional Recovery in Patients At One Year After Medial Patellofemoral Ligament Reconstruction**  
 Hande Guney<sup>1</sup>, Defne Kaya<sup>2</sup>, Inci Yuksel<sup>1</sup>, Egemen Turhan<sup>3</sup>, Gazi Huri<sup>3</sup>, Mahmut Nedim Doral<sup>3</sup>. <sup>1</sup>Hacettepe University Faculty of Health Sciences Physiotherapy and Rehabilitation, Ankara, Turkey. <sup>2</sup>Uskudar University Faculty of Health Sciences Physiotherapy and Rehabilitation Department, Istanbul, Turkey. <sup>3</sup>Hacettepe University Faculty of Medicine Orthopedics and Traumatology Department, Ankara, Turkey.  
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**PURPOSE:** To determine the isokinetic knee muscle strength and functional outcomes after medial patellofemoral ligament reconstruction (MPFL-R) in patients with patellar instability.  
**METHODS:** Seventeen patients with MPFL-R at one year after surgery and 17 controls were included in the study. The concentric isokinetic quadriceps and hamstring knee strength (at 60°/sec and 300°/sec) and knee joint position sense (at 20° and 60°) were evaluated with Biodex System 3. International Knee Documentation Committee and Kujala scores were used to determine the knee functional outcomes. The Mann Whitney U test was used to evaluate the differences between the knee muscle strength and JPS between patients with MPFL-R and controls  
**RESULTS:** The mean IKDC and Kujala scores were 85.2±16.8 and 58.4±11.5 at one year after surgery. The concentric quadriceps at 60°/sec (p=0.838) and 300°/sec (p=0.708) and concentric hamstring at 60°/sec (p=0.124) and 300°/sec (p=0.128) were similar between MPFL-R patients and controls. There were significant differences on JPS at 20° (p<0.001) and at 60° (p=0.003) between MPFL-R patients and controls. While the knee strength and the functional outcomes improved after one year following MPFL-R, the JPS results were poorer when compared with controls.  
**CONCLUSIONS:** The knee muscle strengthening and functional rehabilitation are essential after MPFL-R. The results showed that implementing the proprioception exercises into the rehabilitation programs is also important for MPFL-R patients.

1625 Board #278 June 2, 8:00 AM - 9:30 AM  
**Underlying Factors of Neural Activity that Regulate Torque Development after Anterior Cruciate Ligament Reconstruction**  
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 (No relationships reported)

To quantify a loss in strength after anterior cruciate ligament reconstruction (ACLR), researchers have often only utilized discrete measures of quadriceps force production such as peak torque. Yet, analyzing other characteristics of the waveform, such as rate of torque development (RTD) and time to peak torque (TTP), can tell us about several other factors that regulate force development such as alterations in muscle firing rate and alpha motor neuron recruitment, respectively. **PURPOSE:** To determine if alterations in the RTD, TTP, and peak torque exists between limbs after ACLR at the time when patients are cleared to return to activity.  
**METHODS:** 10 control subjects (4 female, 6 male; age 23.5±3.26yrs; mass 71.79±9.40kgs) and 88 patients (40 female, 48 male; age 21.1±6.05yrs; mass 75.59±15.84kgs) who had undergone ACLR and had been cleared to return to activity (7.53±1.34months) participated. Quadriceps strength was quantified via an isokinetic dynamometer at 60°/sec in concentric mode. The extension phase of the isokinetic trials were analyzed. TTP was calculated by the seconds it took from the onset of the torque value, threshold at 7.5 Nm, to the peak torque value of the trial. RTD was calculated as the slope of the torque from the threshold to the peak torque value, taken every 10ms, and normalized to body weight. One way repeated measures ANOVAs were used to compare limbs for both the ACLR and control groups and P≤0.05 was accepted as significant.  
**RESULTS:** As expected, the control group exhibited no difference between limbs in the TTP, RTD, or peak isokinetic torque (P>0.05). However, inter-limb differences were present in the ACLR group, where the involved leg demonstrated longer TTP (.546±.175s vs .505±.153s, P=0.01), lower RTD (2.822±1.52 Nm/kg/s vs 4.346±1.96 Nm/kg/s, P=0.00) and lower peak torque values (105.8±38.7Nm vs 152.0±52.2Nm, P=0.00) as compared to the uninjured leg.  
**CONCLUSIONS:** Post-surgery, ACLR individuals' exhibit inter-limb quadriceps dysfunction in force production that is not similarly present in a healthy population. The lower RTD may be a cause of a decrease in firing rate in the quadriceps of the involved limb. Whereas the increase in TTP may be indicative of a decrease in the number of motor neurons being recruited.  
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1626 Board #279 June 2, 8:00 AM - 9:30 AM  
**The Effects of Low Intensity Therapeutic Ultrasound on Pain Caused by Lumbar Disc Herniation**  
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Recently, a new wearable long duration continuous low intensity therapeutic ultrasound device (LITUS) was introduced. The effects of LITUS on low back pain associated with a lumbar herniated disc are unknown. **PURPOSE:** To examine the effects of LITUS in alleviating low back pain associated with a herniated disc over an 8-week treatment period. **METHODS:** Four participants (M=2 and F=2, age=39.0±13.9 y, height=172.3±8.3 cm, mass=67.1±10.7 kg) were enrolled for a 9-week pilot study. Participants completed a pain diary throughout the trial and 50-point Modified Oswestry Disability Index (mODI) before and after the treatment period. The diary asked participants to score their pain on a 0-10 numeric rating scale (NRS) during 1) a lumbar flexion activity, 2) a lumbar extension activity and 3) their worst pain throughout the day. At baseline, the pain diary was completed for 1 week and pain scores were averaged for each question. After baseline, participants were given an active ultrasound device (sam<sup>®</sup>, ZetrOZ, Inc.) to wear 4-hours each day. Participants discontinued all other treatments throughout the study. Following each treatment, participants again scored their pain for each activity. Pain scores were averaged for each week and a one-way ANOVA was used to determine differences in pain over the 9-week trial. A paired t-test was used to determine differences in baseline and post-treatment mODI scores. **RESULTS:** Pain after flexion and extension range of motion decreased from 5.0±1.3 and 4.8±1.3 at baseline to 3.7±1.2 and 2.6±0.7 after 8-weeks of treatment, respectively. Participants' greatest daily pain decreased from 5.5±0.7 at baseline to 3.5±1.5 at the end of the 8-weeks of treatment. However, there was no significant difference in pain over the 8-weeks for all questions (Flexion: P=0.863, Power=0.175; Extension: P=0.712, Power=0.241; Greatest Pain: P=0.433, Power=0.377). The mODI decreased from 19.3±7.4 to 17.5±7.9 from baseline to post-treatment, respectively, but was not statistically significant (P=0.213). **CONCLUSION:** During the 8-week treatment period pain decreased for all outcome

measurements, but due to a small sample size definite conclusions can not be made. A full scale clinical trial, which is currently being conducted, is needed to determine the effect of LITUS on low back pain caused by disc herniation.

1627 Board #280 June 2, 8:00 AM - 9:30 AM  
**An Epidemiological Study Of Lisfranc Injuries In Competitive Athletes**

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**Purpose:** We wanted to look at the extent, pattern, and prevalence of associated inter-cuneiform ligamentous tear in the competitive athlete with an unstable Lisfranc injury. We assessed the occurrence of proximal migration of instability and the incidence of medial column dislocation in the purely sports population. We will also see if the pattern of instability affects the patient's return to play and time to return to play. We report epidemiological statistics on the largest cohort of patients sustaining a Lisfranc injury during sport to date.

**Methods:** Fifty-nine patients sustained an unstable Lisfranc injury and met inclusion criteria for this study. Injuries were classified as traditional (1st-2nd TMT ligament tear), medial column dislocation (MC, 2nd TMT and medial-middle cuneiform ligament tear), or proximal extension (PE, 1st, 2nd and medial-middle ligament tear) dislocations at initial visit and confirmed at surgery. The senior author performed open reduction with internal fixation (ORIF) on all patients. Fisher's exact tests and 2-tailed t-tests were utilized to analyze statistical significance according to injury pattern, sport, level of competition, hindfoot angle alignment, and injured side (p<.05)

**Results:** Average age at time of surgery was 21.9 + 5.3 years old (range, 12-40) and mean time for return to sports was 7.5 + 2.1 months. All patients presented with valgus hindfoot alignment and the involved side displayed significantly lower hindfoot angle (2.57 + 1.10° v. 3.01 + 1.11°, p=.009). Distribution of injuries is as follows: traditional (28), medial column (15), proximal extension (16). Medial column dislocation trended toward a longer recovery to sports (9.1 + 3.3 months, p=.074). Wakeboard athletes were statistically older (31.4 + 3.2, p=.0002) and more prone to MC tears (p=.061) than other groups. Basketball players were significantly younger (19.1 + 2.5 years, p=.028) and returned to sports quicker (5.2 + .7, p=.0002) than other athletes.

**Conclusion:** All patients with at least a one-year follow-up returned to pre-injury sports participation. MC dislocations and PE may be more prevalent than previously understood. This is the first study to document the extent, pattern and prevalence of associated inter-cuneiform ligament tear in the competitive athlete with an unstable Lisfranc injury.

1628 Board #281 June 2, 8:00 AM - 9:30 AM  
**Implementing an Osteopathic Manipulation Clinic within an Allopathic Family Medicine Residency**

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 (No relationships reported)

**Background:** Osteopathic residents training in allopathic residencies practice less osteopathic manipulation than those trained in osteopathic residencies.

**Purpose:** This study outlines the implementation of an osteopathic manipulation clinic within an allopathic residency and examines learner experiences.

**Methods:** A survey to assess the need for an osteopathic manipulation clinic was sent to the 21 residents at the Maine Medical Center Family Medicine residency. The clinic was established September - December 2014. Each clinic was precepted by community osteopathic medicine

physicians and staffed by an integrative medicine fellow and one of four osteopathic residents. A post-implementation survey was sent to the residents to assess their impression of the clinic and its effects on education.

**Results:** 20 of 21 residents responded to the needs assessment survey (10 M.D. and 10 D.O.). The majority (90%) of residents believed a dedicated OMT clinic was needed. The residents thought access (35%) resident participation (20%) and OMT trained preceptors (20%) were the most important elements for clinic success. The post-implementation survey was completed by 18 residents. All were aware the OMT pilot was in progress, and most (78%) felt the referrals process was easy. For the n=5 participants in the OMT clinic, most (80-100%) agreed the didactics improved their OMT knowledge, the clinic was run efficiently, and preceptors gave the right amount of guidance.

**Conclusions:** Implementing an osteopathic manipulation clinic within a Family Medicine Residency was feasible, well accepted, and increased resident confidence in performing OMT. An integral part of this clinic's success was integration into the resident curriculum.

Table 1: OMT Clinic Pre- and Post-Implementation Survey Results

Question	Pre-implementation Survey						Post-implementation Survey					
	Total (N=20)		Physician Type (N=10)		DO (N=10)		Total (N=18)		Physician Type (N=9)		DO (N=9)	
	N	%	N	%	N	%	N	%	N	%	N	%
There is a need for a dedicated OMT clinic at current practice	18	90%	8	80%	10	100%	18	100%	9	100%	9	100%
Currently perform OMT in your practice	9	45%	0	0%	9	90%	8	44%	0	0%	8	89%
Instruction provided during residency on OMT helped improve skills	10	50%	6	60%	4	40%	15	83%	6	67%	9	100%
Teaching improved your confidence in providing OMT for patients	10	50%	5	50%	5	50%	14	78%	7	78%	7	78%
Plan to do OMT after residency	13	65%	5	50%	9	90%	13	72%	5	56%	8	89%
Feel confident referring appropriate patients to an OMT clinic	17	85%	8	80%	9	90%	18	100%	9	100%	9	100%
Aware there was an OMT clinic taking place September-December 2014	-	-	-	-	-	-	18	100%	9	100%	9	100%
Easy referral process	-	-	-	-	-	-	14	78%	5	56%	8	89%

1629 Board #282 June 2, 8:00 AM - 9:30 AM  
**Longitudinal Outcomes of Dynasplint Stretching for Carpal Tunnel Syndrome Following a Randomized Controlled Trial**

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**Carpal Tunnels Syndrome (CTS) has affected 48 million patients in the USA, and CTS is a significant challenge on the workforce because it is the most common peripheral compressive neuropathy in the United States.**

**PURPOSE:** to determine if Dynasplint stretching (immediately after diagnosis) had effects on patients' choices for surgical treatment of CTS.

**METHODS:** We recruited fifty patients (10 Men, 40 Women, Mean Age 51.2 ± 12 years) from a single hand center in Maryland and this is a randomized, controlled trial's longitudinal follow up. The intervention used was Dynasplint stretching which delivered a prolonged duration of low load stretching. Patients were randomly applied to experimental subjects who wore the device for two 30-minute sessions each day with sequential, bimonthly increases in splint tension for 60 days. Control patients only received standard of care plus instructions on daily home stretching. The dependent variable was choice of surgery over 12 months following conclusion of the randomized, controlled trial.

**RESULTS:** The final, longitudinal outcome showed a 72% reduction in surgery chosen by the experimental patients (N=25), compared to 38% reduction for control patients (N=25).

**CONCLUSION:** Immediate treatment with Dynasplint stretching showed a 2 to 1 reduction in patients' choice for surgery, with abundant financial savings.



1630 Board #283 June 2, 8:00 AM - 9:30 AM

**High Intensity Laser Therapy vs Kinesio Taping in Patients with Subacromial Impingement Syndrome**

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**High Intensity Laser Therapy vs Kinesio Taping in Patients with Subacromial Impingement Syndrome**

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Subacromial Impingement Syndrome (SAIS) is a major factor for shoulder pain and many treatment approaches (Kinesio®Taping [KT], Manual Therapy [MT] and High intensity laser therapy [HILT]) are used for pain reduction. It is important to determine which technique to use for a more efficient treatment.

**Purpose:** To compare the effects of KT, MT and HILT on pain, range of motion (ROM) and function in patients with SAIS.

**Methods:** Fifty-five patients with SAIS were randomly divided into 3 groups [KT (n=20), MT+KT (n=16) & MT+KT+HILT (n=19)]. Patients were assessed before and at the end of the treatment (15th day). Assessments included the severity of pain evaluated by Visual Analog Scale (VAS) and shoulder flexion, abduction and external rotation ROM measurements by a universal goniometry. Shoulder Pain and Disability Index (SPADI) was used to measure pain and disability associated with shoulder pathology. Shoulder exercise program was given to all groups.

**Results:** Statistically significant differences were found between before and after treatment results of all parameters in MT+KT and HILT+MT+KT Groups (p<0.05).

When comparing three groups in means of ROM and SPADI results, statistically significant differences were found between all groups (p<0.05). These differences were significant especially between MT+KT and KT groups (all p<0.05) and HILT+MT+KT and KT groups (all p<0.05).

**Conclusion:** HILT and MT are found more effective in decreasing pain and disability and increasing ROM in patients with SAIS. Further studies with follow up periods are needed for determining the advantages of these treatments and would provide better information for rehabilitation programs.

1631 Board #284 June 2, 8:00 AM - 9:30 AM

**Comparison Of High And Low Volume Eccentric Resistance Training In Patients With Jumper'S Knee**

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(No relationships reported)

**PURPOSE:** Eccentric strength training has shown to reduce pain and improve functionality in patients with patellar tendinopathy (PT) known as "jumper's knee". The purpose of this study was to compare the effects of a high and a low volume bodyweight strength training on a decline board on pain and functionality.

**METHODS:** A total of thirteen physical active male patients with chronic PT (age 23,6 ± 3,80 years) participated in this study. Subjects were randomly assigned to two groups. Group 1 (low volume; n=7) trained three times per week for eight weeks on a decline board (25°) with one set of 15 repetition and at least 48 h rest between sessions. Group 2 (high volume, n=6) followed the same regime but with three sets of 15 repetitions. No other physical activities were allowed during the first 6 weeks. During the last two weeks of the study the participants returned to their individual sport in addition to the intervention. The Victorian Institute of Sportassessment questionnaire for functionality (VISA) and a numerical rating scale for pain (NRS) was observed at baseline, after week 4 and at the end of the intervention.

**RESULTS:** Both groups showed similar improvements (time effect) during the 8 week intervention for the VISA and the NRS with no significant group effects. VISA: group one (low volume): 30.86 points and group two (high volume): 33 points. NRS: group one and group two: four points each.

**CONCLUSIONS:** The results of this study showed that higher volume of eccentric training on a decline board had no significant advantage compared to lower volume in athletes with PT.

However, more studies with a higher number of participants are needed to confirm our findings.

1632 Board #285 June 2, 8:00 AM - 9:30 AM

**Effects of "Throwers Ten" Exercise Program for Injury Prevention in Adolescent Overhead Athletes: A Randomized Controlled Trial**

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Throwers Ten (T10) exercise program was designed for overhead athletes and commonly used in clinic or field settings. However, it is unknown whether T10 exercise program can also be suggested as an effective injury prevention program.

**PURPOSE:** To investigate the effects of T10 exercise program on injury occurrence in adolescent overhead athletes. The authors hypothesized that T10 exercise program is effective in reducing the rates of injury in adolescent overhead athletes. **METHODS:** The authors randomized 8 teams of the same club. Four teams were allocated to the intervention group (49 athletes), and 4 teams were allocated to the control group (31 athletes). T10 exercise program was performed two sets in a week additional to the routine training program during the season in the intervention group.

Athletes performed their routine training program during the season in the control group. The authors conducted an injury surveillance program during a 9-months season. The primary outcome was any injury to the athletes. The secondary outcome was any injury to the upper extremity. Injury occurrence and location in the body, type of injury on upper extremities were recorded. Statistical analyses were done with chi-square test. **RESULTS:** During the 9-months season, upper extremity injury rates were 14.3% (n=7) and 25.8% (n=8) in the intervention group and control group, respectively. 70% (n=5) interphalangeal sprain and 30% (n=2) rotator cuff tendinitis were observed in the intervention group. 12% (n=1) shoulder dislocation, 12% (n=1) rotator cuff tendinitis and 75% (n=6) interphalangeal sprain were diagnosed in the control group. However, there was no statistically significant difference between groups (p=0.19). **CONCLUSION:** The findings of this study revealed that the T10 exercise program has no effect in reducing the rates of injuries in adolescent overhead athletes. Further studies with more focus on exercise compatibility and larger sample size are warranted.

**C-43 Free Communication/Poster - Resistance Exercise/Strength Training/HIIT**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
 Room: Exhibit Hall A/B

**1633 Board #286 June 2, 8:00 AM - 9:30 AM  
 Twelve Weeks Of Explosive Strength Training Increases Both Maximal And Explosive Voluntary Torque Production**

Thomas G. Balshaw<sup>1</sup>, Garry J. Massey<sup>1</sup>, Thomas M. Maden-Wilkinson<sup>1</sup>, Neale A. Tillin<sup>2</sup>, Jonathan P. Folland, FACSM<sup>1</sup>.  
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Muscle weakness, including low maximal & explosive strength, contribute to the functional limitations experienced by numerous patient groups, including osteoarthritis patients. Strength training can improve function in different populations. However, adaptations to different types of strength training are not well understood which limits the efficacy of training prescription. Explosive training (ET), involving rapid torque development with short duration contractions, provides a less fatiguing loading modality that may be preferably tolerated by patient groups.

**PURPOSE:** The purpose of this study was to compare the functional, neural, & morphological adaptations to ET vs. conventional training (CT).  
**METHODS:** Healthy males completed ET (n=13) or CT (n=16) for 12-wks. Training involved 4 x 10 repetitions (x3/wk): contracting as fast & hard as possible for ~1 s (ET); or gradually increasing to 75% maximal voluntary torque (MVT) before holding for 3 s (CT). Torque & EMG during maximal (MVT & QEMGMVT) & explosive (T100 & EMG0-100) contractions, & total Quadriceps volume (QUADSVOL) were measured pre & post. Absolute changes were considered different between groups when: post hoc P-values were <math>\leq 0.05</math> & effect size (ES) was >math>0.5</math>.  
**RESULTS:** MVT improved after both types of training (CT: +56 ± 23 Nm; ET: +40 ± 22 Nm), but increased more following CT (P=0.052; ES=0.69). There were similar EMGMVT changes after CT (+0.06 ± 0.03 mV) & ET (+0.04 ± 0.08 mV; P=0.449; ES=0.36), but QUADSVOL increases after CT (+148 ± 135 cm<sup>3</sup>) were greater than ET (+46 ± 137 cm<sup>3</sup>; P=0.074; ES=0.74). Improvements in T100 were greater after ET (+23 ± 25 Nm) vs CT (+7 ± 18 Nm; P=0.092; ES=0.72). Changes in EMG0-100 were greater with ET (+0.03 ± 0.04 mV) than CT (+0.01 ± 0.04 mV), but did not reach significance (P=0.253; ES=0.46).  
**CONCLUSIONS:** These results provide evidence for distinct neural & morphological adaptations specific to the training stimulus. However, given the lower contraction durations, fatigue & effort involved in ET, this type of training appears to provide an efficient means of increasing maximal & explosive function in previously untrained individuals.

**1634 Board #287 June 2, 8:00 AM - 9:30 AM  
 Muscle adaptation to 21 Straight Days of Elbow Flexor Exercise in Trained Individuals**

Scott J. Dankel<sup>1</sup>, Brittany R. Counts<sup>1</sup>, Brian E. Barnett<sup>2</sup>, Samuel L. Buckner<sup>1</sup>, Takashi Abe<sup>3</sup>, Michael C. Zourdos<sup>4</sup>, Jeremy P. Loenneke<sup>1</sup>. <sup>1</sup>The University of Mississippi, University, MS. <sup>2</sup>Delta State University, Cleveland, MS. <sup>3</sup>National Institute of Fitness and Sports in Kanoya, Kagoshima, Japan. <sup>4</sup>Florida Atlantic University, Boca Raton, FL.  
 (No relationships reported)

It is recommended for individuals engaging in resistance training to allow at least 48 h of recovery before repeating exercise which stresses the same muscle group. Despite this, studies have shown that training frequencies as high as four, five, or even six days per week have yielded robust increases in muscle size and strength; however, protocols implementing greater frequencies remain untested.

**PURPOSE:** To determine the muscle size and strength adaptations following 21 straight days of elbow flexion exercise in well trained individuals.  
**METHODS:** Using a within subject design, five trained individuals were assigned both a control and experimental arm in a randomized fashion. The control arm performed a one repetition maximum (1RM) and maximal voluntary isometric contraction (MVC) every day for 21 straight days, while the experimental arm performed the same 1RM and MVC test in addition to three sets of elbow flexion exercises at 70% 1RM. Pre to post muscle thickness and strength differences within each condition and median differences between conditions were determined using non-parametric Wilcoxon tests. All significance was set at p ≤ .05. Data are presented as median (25th, 75th percentile).  
**RESULTS:** 1RM strength increased from Pre to Post in both the experimental [Pre: 25.2 (22.6, 33.1), Post: 27.7 (25.1, 34.9) kg] and control [Pre: 22.5 (21.8, 32.6), Post:

25.0 (23.7, 34.2) kg] (p=0.043) arm, with no difference between arms (p=0.345). Individual data plots indicated that muscle growth occurred in the experimental arm for all individuals, however no changes in muscle size were observed at any location in the control arm. Median muscle size differences within the experimental condition were as follows: 50% (Pre: 3.8, Post: 4.2 cm; p=0.066), 60% (Pre: 4.4, Post: 4.7 cm; p=0.034) and 70% (Pre: 4.9, Post: 5.0 cm; p=0.066). Median differences in muscle size between the experimental and control arms found significant differences at the 50% site (p=0.041) with a trend at the 60% (p=0.068) and 70% (p=0.059) sites.  
**CONCLUSIONS:** Everyday training of the same muscle group appears to be effective for increasing muscle size over a relatively short duration, in trained individuals. Additionally, performing only 1RM testing every day may increase 1RM strength, which does not appear to be augmented by greater exercise volume.

**1635 Board #288 June 2, 8:00 AM - 9:30 AM  
 The Acute Response to No Load Exercise: Is it Sufficient?**

Brittany R. Counts, Samuel L. Buckner, Scott J. Dankel, Matthew B. Jessee, Kevin T. Mattocks, J Grant Mouser, Gilberto C. Laurentino, Jeremy P. Loenneke. *The University of Mississippi, University, MS.*  
 (No relationships reported)

Independent of load used, muscle activation is argued to be the most important factor for growth. Though previously untested, it stands to reason that voluntarily contracting a muscle through a full range of motion without an external load may also lead to substantial muscle activation.

**PURPOSE:** To investigate the acute responses of muscle cell swelling, fatigue and muscle activation between No Load and High Load resistance exercise.  
**METHODS:** 12 participants completed two separate visits of acute testing. Participants had one arm randomly designated to No Load and the contralateral arm to High Load (70% 1RM) training. No Load training consisted of 4 sets of 20 maximal repetitions, with 30 seconds of rest between sets. High Load completed 4 sets of 8-12 reps with 90 seconds of rest between sets. On the first acute testing day, muscle cell swelling was measured at pre, post and 15 min post. During the second visit, maximal voluntary contractions (MVC) at 90 degrees of elbow flexion was completed pre, post and 15 minutes post. Electromyography (EMG) amplitude of the biceps and triceps were measured during each set. A repeated measures ANOVA determined if differences existed and significance was set at p ≤ .05. Data are presented as means (SD).  
**RESULTS:** There was a time main effect for MVC (p=0.019) and muscle swelling (p<0.001). MVC decreased from Pre to Post [40.8 (13.2) vs. 36 (9.1) Nm p=0.037] and remained decreased at 15 minutes post exercise [35.8 (11.5) Nm, p<0.001]. Swelling increased from Pre to Post [3.5 (0.6) vs. 3.8 (0.6) cm, p<0.001] and remained increased at 15 minutes post exercise [3.7 (0.7) cm, p<0.001]. There were no EMG differences for biceps of the first 3 reps but there was a condition main effect for the last 3 reps, with High Load being greater than No Load [86 (27) vs. 51 (23) %MVC, p=0.03]. For triceps, there was a condition main effect with the High Load being less than No Load for the first 3 [10 (3) vs. 34 (10) %MVC, p<0.001] and last 3 repetitions [12 (3) vs. 32 (13) %MVC, p<0.001].  
**CONCLUSIONS:** We suggest that high levels of muscle activation can occur without the use of an external load. There are slight differences between the No Load and High Load training, however, the overall response appears similar. Training studies are needed to determine if these acute differences are related to chronic change in muscle size and strength.

**1636 Board #289 June 2, 8:00 AM - 9:30 AM  
 Comparisons of Volume between Agonist-Antagonist Paired Sets and Traditional Sets**

Veronika Pribislavska, Brett A. Davis, John M. Coons. *Middle Tennessee State University, Murfreesboro, TN.* (Sponsor: Dr. Don W Morgan, FACSM)  
 (No relationships reported)

Agonist-antagonist paired set (APS) training refers to resistance training that focuses on grouping exercises targeting the agonist and antagonist muscle groups in an alternating manner. **PURPOSE:** The current study compared set and total volumes between traditional (TRA) and APS resistance training during a flat bench press.  
**METHODS:** Nineteen male participants (age = 22.47 ± 1.80 years; height = 176.95 ± 6.53 cm; weight = 93.14 ± 28.08 kg) completed three resistance training sessions. One repetition maximum (RM) bench press and 20 RM seated cable rows were measured during the first session. Trial two and three were the experimental sessions consisting of TRA or APS protocols conducted in a randomized, counterbalanced design. During the trials, three sets of bench press to volitional failure (80% 1RM) were completed with 3-minute rest intervals between each set. During APS protocol, the rest period included 10 repetitions of seated cable rows (20RM load).  
**RESULTS:** The mean 1RM bench press, 80% 1RM bench press, and 20RM cable rows was 124.2 ± 23.5 kg, 99.8 ± 19.3 kg, and 51.0 ± 7.24 kg, respectively. A two-factor repeated measures analysis of variance revealed significant decreases in volume for both TRA (set 1: 1632.7 ± 386.4

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kg; set 2: 1190.0 ± 209.2 kg; set 3: 930.1 ± 172.4 kg) and APS (set 1: 1579.1 ± 332.8 kg; set 2: 1172.0 ± 269.6 kg; set 3: 909.1 ± 232.4 kg) as the sets progressed through the exercise session ( $p < .001$ ). These decreases were similar between both methods ( $p = .471$ ). There was not a significant interaction of volume between the APS and TRA groups ( $p = .772$ ). **CONCLUSION:** The results indicate that there were no differences in volume between TRA and APS resistance session. The APS training appears to be a time efficient alternative to TRA resistance training.

1637 Board #290 June 2, 8:00 AM - 9:30 AM

**Beta2-adrenergic Sensitivity Prior To Training Is Related To ERK MAPK Down-regulation Following Resistance Exercise Overtraining.**

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(No relationships reported)

Epinephrine (E) and norepinephrine (NE) basal excretion, and beta2-adrenergic ( $\beta_2$ ) receptor content are altered after overtraining (OT). Recent literature implicates  $\beta_2$  signaling in the maintenance of skeletal muscle mass and phenotype.  $\beta_2$  signaling in skeletal muscle involves the signaling protein extracellular signal-regulated kinase (ERK). To date, no study has investigated the E- $\beta_2$ -ERK signaling axis in OT humans. **PURPOSE:** To determine if basal sensitivity of epinephrine (E/ $\beta_2$ ) and norepinephrine (NE/ $\beta_2$ ) were related to changes in ERK activity following a period of resistance exercise OT. **METHODS:** Sixteen males were randomized into an overtraining group (OT: n=8, age=20.6 ± 2.1 yrs, ht=179±10cm, body mass=78.6±12.1kg) or control group (CON n=8, age=19.8±1.7 yrs, ht=179±6cm, body mass=76.7±9.7kg). The OT group performed 10 X 1 at 100% 1 RM daily for 2 wks. CON performed normal training 2 days/wk. Muscle biopsies from the vastus lateralis muscle and nocturnal urinary E and NE were assessed before (pre) and after (post) overtraining. Biopsies were analyzed for total-ERK and ratio of phosphorylated ERK (pERK) via western blotting. The ratio of pERK was corrected for changes in total-ERK content between pre and post training. Multiple regression was used to determine if E/ $\beta_2$  and NE/ $\beta_2$  (independent variables) were significantly related to changes in pERK (dependent variable) after training. Significance was set at  $p < .05$ . **RESULTS:** When groups were analyzed together, E/ $\beta_2$  and NE/ $\beta_2$  at pre explained 64% of variance in the change of pERK at post ( $F[2,13]=14.4$ ,  $p=.001$ , adj.  $R^2=.641$ ). When analyzed separately, OT E/ $\beta_2$  and NE/ $\beta_2$  at pre explained 78% of variance in the change of pERK at post ( $F[2,5]=13.2$ ,  $p=.01$ , adj.  $R^2=.778$ ). Both independent variables significantly contributed to the model (E/ $\beta_2$ :  $b=-1.05$ ,  $t=-4.89$ ,  $p<0.001$ ; NE/ $\beta_2$ :  $b=1.07$ ,  $t=4.99$ ,  $p<0.001$ ). In CON, E/ $\beta_2$  and NE/ $\beta_2$  at pre did not explain any variance in pERK at post ( $F[2,5]=.035$ ,  $p=.966$ , adj.  $R^2=.014$ ). **CONCLUSION:** While preliminary, it appears subjects with lower catecholamine sensitivity prior to stressful training may be predisposed for greater down-regulation of ERK after OT. Furthermore, while  $\beta_2$  sensitivity is related to impaired ERK activity after OT, ERK activity following normal training is likely mediated in part, by other mechanisms.

1638 Board #291 June 2, 8:00 AM - 9:30 AM

**Satellite Cell Reponse to Concurrent Resistance Exercise and High Intensity Interval Training in Overweight/Obese Individuals**

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(No relationships reported)

It is recommended that individuals perform a combination of resistance and endurance exercise to improve cardio-metabolic health. Lack of time is often cited as a reason for being unable to do so. Therefore, combining both in one session may be beneficial. However, work continues to elucidate whether an interference in adaptive outcomes occur when resistance and endurance exercise are performed concurrently.

**PURPOSE**

To determine whether concurrent resistance exercise (RE) and high intensity interval training (HIIT) acutely alters the satellite cell density and activity following exercise compared to single-mode resistance exercise.

**METHOD**

In a balanced crossover design, 8 sedentary overweight/obese individuals (3 male, 5 females) performed either RE only (8 x 8 leg extensions at 70% 1 RM), or RE followed by HIIT (RE + HIIT; 10 x 1 min at 90% HR<sub>max</sub> on a cycle ergometer). Muscle biopsies were obtained before exercise and at 96 h after the RE component. Fiber type-specific satellite cell density (Pax7<sup>+</sup> cells) and activity (MyoD<sup>+</sup> cells) were analysed by immunofluorescence microscopy. Two-way repeated-measure ANOVA was used for statistical analysis.

**RESULTS**

The number of mixed muscle fiber satellite cells (Pax7<sup>+</sup> cells) increased by 27% at 96 h compared to baseline ( $P<0.05$ ) with no difference between exercise trials. There was

a 60% increase in muscle fiber type-I-specific satellite cell number at 96 h compared to baseline ( $P<0.05$ ), but no significant difference in type II muscle fibers. In mixed muscle fibers, the increase ( $P<0.05$ ) in MyoD<sup>+</sup> cells at 96 h compared to baseline for both exercise trials was greatest in RE (98% vs. 48% in RE + HIIT). In both exercise trials, there was an increase in MyoD<sup>+</sup> cells per type I muscle fibers (120%,  $P<0.05$ ), but no significant difference in type II muscle fibers.

**CONCLUSION**

Combining the additional HIIT session to RE does not interfere with the increase in satellite cell density when compared to RE only. However following the concurrent exercise, in this study, there are fewer active satellite cells. This may attenuate the number of myogenic precursors cells, a key requirement for hypertrophy.

**ACKNOWLEDGEMENTS**

This work was in part supported by Technogym, The Wellness Company and the National Institute for Health Research (NIHR) Diet, Lifestyle & Physical Activity Biomedical Research Unit.

**C-44 Free Communication/Poster - Respiratory**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM

Room: Exhibit Hall A/B

1639 Board #292 June 2, 9:00 AM - 10:30 AM

**The Effects of Chest Wall Loading on Pulmonary Function, Muscle Perfusion, Exercise Performance and Fatigue**

Sarina Verma, Brock Bakewell, Anders Gundersen, Ethan Pelletier, Stephen Ives. *Skidmore College, Saratoga Springs, NY.*  
(Sponsor: Paul Arciero, FACSM)

(No relationships reported)

Past studies have shown that altering the work of breathing (WOB), and thus pulmonary muscle  $\dot{V}O_2$ , negatively impacts peripheral  $O_2$  delivery and thus metabolic function during exercise, though it remains elusive whether such physiological changes associated with altered WOB affect exercise performance. **PURPOSE:** To determine the effects of increased WOB, induced by chest wall restrictive loading (CWL) on central and peripheral fatigue, pulmonary and metabolic function, muscle perfusion, and exercise performance. **METHODS:** Using a randomized crossover study design, after completing a familiarization visit, 23 young healthy males completed a 5 km time trial on a cycle ergometer under control (no vest) and CWL (weighted vest with 10% body weight). Pulmonary function (forced vital capacity, FVC; and forced expiratory volume in 1 second; FEV<sub>1.0</sub>) and indices of fatigue (Visual analog scale; VAS, and maximal handgrip strength) were recorded pre- and post-exercise. During exercise, tidal volume ( $V_T$ ), breathing frequency ( $f_R$ ), minute ventilation ( $\dot{V}_E$ ), oxygen consumption ( $\dot{V}O_2$ ), rating of perceived exertion (RPE), power output (PO), blood lactate (BLa), and Near Infrared Spectroscopy (NIRS) assessment of total hemoglobin (THb), oxyhemoglobin (HbO), deoxyhemoglobin (HHb), and tissue oxygen saturation (StO<sub>2</sub>) were recorded. **RESULTS:** Pre-exercise CWL reduced ( $p<0.05$ ) FVC (5.64±0.2 v. 5.54±0.1 L) and FEV<sub>1.0</sub> (4.81±0.1 v. 4.65±0.1 L). CWL decreased PO (237±1 v. 234±1 watts,  $p<0.05$ ) and tended to increase 5 km time (461±12 vs. 470±12 sec, control v. CWL,  $p>0.05$ ). CWL reduced  $V_T$  and  $\dot{V}_E$  (effect of condition,  $p<0.05$ ) while  $\dot{V}O_2$  and  $B_i$  were unchanged ( $p>0.05$ ). CWL tended to elevate RPE (final: 6.6±0.3 v. 6.9±0.2) and BLa (final 10.3±0.5 v. 11.5±0.3 mmol) (both  $p>0.05$ ). No differences were observed between trials in THb, HbO, HHb, or StO<sub>2</sub>. No differences were found between trials in Pre- to post-exercise VAS or handgrip. **CONCLUSION:** Increased work of breathing induced by chest wall loading reduces pulmonary function and ventilation, while increasing lactate and perception of fatigue, which contribute to reduced power output and slower 5km TT performance. Thus modest elevations in the work of breathing, such as might be experienced with wearing a water pack, can compromise physiological function and performance.

1640 Board #293 June 2, 9:00 AM - 10:30 AM

**Task Specific Locomotor Training Effects On Ventilatory Drive In Men With Incomplete Spinal Cord Injury**

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(No relationships reported)

Exercise hyperpnea transitions toward a steady state through a feed-forward coupling of locomotor activation and a cortical irradiation pathway, which occurs prior to blood metabolite stimulation of the respiratory center. During a constant work rate (CWR) the transition curve is characterized by a sudden exponential rise in Phase I and II expired minute ventilation (VE) resolving in a Phase III steady state. However, in

adults with incomplete spinal cord injuries (iSCI) efferent and afferent neural coupling is often impaired, potentially altering ventilatory control. Purpose: This study aimed to characterize exercise hyperpnea during a rest to CWR transition and the effects of 15 weeks of task-specific locomotor training (LT) on CWR hyperpnea. Participants: Subjects were 4 adult males with iSCI (age 24.75±7.80 yrs; BMI 20.4±5.1 kg·m<sup>2</sup>) with C4/C5 lesions capable of step initiation and independent standing. Methods: LT principles included: practice variability, progressive overload and task specificity. Individual sessions included 5 segments: joint mobility, volitional muscle activation, task-isolation, task-integration, activity rehearsal. Training occurred 2x/week for 90 minutes focusing on developing walking efficiency through mastering the specific components of the gait cycle. All activities were weight-bearing and under volitional control. Assistance was only given when needed to ensure safety. Six minutes of CWR treadmill walking was performed before and after the LT at self-selected pace (0.5 or 0.7mph), with pulmonary gas analysis throughout the tests. VE line of best fit was predicted with linear regression and compared to actual VE observed (VE OBS - VEPred=VE variability), with VE variability assessed via an f-statistic. Results: Suitability of linear regression was checked through visual inspection of CWR VE data. Prediction error variability decreased on average by 69% (p<0.001) after LT in 3 of 4 participants. Conclusion: CWR VE from rest to work was linear throughout the transition with no phase III plateau. A significant level of VE variability was observed before LT. In 3 of the 4 participants, VE variability was reduced by 69% after 15 weeks of LT. In these subjects with iSCI, it appears 15 weeks of LT improves exercise hyperpnea by reducing the variability in VE.

1641 Board #294 June 2, 9:00 AM - 10:30 AM  
**Effects Of Inspiratory Muscle Training On Inspiratory And Locomotor Muscle Hemodynamics During Exercise In Men**

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 (No relationships reported)

High levels of respiratory muscle work may elicit a redistribution of blood flow from the locomotor to the respiratory muscles during exercise. It is unknown if specific inspiratory muscle training (IMT) can attenuate this response during high-intensity, whole-body exercise. PURPOSE: To examine the hemodynamic responses of multiple inspiratory muscles and the vastus lateralis (VL) during incremental cycling before and after 5 weeks of IMT. METHODS: After a comprehensive familiarization visit, 25 recreationally active healthy men (mean±SD; age=24±4; maximal aerobic power (VO<sub>2max</sub>)=52±10 ml·kg<sup>-1</sup>·min<sup>-1</sup>) completed two maximal incremental cycle exercise tests (25W/2min steps) separated by 5 weeks of pressure threshold IMT or sham-control training (SC). The IMT group (n=12) performed 30 inspiratory efforts twice daily against a minimum resistance of 50% of maximum inspiratory pressure (MIP), adjusted weekly. The SC (n=13) group performed a daily bout of 60 inspiratory efforts against 10% MIP using the same device with no weekly adjustments. During the incremental cycle tests, participants were instrumented with NIRS optodes on the sternocleidomastoid (SCM), parasternal intercostals (PIC), 7<sup>th</sup> intercostal space (7IC), and VL to measure changes in oxygenated, deoxygenated, and total hemoglobin (tHb) concentrations. RESULTS: The IMT and SC groups were well matched for age, height, mass, and VO<sub>2max</sub>. There was a significant increase in MIP in the IMT group (mean±SD, 135±44 vs. 159±35 cmH<sub>2</sub>O, p<0.05) but not in the SC group (134±39 vs. 134±44 cmH<sub>2</sub>O, p>0.05). No differences were detected when comparing pre vs. post-IMT for any NIRS derived variables at relative percentages of maximal work rate (20, 40, 60, 80, 100%) for any muscle in both the IMT and SC groups. The tHb (muscle blood volume) at the highest equivalent absolute work rate achieved by an individual on each test in the IMT group (pre vs. post-IMT) was 3±15 vs. 1±25, 1±9 vs. 2±11, -6±12 vs. -6±12, and 12±10 vs. 11±9ΔμM whereas the SC group was 2±11 vs. 3±6, 1±9 vs. 4±8, -6±6 vs. -6±8, and 12±8 vs. 9±10ΔμM in the SCM, PIC, 7IC, and VL, respectively (all p>0.05). CONCLUSION: Five weeks of pressure-threshold IMT had no effect on respiratory or locomotor muscle hemodynamics during incremental cycle exercise in healthy recreationally active men.

Supported NSERC

1642 Board #295 June 2, 9:00 AM - 10:30 AM  
**Dyspnea Intensity, Descriptors, And Negative Symptoms During Exercise In Obese And Nonobese Children**

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 (No relationships reported)

**PURPOSE:** The purpose of this study was to examine dyspnea intensity, descriptors, and associated negative symptoms during exercise in 10 and 11 year old obese and nonobese children.

**METHODS:** 12 obese (9 boys, age: 11.3 ± 0.6y, height: 149.7 ± 6.7cm, mass: 65.8 ± 14.4kg, BMI percentile: 97.5 ± 1.4, body fat: 46 ± 3%) and 11 nonobese (5 boys, age: 10.8 ± 0.5y, height: 143.3 ± 5.2cm, mass: 35.8 ± 3.8kg, BMI percentile: 50.3 ± 21.5, body fat: 27 ± 6%) underwent 3 constant load exercise tests for 6 minutes each (at 40W, 50% of VO<sub>2max</sub>, and 50% of VO<sub>2max</sub> + 20W), and a maximal exercise test. Ratings of perceived breathlessness (RPB), ratings of perceived exertion (RPE), top 3 descriptors related to dyspnea, and negative symptoms related to dyspnea (unpleasantness, depression, anxiety, frustration, fear, and anger) on a visual analog scale (VAS) were measured. Also, parents reported whether their child gets short of breath with exertion during the screening process to ascertain whether the child experienced dyspnea on exertion (DOE) outside the laboratory.

**RESULTS:** 58% of obese children complained of DOE outside of the laboratory, compared to only 9% of nonobese children (P = 0.013). RPB and RPE were not different between obese and nonobese children during each submaximal exercise test for both absolute and relative work rates (P > 0.05). Nonobese children picked 13 out of 15 descriptors of dyspnea within their top 3 during cycling at 40W, with 30% of nonobese children expressing that their "breathing required work". In contrast, obese children picked only 7 (i.e. they felt they were breathing more, their breathing was heavy, rapid, and shallow, required work/effort, and they had difficulty with inhalation). Unpleasantness associated with dyspnea on the VAS scale was higher in nonobese children while cycling at 40W compared with obese children (3.0 ± 1.5 vs. 0.8 ± 0.5; P = 0.001), although relative exercise intensity was similar between groups (P = 0.842).

**CONCLUSIONS:** At both relative and absolute exercise intensities, RPB and RPE were not different between obese and nonobese 10 and 11 year old children. Surprisingly, negative symptoms related to dyspnea were actually greater in the nonobese children. This suggests that obese children are able to tolerate moderate to vigorous intensity exercise to the same extent as nonobese children.

1643 Board #296 June 2, 9:00 AM - 10:30 AM  
**Effect of Inspiratory Resistive Loading on Expiratory Muscle Fatigue**

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 (No relationships reported)

Expiratory resistive loading elicits inspiratory as well as expiratory muscle fatigue, suggesting parallel co-activation of the inspiratory muscles during expiration. It is unknown whether the expiratory muscles are similarly co-activated to the point of fatigue during inspiratory resistive loading (IRL). PURPOSE: To determine whether IRL elicits expiratory as well as inspiratory muscle fatigue. METHODS: Healthy male subjects (n=9) underwent isocapnic IRL to task failure (60% maximal inspiratory pressure, 15 breaths/min, 0.7 inspiratory duty cycle). Abdominal and diaphragm contractile function was assessed at baseline and at 3, 15 and 30 min post-IRL by measuring gastric twitch pressure (Pga,tw) and transdiaphragmatic twitch pressure (Pdi,tw) in response to potentiated magnetic stimulation of the thoracic and phrenic nerves, respectively. Electromyographic activity of the diaphragm, rectus abdominis, and external oblique was monitored to ensure consistency of stimulation. Fatigue was defined as >15% reduction from baseline in Pga,tw or Pdi,tw. RESULTS: During IRL (mean±SE; 15.0±2.5 min), mean arterial pressure (MAP) and heart rate (HR) increased in a time-dependent manner (13 mmHg and 50 beats/min for the final min, respectively). Peak Pdi was significantly lower during the final min of IRL than during the first min (p<0.05). Peak Pga did not change significantly throughout IRL. Pdi,tw was significantly lower than baseline (34.3±3.2 cmH<sub>2</sub>O) at 3 min (23.2±1.9 cmH<sub>2</sub>O, p<0.001), 15 min (24.2±1.7 cmH<sub>2</sub>O, p<0.001) and 30 min post-IRL (26.3±2.0 cmH<sub>2</sub>O, p<0.001). Pga,tw was not significantly different from baseline (37.6±5.7 cmH<sub>2</sub>O) at 3 min (36.5±4.9 cmH<sub>2</sub>O), 15 min (33.7±4.13 cmH<sub>2</sub>O) and 30 min post-

IRL (32.9±3.8 cmH<sub>2</sub>O). CONCLUSION: IRL elicits objective evidence of diaphragm, but not abdominal, muscle fatigue. Agonist-antagonist interactions for the respiratory muscles appear to be more important during expiratory versus inspiratory loading. Funding: NSERC

1644 Board #297 June 2, 9:00 AM - 10:30 AM  
**Ventilatory Strategies Of Competitive Swimmers During Incremental Swimming And Cycling Tests To Exhaustion**

Benjamin C. Skutnik<sup>1</sup>, Ting Li<sup>2</sup>, Joel M. Stager, FACSM<sup>1</sup>, Yifan Lu<sup>2</sup>, Chris Brammer<sup>1</sup>. <sup>1</sup>Indiana University, Bloomington, IN. <sup>2</sup>Beijing Sport University, Beijing, China.  
 (No relationships reported)

Ventilation while swimming is generally constrained by the medium (water) and the obligatory timing associated with arm mechanics. Attempts at describing ventilation have been similarly constrained and therefore little published data exists on operating lung volumes and pulmonary function while swimming at maximal efforts. This is in contrast to the considerable data available for cycling and running.

**PURPOSE:** To compare swimming and cycling exercise modes on ventilatory variables.

**METHODS:** Ten trained, competitive men swimmers (age = 24.4 ± 1.9 yrs) were asked to perform two incremental exercise tests to volitional exhaustion on separate days, one on a cycle ergometer and a second while swimming in a flume. Tidal volume (V<sub>T</sub>), peak tidal flow inspired (P<sub>Ti</sub>) and expired (P<sub>Te</sub>), time to inspire (T<sub>i</sub>) and expire (T<sub>e</sub>), total tidal time (T<sub>T</sub>), duty cycle (T<sub>i</sub>/T<sub>T</sub>), and ventilatory capacity (V<sub>cap</sub>) were assessed repetitively in both conditions via flow-volume loops. Maximum aerobic capacity (VO<sub>2peak</sub>) and ventilation (V<sub>E</sub>) were measured via open flow calorimetry. All variables were recorded over the final minute of each incremental exercise test. Paired t-tests were used to compare the exercise modes, with the level of significance set at 0.05.

**RESULTS:** In the final minute of the incremental test to exhaustion, swimming resulted in a smaller P<sub>Ti</sub> (4.74 ± 0.29 vs. 5.66 ± 0.29 L·s<sup>-1</sup>; p<0.05), but a greater P<sub>Te</sub> (7.00 ± 0.20 vs. 6.03 ± 0.38 L·s<sup>-1</sup>; p<0.05) than for cycling. T<sub>i</sub> (0.76 ± 0.05 vs. 0.63 ± 0.38s; p<0.05), T<sub>e</sub> (1.48 ± 0.09 vs. 1.28 ± 0.08s; p<0.05), and T<sub>i</sub>/T<sub>T</sub> (56.7 ± 1.1 vs. 49.4 ± 0.7%; p<0.05) were greater for swimming than for cycling. Despite no difference in T<sub>c</sub> (0.58 ± 0.10 vs. 0.65 ± 0.04s; p=0.13), VO<sub>2peak</sub> (3.61 ± 0.21 vs. 3.60 ± 0.14 L·min<sup>-1</sup>, p = 0.95) or V<sub>cap</sub> (189.1 ± 63.0 vs. 165.9 ± 61.3 L·s<sup>-1</sup>; p=0.07) between exercise modes, V<sub>E</sub> was smaller in swimming versus cycling (102.9 ± 5.8 vs. 129.0 ± 7.8 L·s<sup>-1</sup>; p<0.05).

**CONCLUSIONS:** Swimming appears to require changes in ventilatory strategies during maximal efforts as compared to similar exercise performed on a cycle ergometer despite similar metabolic demands. Whether or not this is due to postural differences, hydrostatic influences or the obligatory ventilatory entrainment remains unclear.

1645 Board #298 June 2, 9:00 AM - 10:30 AM  
**Deep Inspirations Attenuate Postprandial Airway Inflammation in Non-Asthmatic Adults: A Randomized Crossover Study**

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 (No relationships reported)

**PURPOSE:** Airway inflammation (measured via exhaled nitric oxide; eNO) increases after a single high-fat meal (HFM). However previous research suggests that exercise, which causes repeated airway stretch due to high ventilation rates, can modify airway inflammation. Yet the research investigating the impact of physical activity on airway inflammation is conflicting and may depend on 1) airway stretch independent of whole body exercise, and 2) initial levels of airway inflammation. The purpose of this study was to investigate whether deep inspirations (DI's: airway stretch to total lung capacity) would attenuate airway inflammation post-HFM. A secondary purpose was to determine the effect of DI's on inflammation in a subgroup of subjects with high initial airway inflammation. **METHODS:** A randomized cross-over design with eighteen college-aged subjects was used (healthy eNO: 7F/7M; high eNO 3M/1F). Following an initial assessment, all subjects completed both a control (CON), and a deep inspiration (DI) condition. In both conditions, subjects performed baseline testing after a 12-hour fast in the following order; airway impedance, standard pulmonary function tests (PFTs), and exhaled nitric oxide (eNO). Following these tests, baseline blood lipids and glucose were assessed. Subjects then had 20 minutes to consume the HFM. In DI, subjects performed 60 DI's to total lung capacity (1 DI every 6 seconds) immediately after baseline testing which were then followed by the HFM. Baseline experimental measurements were repeated at 2 and 4 hours post-HFM in both conditions.

**RESULTS:** Blood lipids and glucose increased significantly in both conditions (CON, p<0.001; DI, p=0.046) with no significant difference between the healthy and high eNO subgroups. Pulmonary function and airway impedance did not significantly

change in either condition or between groups. There was a significant increase in eNO in healthy eNO subjects (CON: ~3ppb at 2 hours; DI ~2.5 ppb at 4 hours), and in high eNO (CON: ~9 ppb at 2 hours; p=0.027). However DI's abolished the increase in the high eNO subgroup (~6 ppb decrease at 2 hours; p=0.319). **CONCLUSION:** In subjects with healthy eNO levels, DI's attenuated the initial rise in eNO post-HFM. In the high eNO subgroup, DI's abolished airway inflammation post-HFM.

1646 Board #299 June 2, 9:00 AM - 10:30 AM  
**Relationship Between The Change In DLCO With Albuterol And The Change In DLCO With Exercise**

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Stimulation of the Beta<sub>2</sub> Adrenergic Receptors (B<sub>2</sub>AR) induces lung fluid clearance through Epithelial Sodium channels (ENaC) on alveolar cells. We previously demonstrated that both albuterol and exercise increase the diffusing capacity of the lung (DLCO), alveolar-capillary membrane conductance (D<sub>M</sub>), and D<sub>M</sub> corrected for pulmonary capillary blood volume (Vc)(D<sub>M</sub>/Vc). The improvement in diffusing capacity with exercise could be a direct result of B<sub>2</sub>AR stimulation or simply an increase in lymphatic drainage due to augmentations in tidal volume (Vt) and minute ventilation (VE). **PURPOSE:** To investigate the relationship of the change in DLCO (and components, D<sub>M</sub> and Vc) with albuterol and the change in DLCO and components with exercise to determine B<sub>2</sub>AR involvement. **METHODS:** Healthy participants (N=30) completed a maximal VO<sub>2</sub> test for baseline capacity, followed by 2 visits measuring lung diffusing capacity for carbon monoxide and nitric oxide, and functional ventilatory parameters. Measurements were taken at rest and 30-minutes post-albuterol administration or at peak exercise. **RESULTS:** At rest and at peak exercise there were significant relationships in DLCO, D<sub>M</sub>, and D<sub>M</sub>/Vc between the albuterol visit and the exercise visit (DLCO: r=0.90 and 0.78, D<sub>M</sub>: r=0.77 and 0.67, D<sub>M</sub>/Vc: r=0.58 and 0.48 for rest and peak exercise, respectively, p<0.05 for all). Exercise resulted in a significant increase in DLCO and D<sub>M</sub> when compared to albuterol (DLCO=45±16% vs. 0.78±7.6%, D<sub>M</sub>=40±24% vs. 2.8±13% for exercise and albuterol, respectively, p<0.05). There was no relationship between changes in DLCO and D<sub>M</sub> with albuterol when compared to changes with exercise, but the change in D<sub>M</sub>/Vc under the two conditions was trending towards significance (r=0.35, D<sub>M</sub>/Vc=11.5±8.3% and D<sub>M</sub>/Vc=6.4±5.2% for exercise and albuterol, respectively, p=0.06). There was a significant relationship (p<0.05) between the change in Vt and DLCO with exercise, but not with albuterol. **CONCLUSIONS:** The relationship between lung diffusion parameters at peak exercise and following beta-agonist stimulation suggest that at least a portion of this increase is mediated by the B<sub>2</sub>AR. However, DLCO, considered to be a gross measure of the components of lung diffusion, is influenced by changes in ventilation with exercise. Supported by NIH Grant RO1 HL108962-05.

1647 Board #300 June 2, 9:00 AM - 10:30 AM  
**A Prebiotic Galactooligosaccharide Mixture (B-GOS) Reduces Severity of Hyperpnea-Induced Bronchoconstriction and Airway Inflammation**

Neil C. Williams<sup>1</sup>, Michael A. Johnson<sup>1</sup>, Dominick E. Shaw<sup>2</sup>, Ian Spendlove<sup>2</sup>, Jelena Vulevic<sup>3</sup>, Graham R. Sharpe<sup>1</sup>, Kirsty A. Hunter<sup>1</sup>. <sup>1</sup>Nottingham Trent University, Nottingham, United Kingdom. <sup>2</sup>University of Nottingham, Nottingham, United Kingdom. <sup>3</sup>Clasado Research Services, Reading, United Kingdom.  
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 (No relationships reported)

**PURPOSE:** Emerging evidence suggests that the gut microbiota could be a therapeutic target for asthma via the common mucosal system. The aim of the current study was to investigate the effects of prebiotic Bimuno-galactooligosaccharide (B-GOS) supplementation on hyperpnea-induced bronchoconstriction (HIB), a surrogate for exercise-induced bronchoconstriction (EIB), and airway inflammation in adults with asthma.

**METHODS:** In a double blind cross over trial, 10 participants with asthma and HIB (27 ± 7 years; height: 173 ± 8 cm; body mass: 70 ± 9 kg), and 8 control participants without asthma (age: 26 ± 4 years; height: 174 ± 10 cm; body mass: 72 ± 12 kg) were randomized to receive 5.5 g-d-1 of either prebiotic B-GOS or placebo (maltodextrin) for 3 weeks separated by a 2 week washout. HIB severity was based on the peak fall in forced expiratory volume in 1 s (FEV1) following a eucapnic voluntary hyperpnea (EVH) challenge. Markers of airway inflammation included serum concentrations of chemokines (CCL11 and CCL17), tumor necrosis factor alpha (TNF-α), c-reactive protein (CRP), and immunoglobulin E (IgE), and fraction of exhaled nitric oxide (FENO).

**RESULTS:** In the HIB group, the peak fall in FEV1 after EVH was unchanged following placebo (day 0; -880 ± 480 mL, vs day 21; -840 ± 430 mL). Following

B-GOS the peak fall in FEV1 after EVH was attenuated by 40% (day 0;  $-940 \pm 460$  mL, vs. day 21;  $-570 \pm 310$  mL,  $P = 0.004$ ). No changes in pulmonary function in the control group were evident. In the HIB group B-GOS resulted in baseline reductions in CCL17 (day 0;  $399.3 \pm 139.6$  pg mL<sup>-1</sup>, vs. day 21  $323.0 \pm 133.9$  pg mL<sup>-1</sup>,  $P = 0.005$ ) and TNF- $\alpha$  (day 0;  $2.68 \pm 0.98$  pg mL<sup>-1</sup>, vs. day 21  $2.18 \pm 0.59$  pg mL<sup>-1</sup>,  $P = 0.004$ ) and the TNF- $\alpha$  increase after EVH was abolished. Baseline CRP was reduced following B-GOS in both the HIB and control groups ( $P < 0.05$ ). No changes in FENO and CCL11 were evident following either intervention.

**CONCLUSIONS:** B-GOS supplementation attenuated HIB severity in adults with asthma. The associated reduction in markers of airway inflammation suggests that B-GOS may target the underlying immunopathologic features of asthma, thereby attenuating the airway hyperresponsiveness associated with HIB/EIB.

1648 Board #301 June 2, 9:00 AM - 10:30 AM  
**The Effect of Moderate Chest Wall Loading on Fatigue, Performance, and Pulmonary Function in Women**

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While there has been extensive research on the effect of altering work of breathing (WOB) on pulmonary and metabolic function in men, its effect on women is still unknown. Recent work suggests females have a higher oxygen cost of ventilation, and thus might be more susceptible to increased WOB. **PURPOSE:** to determine the effect of increased WOB, via moderate chest wall loading (CWL), in women, both at rest and during a 5km cycle time trial on fatigue, ventilation, oxygen consumption, pulmonary function, microvascular responses, and exercise performance. **METHOD:** After familiarization, in a counterbalanced fashion, 7 females (20±yrs, BMI <30kg/m<sup>2</sup>) performed a 5km time trial (TT) on a cycle ergometer, with and without a weighed vest (CWL; 10% of body weight). Both trials were performed during the 1<sup>st</sup> 7 days of the menstrual cycle with a minimum of 48 hr apart. Pulmonary function (forced expiratory volume in 1sec; FEV1.0, and forced vital capacity; FVC) and fatigue (Visual analog scale; VAS) were measured pre- and post-exercise. Ventilation (VE), oxygen consumption (VO<sub>2</sub>), microvascular responses (Near Infrared Spectroscopy derived total hemoglobin, THb; oxyhemoglobin, HbO; deoxyhemoglobin, Hb; and tissue saturation, StO<sub>2</sub>), and power output (PO), were recorded throughout the 5km TT. **RESULTS:** PO tended to be lower in the CWL v. control ( $105 \pm 5$  v.  $109 \pm 5$  watts,  $p = 0.13$ ) and 5km time slower ( $765.2 \pm 149$  v.  $752.6 \pm 109$  sec,  $p > 0.05$ ). The change in VE was not different between the CWL and the control trial ( $38.5 \pm 16$  v.  $38.5 \pm 14$  L/min,  $p = 0.88$ ). There was no significant difference in the change in FVC between the CWL and control trials ( $-0.138 \pm 0.27$  v.  $-0.036 \pm 0.20$  L) before and after the 5km TT ( $p > 0.05$ ). There was no significant difference in peak VO<sub>2</sub> between the CWL and control ( $34.1 \pm 4$  v.  $32.9 \pm 3$  ml/kg/min,  $p > 0.05$ ) trials. CWL tended to reduce StO<sub>2</sub> ( $59.8 \pm 5.3$  v.  $51.5 \pm 15.0\%$ ), THb ( $37.5 \pm 10.0$  v.  $32.7 \pm 14.7$   $\mu$ M), and HbO ( $22.4 \pm 6.3$  v.  $21.3 \pm 6.6$   $\mu$ M), and increase Hb ( $15.0 \pm 4.3$  v.  $16.8 \pm 3.4$   $\mu$ M), control v. CWL, respectively ( $p > 0.05$ ). The change in VAS was higher in the CWL trial ( $6.0 \pm 1.6$  v.  $4.8 \pm 1.1$ ,  $p < 0.05$ ) **CONCLUSION:** It was demonstrated that CWL, via a weighted vest, tended to reduce microvascular perfusion, lowering StO<sub>2</sub>, decreasing power output, increasing time to complete 5km, and increasing fatigue compared to the control trial.

1649 Board #302 June 2, 9:00 AM - 10:30 AM  
**Increased Post-exercise Lung Volume Does Not Affect Exercise-induced Bronchoconstriction In Asthmatic Adults**

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(No relationships reported)

**PURPOSE:** Due to force coupling between lung parenchyma and intrapulmonary airways, lung volume (VL) has a marked impact on airway caliber. Increased VL has also been shown to disrupt airway smooth muscle actomyosin cross-bridge formation in healthy and asthmatic persons. We hypothesized that elevated operating VL and regular deep lung inflations following an asthmogenic exercise bout would decrease the severity of exercise-induced bronchoconstriction (EIB) in asthmatic adults. **METHODS:** Nine asthmatic adults completed three experimental trials. During all three trials, subjects completed six minutes of cycling exercise at 85% of the peak workrate reached during a graded exercise test. Following exercise, subjects remained on the ergometer with the mouthpiece in place, and performed a maximal volitional flow-volume maneuver every even minute following exercise for a total of 20 minutes. During the first trial, subjects breathed spontaneously during the 20 minute period following exercise (SPON). The second and third trials were randomized and balanced. During one of the trials, minute ventilation was gradually decreased in a stepwise manner during the first ten minutes following exercise (GRAD); during the other

trial, subjects performed an inspiratory capacity every odd minute during the recovery period (IC). Forced expiratory volume 1.0 second (FEV1.0) was compared among the three trials.

**RESULTS:** Nadir post-exercise FEV1.0 (% change baseline) was similar among the three trials (SPON,  $-27.7 \pm 5.3\%$ ; GRAD,  $-22.5 \pm 5.2\%$ ; IC,  $-23.3 \pm 5.1\%$ ;  $P = 0.52$ ). Nadir FEV1.0 also occurred at a similar time after exercise during the three trials (SPON,  $11.1 \pm 1.8$  min; GRAD,  $12.9 \pm 1.5$  min; IC,  $9.1 \pm 1.6$  min,  $P = 0.10$ ). Area under the curve for FEV1.0 was the same during the three trials (SPON,  $47.9 \pm 15.1$  min-l; GRAD,  $50.5 \pm 12.7$  min-l; IC,  $50.5 \pm 13.8$  min-l;  $P = 0.49$ ).

**CONCLUSIONS:** Contrary to our hypothesis, these data suggest that increased VL and regular deep lung inflations after exercise do not attenuate EIB in asthmatic patients. Thus, maintenance of the bronchodilatory influence of increased VL after exercise cessation does not override the opposing stimuli that cause airway narrowing in the asthmatic.

**FUNDING:** Vermont Genetics Network, P20 RR16462 from the INBRE Program of the National Center for Research Resources, NIH.

1650 Board #303 June 2, 9:00 AM - 10:30 AM  
**The 400- And 800-m Track Running Induces Inspiratory Muscle Fatigue In Trained Female Middle-distance Runners**

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Inspiratory muscle fatigue (IMF) may limit exercise performance. A few studies have reported that IMF occurs after short-duration swimming exercise, but whether short-duration running can induce IMF remains unclear. Intra-abdominal pressure is increased during running through diaphragmatic activation to stabilize the spine during movements of the upper limbs. This occurs along with the increased inspiratory muscle effort associated with increased respirations during exercise; thus, we hypothesized that short-duration running exercise would induce IMF. **PURPOSE:** This study was designed to investigate short-duration running-induced IMF. To test this hypothesis we measured maximal inspiratory pressure (MIP) before and after 400-m and 800-m track running sessions. **METHODS:** Eight female middle-distance (400-m, 800-m) runners performed a 400-m and an 800-m running test on an outdoor 400-m tartan athletic track. All the participants were members of a collegiate athletic club and had participated in interscholastic and/or intercollegiate athletic competitions at least once. MIP was measured before whole-body warm-up, and within 2 min after completion of the 400-m and 800-m running tests, using a portable autspirometer. The percentage decrease in MIP from pre-warm up to post-test was considered to represent the IMF associated with each test. **RESULTS:** The mean MIPs were significantly lower after running than before running; values obtained were  $107 \pm 25$  vs.  $97 \pm 27$  cmH<sub>2</sub>O ( $P = 0.01$ ,  $ES = 0.65$ ) and  $108 \pm 26$  vs.  $92 \pm 27$  cmH<sub>2</sub>O ( $P = 0.01$ ,  $ES = 0.74$ ) before vs. after the 400-m and 800-m tests, respectively. The mean MIP after the 800-m test was significantly lower than after the 400-m test ( $P = 0.04$ ,  $ES = 0.48$ ). There was no correlation between IMF value and running time ( $r = 0.53$  and  $r = -0.28$  for either the 400-m and 800-m tests, respectively;  $P > 0.05$ ). **CONCLUSION:** IMF occurs after short-duration running exercise. Coaches could consider prescribing inspiratory muscle training or warm-up in an effort to reduce the inevitable IMF associated with maximal effort running.

1651 Board #304 June 2, 9:00 AM - 10:30 AM  
**Compensating For The Dynamic Response Of A Commercially-available Oesophageal Balloon-catheter**

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The measurement of oesophageal pressure ( $P_{oes}$ ) allows for the calculation of several important parameters of respiratory mechanics, such as: the work of breathing, respiratory muscle fatigue, airways resistance, etc. To ensure that these parameters are quantified with adequate precision during exercise, it is recommended that  $P_{oes}$  catheters display a "flat" frequency response up to 15 Hz. In our experience, however, we have observed that some commercially-available systems display comparatively poor frequency response characteristics (i.e., < 8 Hz).

**PURPOSE:** We explored whether the poor frequency response of a commercially-available  $P_{oes}$  catheter may be adequately compensated via two numerical methods of digital signal compensation.

**METHODS:** The commercial balloon-catheter used in this report was that manufactured by Akrad Laboratories (CooperSurgical, Trumbull, CT). The dynamic response of the commercial  $P_{oes}$  catheter was obtained via pressure "step" testing. A total of 10 step responses were recorded and ensemble-averaged. The numerical

correction methods used to compensate the dynamic response of the commercial balloon-catheter were: 1) a double-exponential model method; and 2) a Fourier-based method called Wiener deconvolution. The frequency responses of the uncorrected, and corrected balloon-catheter systems were considered "flat" up until the discrete frequency beyond which more than 5% amplitude and/or phase distortion was observed.

**RESULTS:** The frequency response of the uncorrected  $P_{oes}$  catheter was "flat" up to only 7 Hz. Double-exponential correction notably extended this flat-region to 20 Hz. The greatest improvement in the catheter's frequency response was observed using Wiener deconvolution - this correction method extended the "flat" region of the catheter's frequency response to 58 Hz.

**CONCLUSIONS:** The present report indicates that, if not corrected, the dynamic response of the commercial balloon-catheter is inadequate for recording  $P_{oes}$  during exercise. Importantly, however, the frequency response of this balloon-catheter may be extended beyond that recommended (i.e., 15 Hz) using either the double-exponential correction method or Wiener deconvolution - whereby superior results are obtained with the latter method.

1652 Board #305 June 2, 9:00 AM - 10:30 AM  
**Functional Inspiratory Muscle Training (IMT) Improves Load Carriage Performance Greater than Traditional IMT Techniques**

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The addition of thoracic loads is common in occupational groups such as the military. The positioning upon the thorax poses a unique challenge to breathing mechanics and causes respiratory muscle fatigue (RMF) following exercise. IMT techniques provide a positive impact to exercise performance as well as attenuating RMF in both health and athletic populations. However in occupational groups, despite increased inspiratory muscle strength and performance, IMT has failed to attenuate RMF, potentially limiting the performance enhancement of IMT. It has been suggested that functional inspiratory muscle training (IMT<sub>f</sub>) may elicit adaptations above that of traditional IMT techniques as it targets the inspiratory muscles throughout the length-tension range adopted during exercise. **Purpose:** To investigate the use IMT<sub>f</sub> techniques on performance in exercise tasks with thoracic load carriage.

**Methods:** All participants (n=17) completed 4-week foundation IMT using a Powerbreathe device (2 x 30 breaths, daily at 50% maximal inspiratory pressure (MIP), either side of a pre-loaded time-trial (LC<sub>TT</sub>) while carrying a 25 kg thoracic load. Participants were randomly assigned to either IMT<sub>f</sub> (n=9) or a maintenance group (CON, n=8) and completed 4 additional weeks of training. IMT<sub>f</sub> consisted of 3 sessions per week whilst simultaneously breathing through the training device at 50% MIP and conducting 4 predetermined core exercises. CON, comprised of 30 breaths at 50% MIP, 3 times weekly.

**Results:** Baseline LC<sub>TT</sub> was 15.93 ± 2.30 and improved to 14.73 ± 2.40 min post 4 week IMT LC<sub>TT</sub> (P < 0.01). Post IMT<sub>f</sub> LC<sub>TT</sub> further improved (13.59 ± 2.33 min, P < 0.05). Relative to baseline (151 ± 36 cmH<sub>2</sub>O), MIP was greater post IMT (172 ± 39 cmH<sub>2</sub>O, P < 0.05) but was similar post IMT<sub>f</sub> (179 ± 25 cmH<sub>2</sub>O, P > 0.05) and CON (P > 0.05). The post exercise reduction in MIP in all trials remained unchanged.

**Conclusion:** IMT improves MIP and exercise performance with thoracic load carriage and the improvement is enhanced by incorporating a period of IMT<sub>f</sub> which provides an additional ergogenic effect to exercise performance. This appears to be the result of improved coordination between core and respiratory muscle groups that are tasked heavily via load carriage exercise and IMT<sub>f</sub>. However, it did not attenuate respiratory muscle fatigue after load carriage activities.

1653 Board #306 June 2, 9:00 AM - 10:30 AM  
**Drink Temperature Influences Resting Pulmonary Function In Active Individuals**

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Pulmonary function is thought to be influenced by a variety of dietary factors and more recently the ingestion of fluids. Specifically, recent evidence suggests that the ingestion of a large volume of fluid (~750 mL) decreased resting pulmonary function. However, it is unknown whether factors other than volume (i.e. drink temperature) influenced the effect of fluid ingestion on airway function.

**PURPOSE:** Therefore, the purpose of the study was to investigate the effect of both the volume and temperature of fluid ingestion on pulmonary function in recreationally active individuals.

**METHODS:** Eight, healthy, recreationally active individuals completed a randomised, crossover study design consisting of four experimental trials. On separate occasions (separated by ≥2 d) participants visited the laboratory after an overnight fast to complete an experimental trial consisting of the ingestion of: 500 mL cold-temperature [CT] (~2°C) water, 500 mL room-temperature [RT] (~18°C) water, 1000 mL CT (~2°C) water or 1000 mL RT (~18°C) water. Pulmonary function (FEV<sub>1</sub>, FVC, FEF<sub>25-75%</sub>) was assessed pre-ingestion and at 1, 5, 10 and 15 min post-ingestion. The maximum percentage fall in forced expiratory volume (FEV<sub>1</sub>) from the pre-ingestion to the post-ingestion value was calculated to provide an index of airway narrowing.

**RESULTS:** The ingestion of 1000 mL of CT water resulted in a group mean decrease in FEV<sub>1</sub> of 7 ± 3% which was significantly reduced compared to 500 mL CT water (2 ± 1%, p=0.005), 500 mL RT water (1 ± 2%, p=0.002) and 1000 mL RT water (3 ± 3%, p=0.002). The maximum reduction in FEV<sub>1</sub> following the ingestion of 1000 mL CT was 9 ± 3% and was significantly decreased compared to the 500 mL CT (3 ± 2%, p=0.036) and RT (3 ± 2%, p=0.004) drink. The ingestion of 1000 mL of CT water caused a significant reduction in FVC (7 ± 4%) compared to 500 mL CT water (2 ± 2%, p=0.006), 500 mL RT water (2 ± 2%, p=0.025) and 1000 mL RT water (4 ± 4%, p=0.031).

**CONCLUSION:** The ingestion of a cold, large drink decreased pulmonary function in healthy, active individuals compared to both small volumes of cold and room temperature drinks and a large room temperature drink. These findings suggest an important link between temperature and volume of fluid intake on airway function and should be considered in relation to fluid intake strategies pre-, during, and post-exercise.

1654 Board #307 June 2, 9:00 AM - 10:30 AM  
**Effect of Puberty on Gas Exchange Threshold in Untrained Boys and Girls**

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Trained boys increase absolute, relative, and gas exchange threshold (GET) as a percent of VO<sub>2max</sub> (GET%VO<sub>2max</sub>) following puberty. Also, trained girls increase absolute GET, but not GET%VO<sub>2max</sub>. It is unknown if these changes exist in untrained boys and girls pre- to post-puberty.

**Purpose:**

The purpose of this longitudinal study was to determine if differences exist in GET pre- to post-puberty in untrained subjects. A secondary purpose was to determine if sex differences were present. We hypothesized that following puberty 1) absolute and relative GET would increase and 2) no sex differences would be present in absolute or relative GET in untrained subjects.

**Methods:**

17 untrained subjects (B: 8; G: 9) were recruited pre- (9.8 ± 0.8 yrs) and post-puberty (14.8 ± 1.0 yrs) from a previously published study (Swain, et al. 2010). Subjects performed an incremental exercise test to exhaustion using a cycle ergometer to determine VO<sub>2max</sub>. Subjects then rested for 15 minutes and performed a constant load exercise bout at 105% VO<sub>2max</sub> to exhaustion to validate VO<sub>2max</sub>. GET was determined using the V-Slope method. Maturation was determined via Tanner stages.

**Results:**

Maturation status increased for boys and girls following puberty (p < 0.05); however there were no differences (p > 0.05) between boys and girls post-puberty (B: 4.1 ± 0.6 stage; G: 3.8 ± 0.7 stage). Absolute GET increased pre- to post-puberty (p < 0.05). Absolute GET was higher in boys than girls pre-puberty (B: 0.85 ± 0.10 L/min; G: 0.61 ± 0.13 L/min) and post-puberty (B: 1.78 ± 0.41 L/min; G: 1.20 ± 0.24 L/min); however change in absolute GET was not different (p > 0.05) between boys and girls. Relative GET was not different (p > 0.05) pre- to post-puberty. Relative GET was higher in boys than girls pre-puberty (B: 26.9 ± 5.6 ml/kg/min; G: 18.6 ± 3.5 ml/kg/min) and post puberty (B: 28.4 ± 4.5 ml/kg/min; G: 20.5 ± 5.2 ml/kg/min). There were no differences (p > 0.05) in GET%VO<sub>2max</sub> pre- to post-puberty between sexes.

**Discussion:**

These data suggest absolute GET increases with increasing body weight during puberty; however, relative GET and GET%VO<sub>2max</sub> do not change in untrained subjects. At pre- and post-puberty, untrained boys have a higher absolute and relative GET than untrained girls; however, no sex differences existed in the change in GET during puberty.

1655 Board #308 June 2, 9:00 AM - 10:30 AM  
**The Effect Of Ischemic Preconditioning On Pulmonary Pressure And Gas Exchange During Exercise In Hypoxia**

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 (No relationships reported)

Elevations in pulmonary vascular pressure are common at high altitude and can influence respiratory gas exchange. **PURPOSE:** The purpose of this study was to determine the role of acute ischemic preconditioning (IPC) on pulmonary vascular pressures and gas exchange during hypoxic exercise in healthy individuals. **METHODS:** A total of 12 healthy subjects were randomly assigned to either treatment group (n=6, 22.4±4.2yrs) or the sham group (n=6, 27.3±9.7yrs). Pulmonary vascular pressure was estimated from right ventricle systolic pressure (RVSP) and mean pulmonary artery pressure (mPAP) via echocardiograph (General Electric, Duluth, GA). In addition, minute ventilation (VE), end tidal CO<sub>2</sub> (PETCO<sub>2</sub>) and breathing efficiency for CO<sub>2</sub> (VE/VCO<sub>2</sub>) were measured breath-by-breath (MGC Diagnostics, Saint Paul, MN). For baseline measurement, subjects exercised at 30W on an echocardiograph-ergometer (Ergoline, Germany) during hypoxia (FiO<sub>2</sub>=~12.5%) followed by IPC treatment. Between baseline measurement and IPC treatment, a 90min washout period was applied. For IPC, an arm cuff was placed on the upper arm and the procedure included 4 cycles of alternating between 5min inflation and 5min deflation. The cuff pressures were 200mmHg for the treatment group and 20mmHg for the sham group. Following treatment or sham, both groups rested for 90min and post measurements were made. **RESULTS:** The treatment group demonstrated a trend towards an improved RVSP (-28.8±27.5% vs. -1.1±20.8% respectively, p=0.055) and mPAP (-11.30±16.2% vs. 13.8±23.8% respectively, p=0.057) but sham did not. However, no significant difference in VE, PETCO<sub>2</sub> and VE/VCO<sub>2</sub> between groups was observed (p>0.05). **CONCLUSION:** In this small preliminary study, IPC reduced pulmonary vascular pressure during hypoxic exercise, however, it was not associated with altered respiratory gas exchange.

1656 Board #309 June 2, 9:00 AM - 10:30 AM  
**Acute Response to High Intensity and Moderate Intensity Exercise in Adults with Confirmed Airway Hyperresponsiveness**

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Exercise can induce bronchoconstriction in those with airway hyperresponsiveness (AHR). This is thought to result from an increase in ventilation during exercise. High intensity interval exercise (HIIE) consists of intermittent recovery periods, which may allow for ventilation to recover and minimize bronchoconstriction. **PURPOSE:** To determine the acute response to HIIE, moderate intensity interval exercise (MIIE) and moderate intensity continuous exercise (MICE) in adults with confirmed AHR. **METHODS:** AHR was confirmed in 9 participants (age: 21.1 ± 3.2 years) by a ≥10% decline in forced expiratory volume in 1 second (FEV<sub>1</sub>) following a eucapnic voluntary hyperventilation challenge. Participants completed a maximal exercise test on a cycle ergometer; peak power output (PPO) was used to determine exercise intensity. Participants completed the HIIE (90% PPO for 1 minute, 10% PPO for 1 minute, repeated 10 times), MIIE (65% PPO for 1 minute, 10% PPO for 1 minute, repeated 10 times), and MICE (65% PPO for 20 minutes) in random order at least 72 hours apart. Lung function was assessed pre and post-exercise (immediately, 5, 10, 15, and 20 minutes post). Participants completed a questionnaire 24 and 48 hours post-exercise to determine the occurrence of late phase symptoms. Repeated measures ANOVAs were used for analysis. **RESULTS:** A greater decline in FEV<sub>1</sub> was observed for MICE as compared to MIIE and HIIE (11.0%, 4.9%, 5.8%, respectively, p<0.01); the decline did not differ between MIIE and HIIE (NS). Moderate/severe symptoms of coughing (n=5), wheezing (n=3), shortness of breath (n=2), sore/dry itchy throat (n=2), chest tightness (n=3), increased mucous production (n=3), and sleep disturbances (n=2) were reported following the MICE. Slight/severe symptoms of coughing (n=4), wheezing (n=3), shortness of breath (n=2), sore/dry itchy throat (n=1), chest tightness (n=2), increased mucous production (n=3), and sleep disturbances (n=1) were reported following HIIE. Shortness of breath (n=2) was reported following MIIE. **CONCLUSION:** MICE appears to trigger bronchoconstriction in those with confirmed AHR; the changes in lung function are both statistically and clinically relevant. Both HIIE and MICE are associated with self-reported late phase symptoms. Interval exercise does not appear to trigger bronchoconstriction.

1657 Board #310 June 2, 9:00 AM - 10:30 AM  
**Experimental Woodsmoke Exposure During Exercise and Blood Oxidative Stress**

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**PURPOSE:**

Woodsmoke exposure and exercise elicit oxidative stress in blood. The purpose of this investigation was to understand the effects of woodsmoke exposure on blood oxidative stress.

**METHODS:**

Ten males (18-40 yrs) performed 3 treadmill exercise sessions to simulate wildland firefighting while exposed to woodsmoke (separated by 1 week). Participants were exposed particulate-free air (0µg/m<sup>3</sup>, Filtered Air), 250µg/m<sup>3</sup> (Low Exposure) and 500µg/m<sup>3</sup> (High Exposure) woodsmoke (particulate matter 'PM<sub>2.5</sub>', <2.5µm) in a randomized counter-balanced crossover fashion. Blood samples obtained at baseline (Pre), immediately post (Post) and 1 hour following (1Hr) post exposure were assayed for trolox equivalent antioxidant capacity (TEAC), uric acid (UA), lipid hydroperoxides (LOOH), protein carbonyls (PC), nitrotyrosine (3-NT), 8-isoprostane, and myeloperoxidase (MPO) activity and protein content.

**RESULTS:**

There were no self-reported respiratory complications to the exposure trials. UA values were lower only following Low Exposure (p=0.042), while plasma TEAC levels were elevated Post (Filtered Air and High exposure, p=0.015 and p=0.001 respectively) and at 1Hr (Filtered Air and High exposure, p=0.001) time points. LOOH levels were decreased 1Hr Post (High exposure, p=0.036), while plasma 8-Iso levels were elevated in Post samples from both smoke doses (Low exposure p=0.004, High exposure p=0.009). There were no increases in plasma PC levels for any of the 3 trials, while 3-NT values were elevated over Filtered Air when Low/High Exposure values were combined (p=0.012). Neither MPO activity nor protein content was altered following the 3 trials.

**CONCLUSIONS:**

The current laboratory simulation of wildland firefighting reveal indications of oxidative stress that were independent of PM<sub>2.5</sub> concentrations. Circulating plasma antioxidants and two redox sensitive inflammation markers were unaltered by smoke exposure. Future lab-based woodsmoke exposure studies should employ longer duration exposure times and more intense exercise to better mimic firefighting scenarios. Future study should continue to identify oxidative biomarkers and physiologic parameters that are sensitive to woodsmoke exposure leading up to comprehensive field studies.

1658 Board #311 June 2, 9:00 AM - 10:30 AM  
**Gas Exchange During Submaximal Step Test In Acutely Decompensated Heart Failure Patients After Inpatient Diuresis: A Preliminary Analysis**

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**PURPOSE:** Minimizing Hospital admission and readmission in heart failure is of critical importance. Submaximal exercise gas exchange may be an important indicator of proper recompensation and clinical outcomes. This study sought to quantify the physiological response to a submaximal step test after acute diuresis.

**METHODS:** Six patients presenting with acute decompensated heart failure (ADHF) were recruited on admission to St Marys Hospital, Mayo Clinic, MN. At both admission and discharge, pulmonary function, resting gas exchange, and lung diffusing capacity for carbon monoxide (DLCO) were measured. A submaximal step test was performed at 60 and 90 steps-min<sup>-1</sup> on discharge. Pulmonary gas-exchange was measured during exercise. The VE/VCO<sub>2</sub> ratio was calculated for each breath, while the VE/VCO<sub>2</sub> slope was calculated via linear regression using the entire exercise dataset.

**RESULTS:** Patients spent 3.5 ± 1.5 days in hospital and were diuresed 9.3 ± 3.8 L of fluid. Forced vital capacity and forced expiratory volume in 1 s both improved (17 ± 19%, P = 0.06 and 16 ± 17%, P < 0.01). DLCO did not change from admission to discharge. During resting breathing, VO<sub>2</sub> and tidal volume (V<sub>t</sub>) fell from admission to discharge, while VE and VE/VCO<sub>2</sub> did not change. All patients completed 1-min of exercise at both 60 and 90 steps-min<sup>-1</sup>. V<sub>t</sub>, respiration rate, and VE increased with work rate. VO<sub>2</sub> increased during exercise (rest=4.6 ± 0.9 ml·kg<sup>-1</sup>·min<sup>-1</sup>; 90 steps-min<sup>-1</sup>=9.4±1.0 ml·kg<sup>-1</sup>·min<sup>-1</sup>) and VCO<sub>2</sub> increased (rest=3.8 ± 0.6; 90 steps-min<sup>-1</sup>=7.5 ± 1.2 ml·kg<sup>-1</sup>·min<sup>-1</sup>). The VE/VCO<sub>2</sub> ratio decreased from baseline

before plateauing (rest=39 ± 2.9; 90 steps·min<sup>-1</sup>=37.0 ± 3.7). End tidal CO<sub>2</sub> (PETCO<sub>2</sub>) remained constant during exercise (rest=34.8±3.2; 90 steps·min<sup>-1</sup>=35.2±2.5 mmHg). The VE/VCO<sub>2</sub> slope was inversely correlated with fluid loss (R<sup>2</sup>=0.34). **CONCLUSIONS:** ADHF patients after inpatient diuresis showed improvement in pulmonary function but not lung diffusing capacity. VE/VCO<sub>2</sub> ratio fell before plateauing, and PETCO<sub>2</sub> remained constant during exercise. Both values were elevated relative to published norms. VE/VCO<sub>2</sub> slope followed volumetric status after diuresis and may predict proper reoxygenation. In this continuing study, we seek to determine the usefulness of submaximal exercise as a predictor of clinical outcome.

1659 Board #312 June 2, 9:00 AM - 10:30 AM

### Does Hyperoxia Alter the Mechanoreflex in Young Healthy Males and Females?

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(No relationships reported)

Passive limb movement (PLM) has been used as a method of activating the mechanoreflex, inducing limb hyperemia which is nitric oxide (NO) dependent. Breathing hyperoxic gas has been used as a model to elevate free radicals (FR), though it remains to be seen, in humans, if acute elevations in FR alter the mechanoreflex response to PLM, and whether the effect may be sex specific. **PURPOSE:** The purpose of this study was to compare the male and female central and peripheral hemodynamic responses to dynamic PLM, under normoxic (21% O<sub>2</sub>) and hyperoxic (100% O<sub>2</sub>) conditions. **METHODS:** In 23 young healthy participants (12 female(F) and 11 male(M)) using a single blind design, participants were positioned supine and breathed normoxic (21% O<sub>2</sub>) and hyperoxic (100% O<sub>2</sub>) gas from a Douglas bag for 10 minutes, after which 2 minutes of PLM were performed. Central hemodynamic responses (cardiac output [CO], stroke volume [SV], and HR), were measured using a Finometer, while a near-infrared spectrometer (NIRS) was used to assess the microvascular response (tissue oxygen saturation, StO<sub>2</sub>%) at baseline and during the PLM. **RESULTS:** No sex differences in hemodynamics were observed at baseline in normoxia (p>0.05). In response to PLM, both sexes increased HR and CO from baseline (p<0.05); however, males elicited significantly higher CO response than females ( $\Delta$ CO: 1.7±0.7 vs. 0.9±0.6 L/min, p<0.05). Peripherally, PLM increased StO<sub>2</sub> from baseline for both sexes (p<0.05), though there was a significant difference in the peripheral response to PLM between the sexes (M: 4.2±2.0 vs F: 2.3±2.7  $\Delta$ StO<sub>2</sub>%, p<0.05). Hyperoxia had no effect on baseline CO or StO<sub>2</sub> (p>0.05) or the response to PLM, and the sex difference persisted ( $\Delta$ CO: 1.8 ± 1.0 vs 1.1 ± 0.6 L/min, M v. F) (p<0.05). PLM induced significant changes in StO<sub>2</sub>, which were not different from normoxia, though the sex specificity persisted (M: 4.5±1.8 vs F: 2.1±2.7  $\Delta$ StO<sub>2</sub>%, p<0.05). **CONCLUSION:** The present study provides further evidence that females exhibit an attenuated mechanoreflex as compared to males, which may reduce CVD risk. Though, unlike the macrovascular responses to PLM which have been reported to be similar between sexes, the microvascular responses to PLM may differ. In the current model, prior inhalation of 100% oxygen had no effect on the mechanoreflex in young healthy males and females.

1660 Board #313 June 2, 9:00 AM - 10:30 AM

### Hypoxic Preconditioning Strengthens Respiratory Skeletal Muscle Function during Reoxygenation via Mitochondrial Regulation

Li Zuo, FACSM, Tingyang Zhou, Chia-Chen Chuang, Benjamin K. Pannell. *Ohio State University, Columbus, OH.*  
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(No relationships reported)

Respiratory skeletal muscle subjected to reoxygenation after a period of hypoxia is susceptible to damage and subsequent muscle dysfunction. The mechanism that promotes muscle fatigue during reoxygenation is not clear. Limited studies have explored the efficacy of hypoxic preconditioning (HPC), which consists of alternating periods of low and high oxygen levels, as a strategy for mitigating skeletal muscle fatigue during reoxygenation. **PURPOSE:** We tested the hypothesis that HPC has a protective effect on respiratory muscle during reoxygenation via opening of the ATP-sensitive potassium channel (K<sub>ATP</sub>) and closing of the permeability transition pore (mPTP) located in the mitochondrial inner membrane. **METHODS:** Mouse diaphragm muscle strips were isolated and either non-treated (n = 10), treated with HPC (n = 7), or incubated with a K<sub>ATP</sub> channel opening inhibitor (glibenclamide; 100  $\mu$ M; n = 6), mPTP channel opener (carboxyatractyloside; 50  $\mu$ M; n = 5), or a combination of these two (n = 5) prior to HPC treatment followed by a 30 min hypoxic period (95% N<sub>2</sub> and 5% CO<sub>2</sub>) and subsequent reoxygenation. The K<sub>ATP</sub> channel opener (diazoxide; 50  $\mu$ M; n = 7), mPTP channel opening inhibitor (cyclosporin A; 100  $\mu$ M; n = 5), and a combination of these two (n = 8) were used as positive controls to mimic the HPC effect. The muscle strips were electrically

stimulated in a contraction chamber filled with Ringer's solution. Data were analyzed using a multi-way ANOVA, and expressed as means ± SE. p < 0.05 was the criterion level for significance.

**RESULTS:** Our results confirmed that HPC significantly attenuates skeletal muscle fatigue during reoxygenation (37.7 ± 8.5% for treated vs. 9.9 ± 2.5% for control, p < 0.05; expressed as percentage of maximal force at the end of the contraction protocol). Inhibitors glibenclamide (8.6 ± 2.2%), carboxyatractyloside (7.6 ± 0.9%), and glibenclamide + carboxyatractyloside (6.0 ± 1.2%) abolished the protective HPC effect. Individual incubation with diazoxide (13.2 ± 2.4%) and cyclosporin A (13.5 ± 0.7%) has a trend to increase muscle fatigue resistance, while their combinatory effect (17.4 ± 2.6%, p < 0.05) significantly resisted fatigue development.

**CONCLUSION:** We propose that HPC may protect against fatigue in respiratory skeletal muscle during reoxygenation through mitochondrial regulations.

## C-45 Free Communication/Poster - Running

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
Room: Exhibit Hall A/B

1661 Board #314 June 2, 8:00 AM - 9:30 AM

### A Novel Method to Monitor Training Effect in Running

Ari T. Nummela, Ville Vesterinen. *Research Institute for Olympic Sports, Jyväskylä, Finland.*  
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(No relationships reported)

A novel method to determine training induced changes in maximal aerobic (MAS) and Marathon running speed has been developed. The new method includes several algorithms which take into account not only the effect of single exercise induced fatigue and adaptation on MAS and Marathon speed but also individual training status, specificity of training, decreased training and detraining are included in the method.

**PURPOSE:** The aim of the present study was to evaluate the validity of the new method to estimate changes in MAS and Marathon speed during a short-term training period.

**METHODS:** Training data of eighty (51 men and 29 women) recreational distance runners were used to test the validity of the method. They trained 3-7 times per week and the length of the training period varied 3-14 weeks. In order to test the validity of the estimated MAS and Marathon speed endurance performance characteristics like AnT, MAS and VO<sub>2</sub>max were determined before and after the training period by an incremental treadmill test.

**RESULTS:** AnT and MAS increased 4.7 ± 5.1 % (range -4.5 - 20.0 %) and 3.9 ± 4.5 % (-3.4 - 25.8 %), respectively, during the training period. No correlations were observed between training volume and intensity characteristics and the changes in AnT and MAS. A significant correlation was observed between the measured and estimated changes in MAS (r = 0.634, P < 0.001) but not in AnT/Marathon speed (r = 0.012, P = 0.914) using the new model. However, the correlation between the measured and estimated MAS and AnT/Marathon speed at the end of the training period was 0.960 and 0.932 (P < 0.001), respectively. The new method could estimate the MAS at the accuracy of -0.01 ± 0.51 km/h.

**CONCLUSIONS:** It was concluded that the new method is valid for monitoring changes in the MAS and estimating both the MAS and AnT during short-term training periods in recreational runners, although all individual factors and non-training stress factors are not included in the method.

1662 Board #315 June 2, 8:00 AM - 9:30 AM

### Validation of Hexoskin Biometric Shirt to Cosmed k4b2 Metabolic Unit in Adults During Trail Running

Elizabeth Tanner<sup>1</sup>, Jacob W. Manning<sup>2</sup>, Julie Taylor<sup>2</sup>, Jeffrey Montes<sup>1</sup>, Damon McCune<sup>1</sup>, Tessa Koschel<sup>1</sup>, Debra K. Tacad<sup>1</sup>, Ashley Tovar<sup>1</sup>, John C. Young, FACSM<sup>1</sup>, Mark DeBeliso, FACSM<sup>2</sup>, James W. Navalta<sup>1</sup>. <sup>1</sup>University of Nevada, Las Vegas, Las Vegas, NV. <sup>2</sup>Southern Utah University, Cedar City, UT.  
(Sponsor: John C. Young, FACSM)  
(No relationships reported)

The development of new wearable biometric technologies have increased in recent years. The Hexoskin biometric shirt is a wearable technology designed to monitor biometric measures including heart rate (HR), ventilatory rate (VR), minute ventilation (VE), steps, and energy expenditure (EE). It is unknown whether the Hexoskin produces valid results for these measures in real-world applications. **PURPOSE:** To validate biometric measures using the Hexoskin against the Cosmed k4b2 portable metabolic unit during trail running. **METHODS:** Participants (N=26) completed a

self-paced one-mile trail run wearing the Hexoskin and the Cosmed unit. Biometric measures (HR, VR, VE, steps, and EE) were recorded each minute by the Hexoskin and breath-by-breath by the Cosmed. Data for HR, VR, and VE were analyzed in 6 one-minute intervals, the first three minutes (min: 1, 2, 3) and the last three minutes (min: 1', 2', 3'). Data for steps and EE were analyzed for the entire one-mile trail run. RESULTS: All Hexoskin and Cosmed data were analyzed using intraclass correlation with significance at  $p < 0.05$  level. Only one HR measure, the second to last minute, showed significant correlation (HR 2': ICC=0.342,  $p=0.041$ ). All other HR measures were not significantly correlated (HR 1: ICC=0.029,  $p=0.443$ ; HR 2: ICC=0.115,  $p=0.283$ ; HR 3: ICC=-0.11,  $p=0.552$ ; HR 1': ICC=0.253,  $p=0.102$ ; HR 3': ICC=0.045,  $p=0.412$ ). All VR measures at all time points were significantly correlated (VR 1: ICC=0.744,  $p < 0.001$ ; VR 2: ICC=0.626,  $p < 0.001$ ; VR 3: ICC=0.936,  $p < 0.001$ ; VR 1': ICC=0.926,  $p < 0.001$ ; VR 2': ICC=0.897,  $p < 0.001$ ; VR 3': ICC=0.796,  $p < 0.001$ ). The remaining variables (VE, steps, and EE) were not significantly correlated at any time point (VE 1: ICC=-0.195,  $p=0.835$ ; VE 2: ICC=-0.020,  $p=0.540$ ; VE 3: ICC=-0.039,  $p=0.577$ ; VE 1': ICC=0.144,  $p=0.237$ ; VE 2': ICC=0.118,  $p=0.279$ ; VE 3': ICC=0.091,  $p=0.325$ ; steps: ICC=0.154,  $p=0.222$ ; EE: ICC=-0.058,  $p=0.614$ ). CONCLUSION: Our results indicate the Hexoskin provides valid real time measures of VR and HR in the second to last minute of activity. Hexoskin validation results for all other measures (HR, VE, steps and EE) may improve with improved Hexoskin biometric shirt HR detection methods.

1663 Board #316 June 2, 8:00 AM - 9:30 AM  
**Vertical Jump Performance as a Predictor of Track and Field Jumping Events Performance**  
 Sherry A. Barkley, FACSM<sup>1</sup>, Riley Northrup<sup>2</sup>. <sup>1</sup>Augustana University, Sioux Falls, SD. <sup>2</sup>Ashland University, Ashland, OH.  
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 (No relationships reported)

Millions of athletes participate in the sport of track and field annually. Coaches at all levels are interested in identifying the athletes who have the potential to become top performers. While a number of tests have been used to analyze performance potential in running events, similar tests for jumping events do not exist. PURPOSE: The aim of this study was to determine whether standing vertical jump test results could be used to predict performance in long jump, triple jump, and high jump events in track and field. METHODS: Fifty-seven Division II student athletes (27 males, 34 females) agreed to participate. Pre-season vertical jump scores were recorded by coaches. Season-best performances in long jump, triple jump and high jump were collected from meet results. Regression analysis was used to determine the relationship between vertical jump and performance in the various jumping events and to develop prediction equations. Institutional Review Board (IRB) approval was granted for this study. RESULTS: Vertical jump was shown to account for 72% of the variability in the long jump, 71% of the variability in the triple jump, and 51% of the variability in the high jump. These relationships were significant ( $p < 0.01$ ). CONCLUSIONS: There is a correlation between vertical jump scores and track and field jumping performance. While other variables will also contribute to success in the jumping events, this simple test could be used by coaches as one predictor of performance potential.

1664 Board #317 June 2, 8:00 AM - 9:30 AM  
**Determination Of Maximal Oxygen Consumption For Different Categories Of Fitness Utilizing The Astrand Modified Running Protocol**  
 Nidhi Gupta<sup>1</sup>, Govindasamy Balasekaran, FACSM<sup>1</sup>, Visvasuresh Victor Govindaswamy<sup>2</sup>, Diana Thor<sup>1</sup>. <sup>1</sup>Physical Education and Sports Science, Human Bioenergetics Laboratory, Nanyang Technological University, Singapore, Singapore. <sup>2</sup>College of Arts and Science, Computer Science, Concordia University, Chicago, IL.  
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 (No relationships reported)

Among laboratory protocols, Astrand modified running maximal oxygen consumption test (AMRMAX) has been a popular and valid measure for aerobic fitness. AMRMAX can further supplement to its validity if it can significantly determine and differentiate maximal oxygen uptake ( $\dot{V}O_{2max}$ ) between endurance trained (ET), sprint trained (ST) and untrained (UT) participants. PURPOSE: To investigate if AMRMAX can differentiate maximal oxygen consumption of 3 distinct groups with different fitness levels. METHODS: Seventeen UT, 9 ST and 12 ET participants were recruited who were categorized into the 3 distinct cohorts by their body fat percentage (ET: 12.74±2.38, ST: 10.59±2.55, UT: 18.32±4.17,  $P=0.00$ ), body mass index (BMI;  $kg \cdot m^{-2}$ ; ET: 23.47±2.04, ST: 23.09±2.07, UT: 23.47±2.04,  $P=0.01$ ), hemoglobin (HB;  $g \cdot dl^{-1}$ ; ET: 14.79, ST: 15.50, UT: 14.73,  $P=0.08$ ), hematocrit (%) (ET:43.51, ST:45.59, UT:43.32,  $P=0.08$ ), and with a questionnaire on their exercise history which included specific

questions on the type of training either sprint or endurance, duration and intensity. For the AMRMAX test, the initial speed of the treadmill was set at 8-12  $km \cdot h^{-1}$  depending on the training background of the participants with 0% gradient. After 3 minutes of running, a 2.5% gradient was increased at 2 mins stages until volitional exhaustion. One-Way Analysis of Variance (ANOVA) was used to measure the significant difference between  $\dot{V}O_{2max}$  of ET, ST and UT participants. RESULTS: There was a significant difference ( $P=0.00$ ) for the  $\dot{V}O_{2max}$  ( $ml \cdot kg^{-1} \cdot min^{-1}$ ) between the ET (57.62±5.40), UT (46.86±3.76), and ST (51.12±3.59) participants.  $\dot{V}O_{2max}$  correlated significantly with body fat percentage ( $r = -0.66$ ), BMI ( $r = -0.46$ ), training status ( $r = -0.74$ ) and with very low correlations for HB ( $r = -0.005$ ) and hematocrit ( $r = -0.004$ ). CONCLUSION: Results indicated an additional validity for AMRMAX since it can successfully determine and differentiate maximal oxygen consumption of ET, ST and UT participants. The detection of central and peripheral adaptations due to training status has to be evaluated with a  $\dot{V}O_{2max}$  test preferably with AMRMAX in combination with blood variables, body composition and training history questionnaire. Such combined laboratory procedures will increase the accuracy of differentiating cohorts from ET, ST and UT.

1665 Board #318 June 2, 8:00 AM - 9:30 AM  
**Effects Of Uphill Only Marathon On Biomarkers Of Muscle And Cardiac Damage**  
 Nicola Giovanelli, Alessandro Da Ponte, Guglielmo Antonutto, Daniele Nigris, Francesco Curcio, Pietro Cortese, Stefano Lazzar. University of Udine, Udine, Italy.  
 Email: stefano.lazzar@uniud.it  
 (No relationships reported)

Nicola Giovanelli<sup>1</sup>, Alessandro Da Ponte<sup>1</sup>, Guglielmo Antonutto<sup>1</sup>, Daniele Nigris<sup>1</sup>, Francesco Curcio<sup>1</sup>, Pietro Cortese<sup>2</sup> and Stefano Lazzar<sup>1</sup>  
<sup>1</sup>University of Udine and <sup>2</sup>Department of Laboratory Diagnostics of Catania (Italy)  
**Purpose:** Endurance exercise is associated with serum increment of muscle and cardiac biomarkers but the effects of an uphill only marathon has not been studied yet, so we investigated possible differences from flat marathon.  
**Methods:** in occasion of the Etna supermarathon starting at sea level and reaching 3063 AMSL at finish line, twenty-two healthy experienced ultra-endurance runners (age 46.1 ± 10.8 years [mean ± SD], body mass index 23.5±2.3  $kg \cdot m^{-2}$ , maximal oxygen uptake ( $VO_{2max}$ ) 49.8 ± 6.8  $ml \cdot kg^{-1} \cdot min^{-1}$ ) were enrolled for this study. The day before and immediately after the race, blood samples were taken and hydration status was measured by bioelectrical impedance.  
**Results:** Marked running-related increase were found in serum muscle, cardiac and inflammatory biomarkers. Mean activity of aspartate aminotransferase (AST), lactate dehydrogenase (LDH), creatine kinase (CK) and myoglobin (MB) increased significantly at the end of the race by 38±25, 37±17, 193±174 and 791±640%, respectively ( $p < 0.001$ ) reaching for LDH, CK and myoglobin values exceeding normal upper limits (+8,+71 and +551% respectively). Mean cardiac troponin I (cTnI) increased significantly (+673±1042%  $p < 0.001$ ) from the pre-race values in all athletes, reaching values above upper normal limit in more than 52% of them. We found no significant correlation of cTnI increase with age, BMI,  $VO_{2max}$ , training status, ultra-endurance training experience, race time, basal troponin level, body fat mass, CK and MB following race. Blood cortisol increased significantly (+276±150%,  $p < 0.001$ ) while mean C-reactive protein (CRP) levels did not change.  
**Conclusion:** despite less eccentric muscle contraction and lighter ground impact, an uphill only marathon is associated with significant muscle biomarkers increment. Moreover, most athletes show cTnI increment above threshold of normality without correlation with other predictive parameters as often seen in flat marathon.

1666 Board #319 June 2, 8:00 AM - 9:30 AM  
**The Effects of Oxidative Status and Training Load on Performance and Injury in Collegiate Runners**  
 Sarah Moniz, Ryan Wolff, Conor Schmidt, Emilia Leszkowicz, Ryan VanNieuwenhuyze, Karen Myrick, Rachel Pata, Richard Feinn, Thomas Martin. Quinnipiac University, Hamden, CT.  
 (No relationships reported)

PURPOSE: To determine the effects of initial fitness, training load and oxidative stress markers on race performance and injury in Female Division I cross country athletes. METHODS: 18 female athletes (18.9 ± 0.86 yrs old) were monitored during the 2014 cross-country season.  $VO_{2max}$ , Body Mass Index (BMI), oxidative stress (d-ROMs) and antioxidant capacity (PAT) were assessed during the pre-season. Participants also underwent additional tri-weekly testing throughout the season for BMI and oxidative assessment (d-ROMs & PAT). Athletes utilized a GPS/HR monitor system daily during practice sessions to record training load. Training load was determined using the Running Training Stress Score (rTSS) according to a commercial web-based software (TrainingPeaks). Race performance and injury status was also monitored during the season. Linear mixed models were used to analyze the effect of cumulative training load, BMI, PAT and d-ROMs on race performance during the season. A Cox

regression model was used to predict time to injury for various covariates. RESULTS: Weekly training load and race pace both decreased as the season progressed ( $p < 0.05$ ). No significant changes in BMI ( $p = 0.49$ ), d-ROMs ( $p = 0.79$ ), or PAT ( $p = 0.75$ ) were observed during the season. Runners with relatively high cumulative training load over the course of the season showed less improvement in race performance as the season progressed ( $p < 0.001$ ). Higher preseason VO<sub>2</sub> max scores were associated with faster race performances throughout the season ( $p < 0.013$ ). Higher weekly PAT scores were predictive of faster race performance ( $p < 0.004$ ) for that given week. Increased d-ROMs values were a significant predictor of injury ( $p < 0.033$ ). In addition, runners who sustained an injury during the course of the season had a significantly lower preseason VO<sub>2</sub> max score ( $p < 0.018$ ). CONCLUSION: Across subjects, race performance improved during the season. Athletes whose cumulative training loads were lower than the team average demonstrated greater improvements in performance as the season progressed. Baseline VO<sub>2</sub> max, PAT values and training intensity may be used as a predictor of race performance. d-ROMs and baseline VO<sub>2</sub> max may help predict potential injury in athletes.

Supported by Quinnipiac University, School of Health Sciences

1667 Board #320 June 2, 8:00 AM - 9:30 AM

### Pace Versus Prediction: Is the Experience of the Runner Associated With Marathon Success?

Dan A. Gordon, Itay Basevitch, Adrian Scruton, Justin Roberts, Joseph Biggins, Viviane Merzbach. *Anglia Ruskin University, Cambridge, United Kingdom.*  
Email: dan.gordon@anglia.ac.uk  
(No relationships reported)

PURPOSE: Pacing strategies during exercise are attributed to optimising the balance between the artefacts of fatigue and regulation of substrate metabolism. Pace judgement is set within a continuum of information from the ability to anticipate metabolic demands and select an appropriate strategy through to the accumulation of prior experience for completion of such a task that has a known end-point. Therefore the purpose of this study was to evaluate the importance of athlete experience to successfully regulate pace and attain a predicted end time during a marathon.

METHOD: Following local institutional ethical approval  $n = 777$  runners competing in the 2015 London Marathon agreed to participate. Using an on-line survey and opportunistic questionnaires at a pre-marathon event participants were asked to predict their race time. Athlete experience (EXP) was established based on the number of previously completed marathons using a Likert scale from 0 to greater than 10 with increments of 1 race. Athlete age was also recorded. All race data was downloaded from the race website generating 5Km split times, then converted to speed and normalised (%) to the final split time/speed ( $m \cdot s^{-1}$ ). Prediction time (PT) was used a proxy for end-point and compared to finish time (FT). RESULTS: FT for whole group (WG) was  $15479 \pm 3311$ s compared to the group PT  $15003 \pm 2972$ s a significant difference of 476s ( $P = 0.0001$ ). An  $R^2$  of 0.863 observed for WG compared to 0.799 (0-EXP) and 0.852 (EXP-5) when comparing FT to PT. Significant differences observed between PT and FT for all EXP groups apart from EXP-5 ( $P = 0.0001$ ). 0-EXP showed significant differences across all split times apart from 35-40 km ( $P = 0.0001$ ) with a decrease in normalised speed from 5km ( $109.0 \pm 7.6$ ) - 40km ( $89.9 \pm 7.4\%$ ). The 5-EXP group showed significant changes in pace between 25-30 km ( $P = 0.001$ ) (ES = 0.35), 30-35 km ( $P = 0.0001$ ) (ES = 0.44) and 35-40 km ( $P = 0.0001$ ), decrease in pace from 5km ( $105.0 \pm 5.7\%$ ) to 40km ( $93.7 \pm 5.6\%$ ). CONCLUSIONS: These data suggest that successful marathon pacing is dependent on the experience of the athlete reflecting the development of the pacing template. Additionally experience is associated with better attainment of prediction time suggesting that less experienced runners should run with more experienced athletes with similar end-point targets.

1668 Board #321 June 2, 8:00 AM - 9:30 AM

### Pace Versus Prediction: Is the Sex of the Runner Associated With Marathon Success?

Adrian Scruton, Itay Basevitch, Justin Roberts, Joseph Biggins, Viviane Merzbach, Dan Gordon. *Anglia Ruskin University, Cambridge, United Kingdom.*  
Email: adrian.scruton@anglia.ac.uk  
(No relationships reported)

PURPOSE: The ability to regulate effort (pace) is ascribed to the ability to make prospective judgments regarding the metabolic demands of the exercise challenge against personal metabolic capacity. Thus pace modulations which are dependent on knowing an exercise end-point are a function of biologically and cognitively orchestrated afferent signals and the homeostatically orientated efferent responses are manifest to prevent a depletion of the finite anaerobic capacity and onset of fatigue. The purpose of this study was to examine the pacing strategies adopted during a marathon and to explore whether there was a difference in outcome between males and females.

METHOD: Following local institutional ethical approval  $n = 777$  runners competing in the 2015 London Marathon volunteered and agreed to participate of which  $n = 393$  were females and  $n = 384$  were males. Using an online survey, available for 12 weeks up to the marathon and opportunistic sampling at the pre-marathon registration, participants were also asked to predict race time. Additional information regarding age and experience (number of marathons) were also obtained. Prediction time (PT) served as a proxy of end target time. For each participant 5km splits and finish time (FT) were converted to speed and then normalised (%) to the final split time/speed ( $m \cdot s^{-1}$ ).

RESULTS: A significant difference ( $P = 0.0001$ ) of 476s was observed between PT and FT for the whole group compared to differences of 531 s ( $p = 0.000$ ) and 419s ( $P = 0.000$ ) for the males and females respectively. Both males ( $P = 0.0001$ ) and females ( $P = 0.0001$ ) showed significant differences between PT and FT. Males exhibited differences in pace for all 5km splits ( $P = 0.0001$ ) except 5-10km ( $P = 0.483$ ), large ES between 25-30km ( $r = 0.319$ ) and 30-35km ( $r = 0.426$ ), pace decreased from  $107.4 \pm 7.8\%$  (5km) to  $91.2 \pm 7.1\%$  (40km), compared to  $109.1 \pm 8.6\%$  (5km) to  $93.2 \pm 6.5\%$  (40km) for females. Females exhibited differences across all 5km splits ( $P = 0.0001$ ) except between 35-40km ( $P = 1.000$ ) with medium ES for 20-25km ( $r = 0.243$ ) and 30-35km ( $r = 0.313$ ).

CONCLUSIONS: There is no difference between male and female marathon pacing strategies suggesting that the pacing template is not sex specific. Furthermore these data lend support to the notion that there is not an unfair advantage for females to be paced or race with males.

1669 Board #322 June 2, 8:00 AM - 9:30 AM

### Effectiveness of Aqua-titanium Infused Compression Garment in Outdoor Track Event

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(No relationships reported)

Compression Garments (CG) may improve performances in various sports. There is a lack of research on the use of aqua-titanium CGs (ATCG) to improve running performance. PURPOSE: To investigate the effects of Phiten's ATCG in running performance for the 50m, 200m and 3000m outdoor track events and maximal speed in the 50m. METHODS: 18 healthy university students, 15 males (age:  $23.20 \pm 1.86$  yrs, height:  $173.01 \pm 6.58$  cm, weight:  $67.00 \pm 5.21$  kg, percentage (%) body fat:  $13.30 \pm 3.20$ ) and 3 females (age:  $21.00 \pm 1.00$  yrs, height:  $156.23 \pm 2.89$  cm, weight:  $50.63 \pm 4.44$  kg, % body fat:  $22.10 \pm 3.21$ ) volunteered for the randomized, double-blinded study. Participants went through two single morning sessions at an Olympic outdoor track where the ATCG was worn on one session and a placebo CG (PCG) on another. 50m was run twice with maximal effort, followed by a 200m and 3000m trial. 15 minutes rests were given between each run trial and washout period between each session was 10 days. Runs were recorded with a stop watch, and the highest maximal speed was measured during the 50m sprint with timing gates and a video camera. The better of the two 50m sprint times was taken for analysis. RESULTS: Paired samples t-test showed significant differences between ATCG and PCG times in the 200m (ATCG:  $30.55 \pm 3.25$  sec vs. PCG:  $31.23 \pm 3.71$  sec,  $p = 0.02$ ) and maximal speed attained in the 50m (ATCG:  $7.95 \pm 0.68 m \cdot s^{-1}$  vs. PCG:  $7.78 \pm 0.59 m \cdot s^{-1}$ ,  $p = 0.01$ ). There was no significant difference in distance where maximal speed was attained (ATCG:  $35.91 \pm 5.61$  m, PCG:  $35.70 \pm 5.24$  m,  $p = 0.89$ ). Wilcoxon signed rank test found no significant difference in performance times for 50m (ATCG:  $7.13 \pm 0.49$  sec, PCG:  $7.18 \pm 0.59$  sec,  $p = 0.23$ ) and 3000m (ATCG:  $13.47 \pm 1.98$  sec, PCG:  $13.76 \pm 2.06$  sec,  $p = 0.38$ ). CONCLUSION: ATCG had faster run times in 50m and 3000m but results indicated that it was not significant. Significant differences in 200m and maximal speed of the 50m sprint suggests that ATCG may be more effective in events that require higher contribution from the phosphagen and lactic acid systems. These differences may be attributed to better running economy and greater efficiency of lower limb movement. ATCG may be useful during training and competition where running has to be performed multiple times in a single day. More studies are needed to ascertain the reasons for better running times with ATCG.

1670 Board #323 June 2, 8:00 AM - 9:30 AM

### Pace Versus Prediction: Is the Age of the Runner Associated With Marathon Success?

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PURPOSE: During closed-loop exercise, such as marathon running, the athlete adopts a pacing strategy to optimise performance. Exercise intensity (speed) is modulated in

response to afferent signals from biological and psychological systems, which relay the responses of the exercise to the brain where efferent, homeostatic-orientated responses are issued. Thus a conscious perception of effort is continuously compared to a subconscious template which is derived from previous exposure to the sensations of pain and fatigue and expected exercise duration. The purpose of this study was to explore the association between pacing strategy/race outcome and biological age of the athlete. **METHODS:** Following local institutional ethical approval n= 777 runners who were competing in the 2015 London Marathon volunteered and agreed to participate. Age, gender and experience of the participants were ascertained using an online survey and opportunistic questionnaire surveying at the pre-marathon registration event. Age was stratified according to those adopted by the marathon organisers: 18-39yrs, 40-49yrs, 50-59yrs and >60yrs. Additionally participants were asked to predict their marathon finish time (PT) serving as a proxy for end-point and compared to actual finish time (FT). All participating runners 5km splits and FT were downloaded from the race website, converted to speed and then normalised (%) to the final split time/speed (m s<sup>-1</sup>).

**RESULTS:** Significant differences were observed for all age groups (P= 0.0001) between FT and PT except >60yrs (P= 0.153). Non-significant differences observed between age groups across all 5km splits (p> 0.05), but within group differences observed between 10-15km for all age groups (p< 0.05), with this being only difference for >60yrs group. Large effect sizes (ES) observed for 18-39yrs at 30-35km (r= 0.370), 40-49yrs at 30-35km (r= 0.337), 50-59yrs at 25-30km (r= 0.368) and 30-35km (r= 0.418) and >60yrs at 30-35km (r= 0.527).

**CONCLUSIONS:** These data suggest that the biological age of the athlete is associated with the implementation of a successful pacing strategy and may be a function of the accrued training volume and/or emotional-event development. Athletes are encouraged to pace themselves with older (>60yrs) athletes with similar PT's.

1671 Board #324 June 2, 8:00 AM - 9:30 AM  
**The Influence Of Drinking Vs. Rinsing With Water During Prolonged Running Exercise On Affective Response**

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*(No relationships reported)*

**PURPOSE:** This study examined the influence of consuming water (CW) versus mouth rinsing (RW) with water during a prolonged running exercise on affective response. **METHODS:** 23 female runners: 26 ± 6 y, 165 ± 5 cm, 60 ± 7 kg and body fat 22 ± 3 % completed two, 15-KM time trials on an outdoor paved course in temperate environment separated by at least one week in a randomized cross-over study design. Participants either consumed 90 ml or rinsed with water for 5 s every 3-KM. Before and after each trial participants completed Activation-Deactivation Adjective Checklist (AD ACL), ratings of the perceived exertion scale (RPE), feeling scale (FS) and felt arousal scale (FAS). In addition, FS and FAS were repeatedly assessed throughout the run and physiological changes were recorded. **RESULTS:** Heart Rate (HR) and RPE increased significantly during the run, however, no significant differences in 15-KM time (p = 0.64), heart rate (p = 0.44) or RPE (p = 0.97) between CW and RW was observed. A significant time (p < 0.001) but not condition effect (p = 0.85) was observed for FS and FAS. Participants felt higher arousal and decreased ratings of pleasure as exercise progressed. There was a significant condition (p = 0.007) and time effect (p < 0.001) for energy, calmness, tiredness and tension. A significant condition effect was observed as a results of higher tension (p < 0.001) for RW compared to CW. A significant time effect (p < 0.001) was observed as a result of change from pre- to post-time trial in energy, calmness, and tiredness, but not tension. In addition, there was no significant condition (p = 0.2) or time effect (p = 0.27) observed for state anxiety. **CONCLUSION:** RW compared to CW did not impair performance and resulted in similar affective response during and after runs >1h in female runners.

1672 Board #325 June 2, 8:00 AM - 9:30 AM  
**Stride Frequency Changes Do Not Influence Running Economy In Minimalist Footwear Or Conventional Running Shoes**

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An increased stride frequency has been well documented whilst running in minimal footwear when compared to conventional running shoes. Furthermore it has been suggested that this reported change in stride frequency associated with minimalist footwear may influence running economy (RE). However, the changes to stride frequency in relation to footwear type are typically very small (~2-5%), and well below the magnitude of changes imposed in controlled studies (~8%). **PURPOSE:** The purpose of this study therefore was to examine if small "footwear related" changes to stride frequency can influence RE.

**METHODS:** Twelve club level runners, with six weeks of minimal footwear experience were recruited for the study (Age; 41 ± 9 years, Stature; 177.2 ± 10.4 cm, Mass; 72.6 ± 10.2 kg, V02max; 52.1 ± 7.5 mL·min<sup>-1</sup>·kg<sup>-1</sup>, Weekly km; 52 ± 11 km). Two 6-minute RE tests in both minimal footwear (brand) and conventional running shoes were performed at a self-selected stride frequency, at 11km/h. Tests were separated by ten minutes. Participants subsequently completed two more 6-minute efforts where stride frequency was controlled at the cadence of the opposite footwear condition using a metronome (RErevSF). Direct comparisons between RE and RErevSF were completed in the same footwear using paired t-tests.

**RESULTS:** The mean increase in stride frequency for minimal footwear vs. conventional running shoes was 7.3 ± 2.3 steps per minute (3.9% difference; 95% CI of difference [5.87 to 8.80]; p≤0.001; Cohen's d = 0.70). No significant differences were identified between RE and RErevSF for minimal footwear (40.72 ± 4.08 vs 41.09 ± 4.19 mL·min<sup>-1</sup>·kg<sup>-1</sup>; 95% CI of difference [-1.63 to 0.89]; p=0.53; Cohen's d = 0.09), or conventional running shoes (42.04 ± 4.68 vs. 41.74 ± 5.09 mL·min<sup>-1</sup>·kg<sup>-1</sup>; 95% CI of difference [-0.73 to 1.32]; p=0.54; Cohen's d = 0.06).

**CONCLUSIONS:** Changes in stride frequency as a result of footwear condition (~4%) were not of a large enough magnitude to have any significant impact on RE. This supports previous work in this area suggesting that stride frequency may not be an influencing factor for RE.

1673 Board #326 June 2, 8:00 AM - 9:30 AM  
**Physiological Responses To Lower-body Positive-pressure Treadmill Running- A Systematic Review And Meta-analysis**

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Lower body positive pressure treadmills (LBPTT) have been shown to reduce loading on the musculoskeletal system during walking and running by providing vertical lifting forces to an individual sealed inside a chamber. Subsequently, there has been an increase in published research examining the physiological effects of LBPTT exercise, but data have not been synthesized. **PURPOSE:** To collectively analyze all available literature to develop a model which describes how volume of oxygen consumption (VO2) is influenced by unweighting during running on LBPTT.

**METHODS:** This systematic review was conducted and reported according to the protocol outline by Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). A generic search strategy using PubMed, CINAHL, and SportsDiscus was employed to comprehensively identify all peer-reviewed publications which evaluated VO2 response in healthy individuals using LBPTT. A generalized estimating equation model with autoregressive covariance structure was developed to determine the relationship between VO2, running speed, and unweighting setting (percent of body weight) on LBPTT.

**RESULTS:** Six articles met inclusion criteria for this review, but only three (Hoffman 2011, Kline 2015, McNeill 2015) provided sufficient tabular data for meta-analysis of VO2 response. All model parameters were statistically significant (p<0.001). The final equation was: VO2 (ml O2/kg/min) = 6.716 × speed (m/s) + 0.336 × body weight (percent) - 20.251. The correlation between observed and model-predicted VO2 was excellent (r=0.94). The systematic review verified that faster treadmill speeds may be utilized to increase metabolic stimulus during unweighted running on LBPTT (Gojanovic 2012 and Raffalt 2013).

**CONCLUSIONS:** Within a given running speed, each ten percent decrease in LBPTT body weight setting is associated with ~3.4 ml O2/kg/min reduction in VO2. However, this model only represents three datasets, with treadmill speeds ranging from 1.79 to 5.36m/s and LBPTT settings of 50-100% of body weight, and thus this equation should not be extrapolated beyond these limits. There is a need to develop standardized LBPTT research protocols to allow for more straightforward comparison of unweighting between studies.

1674 Board #327 June 2, 8:00 AM - 9:30 AM  
**Influence Of Short-term Training On Performance And Reliability Of A 1-mile Run Test**

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**PURPOSE:** A 1-mile run is a common measure used to assess cardiorespiratory endurance for general fitness or as a construct for occupational fitness tests. However, the ability to quickly improve scores by directly training for the assessment is not well elucidated. **METHODS:** Eight (female = 4, male = 4), college-aged students (23 ± 4 y) completed nine, 1-mile run tests on an indoor track. Each session was separated

by  $\geq 48$  hours and all were completed in  $\leq$  four weeks. Participants reported to each session after a  $\geq 2$ -hour fast. **RESULTS:** A weak, negative relationship between test session and 1-mile run time was revealed by a Spearman-Rho rank order correlation ( $r = -0.25$ ,  $p = 0.03$ ). A repeated-measures ANOVA indicated a significant effect of time on 1-mile run score [ $F(5.096, 8)$ ,  $p < 0.001$ ], with session 9 ( $450.3 \pm 27.6$ s) significantly faster than sessions 1 ( $491.4 \pm 36.3$ s), 2 ( $468.2 \pm 46.2$ s), 4 ( $458.1 \pm 42.6$ s), and 5 ( $454.4 \pm 33.8$ s). There were no other differences among sessions. Additionally, test-retest reliability revealed strong ICC between session 1 and session 2 ( $ICC = 0.81$ ) and session 8 and session 9 ( $ICC = 0.96$ ). **CONCLUSIONS:** This study demonstrated that a short-term, directly targeted, training or familiarization program improved 1-mile run test scores in active college-aged students. Practitioners and those who must meet fitness standards for employment may be able to utilize a short-term, assessment specific, training protocol to improve 1-mile run scores.

1675 Board #328 June 2, 8:00 AM - 9:30 AM

### Electrocardiographic Analysis of Runners Before, During, And After An Ultramarathon

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It is known that ultra-endurance exercise places extraordinary stress on the cardiovascular system. Still, limited data are available examining cardiac physiology throughout an ultramarathon. Additionally, such events have been implicated in augmented ectopic activity and sudden cardiac death. Therefore, detecting arrhythmias during an ultramarathon event would be of interest. **PURPOSE:** The purpose was to evaluate electrocardiographic activity continuously before, during, and after a mountainous ultramarathon run. **METHODS:** Twenty-seven runners who registered for either a 44 kilometer (5 men, age  $49.2 \pm 1.6$  y; 4 women, age  $43.8 \pm 11.9$  y) or 163 km (14 men, age  $40.1 \pm 7.8$  y; 4 women, age  $38.8 \pm 11$  y) trail race underwent continuous EKG monitoring 1 day before an ultramarathon run (baseline), during, and a minimum of 24 hours post-race. Electrocardiograms were analyzed for the presence of arrhythmias. Participants completed a survey that included detailed health and running histories. **RESULTS:** There were no recognizable differences between men and women in HR or rhythms, so sexes were combined for group analyses. Ultramarathon experience ranged from 1 to 36y of racing with most racing 4-6y. No runners reported a history of coronary artery disease, and besides caffeine, no runners reported use of substances that would affect HR or rhythm. Minimum HR the night before the race was  $42 \pm 6$  BPM and ranged from 31-53 BPM. Rare PVCs and/or PACs occurred in 17 of 18 runners, and throughout the observational period, clinically relevant arrhythmias were observed in 5 runners. Generally, occurrences of arrhythmias were no different during or after than before the race. **CONCLUSIONS:** In a small sample of endurance runners at one ultramarathon run, the prevalence of arrhythmias during and after an ultramarathon race was not different from baseline.

1676 Board #329 June 2, 8:00 AM - 9:30 AM

### Physiological And Perceptual Response Of Drinking Vs Mouth Rinsing With Water During A 15-km Running Time Trial

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**PURPOSE:** This study examined the effects of ingesting versus mouth rinsing with water during a running time trial. **METHODS:** Recreationally active female runners ( $n = 23$ ;  $26 \pm 6$  y;  $22 \pm 3$  % body fat) completed two, 15-km time trials on an outdoor course ( $\sim 20^\circ\text{C}$ ; 87% RH) in a randomized cross-over study design. Participants consumed 355 ml of water (CW) or mouth rinsed (MR) with water every 3-km for 5 s. Completion time, HR, RPE, sweat loss, pre-and post-run ratings of perceived thirst, and gut fullness were measured. **RESULTS:** Sweat losses were greater ( $p = 0.01$ ) for CW ( $1.6 \pm 0.6$  L) compared to MR ( $1.2 \pm 0.3$  L), however did not alter performance ( $79.8 \pm 7.0$  min and  $79.7 \pm 7.1$  min,  $p = 0.64$ ), HR ( $181 \pm 15$  and  $179 \pm 13$  bpm,  $p = 0.44$ ), or RPE ( $16 \pm 2$  and  $16 \pm 2$ ,  $p = 0.97$ ). Perceived thirst did not differ before run ( $3.6 \pm 1.8$  and  $4.1 \pm 1.5$  for CW and MR), but was higher ( $p = 0.02$ ) for MR ( $6.8 \pm 1.1$ ) compared to CW ( $5.8 \pm 2.0$ ) post-run. No difference in post-run GF ( $5 \pm 1.7$  and  $4.7 \pm 1.4$ ,  $p = 0.85$ , for CW and MR) was observed. **CONCLUSION:** MR may reduce sweat volume versus CW when running for  $>1$  h in temperate and humid environments, but does not impair performance or induce significant cardiovascular drift in female runners who begin exercise euhydrated. A MR strategy may reduce gastrointestinal distress for runners who do not like drinking during runs and allow for a reduction in volume of water carried.

1677 Board #330 June 2, 8:00 AM - 9:30 AM

### Relationship between the Hamstring to Quadriceps Strength Ratio and Endurance Exercise Performance in Trained Female Runners

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**PURPOSE:** The relationship between the hamstrings to quadriceps (H/Q) strength ratio and endurance exercise performance was examined in ten trained female runners as measured by  $\text{VO}_{2\text{peak}}$ , running economy, lactate threshold, and 10 K running time. **METHODS:** Subjects ( $23.5 \pm 4.6$  yr;  $\text{VO}_{2\text{peak}}$   $57.03 \pm 5.09$  mL/kg/min) completed three exercise testing sessions consisting of a Modified McConnell  $\text{VO}_{2\text{peak}}$  test, isokinetic lower extremity strength test, and 10 K time trial. Blood lactate was measured via capillary blood pre exercise, at every 3 min during exercise, and immediately post exercise during the  $\text{VO}_{2\text{peak}}$  test to determine lactate threshold. All  $\text{VO}_{2\text{peak}}$  tests were videotaped and stride rate and stride length were determined at 3.13 m/s, 3.58 m/s, and 4.02 m/s. **RESULTS:** No significant correlations were observed between the H/Q strength ratio at 60°/s and 180°/s and any of the performance variables. No significant correlations existed between the H/Q strength ratio at 60°/s and 180°/s and stride rate and stride length at any speed. **CONCLUSION:** The physiological adaptations associated with endurance training may have contributed to high H/Q strength ratios at both angular velocities, despite no direct relationship with running performance. High H/Q strength ratios neither helped nor hurt running performance and the H/Q strength ratio alone may not be the main determinant of performance for competitive runners.

1678 Board #331 June 2, 8:00 AM - 9:30 AM

### Correlation Between Aerobic Threshold And Point Of Maximal Fat Utilization In Male Runners

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The oxidation of fat and carbohydrates during exercise has been widely studied in different populations but there are still contrasting results regarding relative intensity at which maximal fat utilization (FATmax) occurs in athletes.

**PURPOSE:** To determine the point at which FATmax occurs in runners using a treadmill protocol with constant grade and running speed. Also, to correlate FATmax and aerobic threshold (AerT) in endurance runners. **METHODS:** Fifty trained male runners (age  $24.7 \pm 3.4$  years,  $\text{VO}_{2\text{peak}}$  of  $50.53 \pm 8.45$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) reported to the laboratory between 8:00am and 2:00pm, two hours from last food intake and 24 hours from the last caffeine and alcohol intake and from high intensity physical activity. Athletes completed a cardiopulmonary exercise test on a treadmill starting at 6 km·h<sup>-1</sup> speed and 1% grade and the intensity (speed) was increased 1 km·h<sup>-1</sup> every 2 minutes until exhaustion. Fat oxidation was calculated by COSMED Quark PFT suite software using a stoichiometric equation. The AerT was detected as 1. The first rise of  $\text{VE}/\text{VO}_2$ , 2. The breakpoint of the  $\text{VCO}_2/\text{VO}_2$  curve, 3. The first constant increase of RQ, 4. The first increase of expiratory fraction of O<sub>2</sub>. Pearson's correlation coefficients ( $r_2$ ) was used to compare  $\text{VO}_2$  at AerT and  $\text{VO}_2$  at FATmax. **RESULTS:** FATmax and AerT occurred at  $47.4 \pm 4.25$  %  $\text{VO}_{2\text{peak}}$  and  $45.54 \pm 4.07$  %  $\text{VO}_{2\text{peak}}$ , respectively with fat oxidation at FATmax equal to  $0.59 \pm 0.26$  g·min<sup>-1</sup>. A high correlation was found between FATmax and AerT ( $r_2 = 0.87$ ,  $P < 0.001$ , 95% CI of 0.79 to 0.93). **CONCLUSIONS:** The correlation between AerT and FATmax supports our hypothesis that the point of optimal ventilatory efficiency corresponds to the maximal capacity of the muscles to oxidize fat in trained runners. These results demonstrate that FATmax can be used as an individual parameter for the cardiopulmonary exercise test.

1679 Board #332 June 2, 8:00 AM - 9:30 AM

**Digit Ratio Is Unrelated To One Mile Running Performance In Males And Females**Lucas K. Fogaca, Eric J. Hegedus, James M. Smoliga. *High Point University, High Point, NC.* (Sponsor: Gerald Zavorsky, FACSM)

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“Digit ratio” is the ratio between the second and fourth fingers of the hand, and has been explored in relation to various biologic phenomena, including physical fitness. It has been suggested that digit ratio reflects pre-natal testosterone exposure, and that this has implications in adulthood. Recent research (Longman 2015) suggested that digit ratio was related to half marathon performance. However, the weak relationships between digit ratio and human performance suggest further research is needed to better characterize its biological relevance.

**PURPOSE:** To determine the relationship between digit ratio and one mile run performance in males and females.

**METHODS:** 27 recreational and competitive athletes (19 males and 8 females) completed a questionnaire regarding their sports abilities and best times in various track events. Each participant underwent standard digit ratio measurement procedures, in which hand was digitally scanned and the image saved for analysis. Digit length was measured from the proximal crease to the tip of the finger using digital photography editing software. The ratio between the second and fourth fingers was then computed bilaterally. Spearman's correlation was then performed to relate mile run time to digit ratio for each hand.

**RESULTS:** Mile run time was  $281 \pm 37$ s in males and  $305 \pm 8.0$ s in females. Digit ratio was  $0.94 \pm 0.03$  on the left side and  $0.94 \pm 0.02$  on the right side in males and  $0.97 \pm 0.03$  bilaterally in females. All correlations were weak and not statistically significant. In males, the correlations between mile run time and digit ratio were  $r = -0.19$  ( $p = 0.43$ ) on the left and  $r = 0.18$  ( $p = 0.47$ ) on the right. For females, the correlations were  $r = 0.18$  ( $p = 0.66$ ) on the left and  $r = 0.15$  ( $p = 0.72$ ) on the right. When both sexes were combined, the correlation was  $r = 0.02$  ( $p = 0.93$ ) on the left, and  $r = 0.28$  ( $p = 0.15$ ) on the right.

**CONCLUSIONS:** Weak, non-significant relationships between digit ratio and mile run performance suggest that there is not a biologically relevant relationship between these two variables. If larger sample sizes were to demonstrate statistical significance, the utility of digit ratio measurements likely remains questionable, as the relationship appears inherently weak.

1680 Board #333 June 2, 8:00 AM - 9:30 AM

**The Effect Of Graduated Compression Garments on Foot Volume During Running**Andrew Creer, Kelsee Soelberg, Skyler Peterson, Dillon Hepworth, Michael Bohne. *Utah Valley University, Orem, UT.*

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Compression stockings are commonly recommended to help reduce edema in the lower extremities at rest; however, the effect of wearing compression stockings on lower extremity edema during exercise remains a mystery. Understanding the effects of compression stockings on foot volume during exercise could potentially increase the type of aerobic activities available to adults with conditions contributing to lower extremity edema. **Purpose:** To determine if compression stockings will reduce running associated increases in foot volume compared to running without compression stockings. **Methodology:** Ten recreational runners (8 male, 2 female;  $27.3 \pm 5.8$  yrs;  $73.2 \pm 8.4$  kg,  $VO_{2max}$   $49.1 \pm 5.9$  ml/kg/min) completed two 20 min submaximal treadmill runs (1% grade,  $11.2 \pm 1.1$  km/hr,  $72.3 \pm 2.9\%$  of  $VO_{2max}$ ) with a compression sock or sleeve on the dominant leg and a regular sock on the control leg. Compression and control foot volume was measured using a foot volumeter before and after each trial and compared using a repeated-measures ANOVA. Pre and post run volume comparisons within groups were performed using a paired t-test ( $\alpha = 0.05$ ). **Results:** In response to 20 min of treadmill running, foot volume significantly increased ( $p < 0.05$ ) in the control leg of the sock and sleeve trials ( $4.2 \pm 2.4$  and  $6.0 \pm 4.9\%$ ), as well as in the sleeve leg ( $3.1 \pm 3.5\%$ ). There was a non-significant trend for an increase in the sock leg ( $1.8 \pm 3.1\%$ ;  $p = 0.08$ ). The overall increase in foot volume was greater ( $p < 0.05$ ) in the control leg compared to the sock ( $24 \pm 14.1$  to  $11 \pm 17.8$ ml) and sleeve ( $33.0 \pm 27.5$  to  $17.5 \pm 20.8$ ml) legs, respectively. There was no difference in foot volume when comparing the effects of the compression sock to the sleeve. **Conclusion:** Use of a compression sock or sleeve appears to reduce the observed increase in foot volume experienced among runners, and this effect may be greater with a compression sock than sleeve.

1681 Board #334 June 2, 8:00 AM - 9:30 AM

**Respiratory Exchange Ratio is Not Associated with Slowing in the Marathon**Erin K. McGuirk, Christopher J. Lundstrum, Morgan R. Betker, Zachary T. Rourk, Katelyn E. Uithoven, Emma J. Lee, Eric M. Snyder. *University of Minnesota, Minneapolis, MN.* (Sponsor: Michael J. Joyner, FACSM)

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Previous research has shown that males slow more throughout the course of a marathon than females. A possible cause of differences in slowing could be that females oxidize proportionately more lipids and less carbohydrates during exercise compared to males. Respiratory exchange ratio (RER) can be used to estimate the ratio of fat to carbohydrates being metabolized. **Purpose:** To compare the degree of slowing (time in the first vs. second half of a marathon) between men and women, and determine if steady-state RER predicts slowing in male and female novice marathon runners. **Methods:** Chip times for 72 female and 19 male novice marathon runners ( $21.5 \pm 1.6$  yrs) were used to determine change in pace observed in the second half of the marathon compared to the first half. Subjects were categorized as having maintained pace ( $\leq 10\%$ ) or marked slowing ( $\geq 30\%$ ). A two-mile time trial (2MI) was used to assess baseline fitness. A submaximal 6-minute treadmill run at 75% of 2MI velocity was completed 1-3 weeks before the marathon. RER was collected using a metabolic cart (MGC Diagnostics Ultima). Independent samples t-tests were used to assess differences in RER and percent slowing between the sexes. Fisher's Exact Test was used to test if pace maintenance category is significantly different between the sexes. Pearson's Correlation  $r$  was used to assess the correlation between RER and percent slowing. **Results:** The mean percent slowing for males and females was  $29.1 \pm 13.4\%$  and  $20.5 \pm 16.6\%$ , respectively ( $p = 0.032$ ). Females had a significantly lower RER during steady-state exercise in comparison with males (Female =  $0.86 \pm 0.04$ , Male =  $0.89 \pm 0.04$ ,  $p = 0.02$ ). Sex was a predictor of maintaining marathon pace or marked slowing ( $p = 0.028$ ). There was no significant correlation between RER and percent slowing in either males or females. **Conclusion:** Consistent with previous research, males slow more than females from the first to second half of the marathon. However, RER was not associated with slowing during the marathon. This suggests that pace maintenance is not due to substrate metabolism.

1682 Board #335 June 2, 8:00 AM - 9:30 AM

**Impact Of Exhaustive Run On The Lower Extremity Biomechanics**Zhuwen Jiang<sup>1</sup>, Jiahao Pan<sup>2</sup>, Li Li, FACSM<sup>3</sup>. <sup>1</sup>Shanghai Technical Institute of Electronics Information, Shanghai, China. <sup>2</sup>Shanghai Sanda University, Shanghai, China. <sup>3</sup>Georgia Southern University, Statesboro, GA. (Sponsor: Li Li, FACSM)

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**Impact of exhaustive run on the Lower Extremity Biomechanics****Abstract**

**Purpose:** The aim of this study was to investigate kinematic and kinetic changes occurred in stance phase during running to exhaustion.

**Method:** 8 male recreational runners (age  $22.5 \pm 1.6$  years old, height  $177.60 \pm 0.02$ cm and mass  $80.6 \pm 8.63$ kg) from local community were participants in this study. They had no lower extremity injury history within-six months, and in apparent good health. AMTI three dimensional force treadmill was used to measure the ground reaction force, and the speed were set at 7.5 mile/hour with sample frequency of 1000Hz. Vicon Motion system with 8 cameras was used for capturing 3D kinematic movements of lower extremities with 40 14mm reflective markers. The sampling frequency was set at 200Hz. The participants were instructed to run on the treadmill until they cannot run, due to exhaustion, anymore. Ten seconds he data of from the start, middle and end of the run were calculated and processed by using C-Motion visual 3D software for both kinetics and kinematics parameters.

**Results:** Stride duration decreased ( $0.72 \pm 0.03$  vs.  $0.71 \pm 0.04$ s, at the start and end of the run, respectively), and stance phase duration increased ( $0.23 \pm 0.01$  vs.  $0.23 \pm 0.01$ s) as observed in this study. More ankle plantarflexion ( $-44.9 \pm 5.4$  vs.  $-46.4 \pm 5.5^\circ$ ) was noted at foot contact during run to exhaustion. No prominent adjustment of knee flexion ( $46.2 \pm 4.3$  vs.  $45.2 \pm 7.0^\circ$ ) was observed during foot initial contact, but an increase ( $12.2 \pm 4.2$  vs.  $10.2 \pm 3.8^\circ$ ) observed during toe-off. There was a decline of ankle plantarflexion moment ( $3.2 \pm 0.3$  vs.  $3.1 \pm 0.3$  N-m/kg) and an increase of knee extension moment ( $2.8 \pm 0.4$  vs.  $3.0 \pm 0.7$  N-m/kg) observed.

**Conclusion:** There was a trend of adjustment of sagittal plane kinematics and kinetics variables observed, regarded as runners were seeking to modulate movements for protecting themselves from injury potential.

1683 Board #336 June 2, 8:00 AM - 9:30 AM  
**Descriptive Comparison of Visually Assessed Quality of Movement Assessments in Young Runners**

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Females who participate in sports are 4-6 times more likely than males to rupture their ACL. Numerous means of assessing risk of injury requiring the use of expensive equipment and significant time investment exist. The Tuck Jump and Lateral Step Down assessments have been deemed "clinician friendly" and can be administered with simple visual assessment. Both tests assess the quality of movement and neuromuscular control of the individual. The lateral step down assessment also evaluates the biomechanics of the lower extremity and trunk during a single leg task. Based on deficiencies, determinations of injury risk can be determined and prevention strategies can be developed. **PURPOSE:** (1) To determine the frequency of lower extremity injury risk in adolescent runners based on visual assessment of the quality of movement during using the Tuck Jump Assessment and Lateral Step Down Test. (2) To compare the visual assessment outcomes of the Tuck Jump Assessment and Lateral Step Down Test in a clinical setting. **METHODS:** Age, gender, lower extremity dominance, and history of knee pain were collected from each participant (n=82). Participants underwent visual assessment of the Tuck Jump Assessment and the Lateral Step Down Test. Two separate clinicians graded each test in without video assistance. **RESULTS:** Average risk calculated from the tuck jump assessment was 2.78 +/- 1.35 points. Females scored higher than males (2.98+/- 1.29 vs. 2.32 +/-1.41 points. 67% of females scored greater than 3 points compared to males at 45% scoring 3 or more points.. Average score for the lateral step down test was 2.19 +/- 1.09 points. Females scored lower than males (2.17+/-1.06 vs. 2.24+/-1.09 points). 76% scored of females were scored as moderate risk or greater while 71% of males scored similar. **CONCLUSION:** Females demonstrated higher frequency of risk of lower extremity injury when scored using the Tuck Jump as compared to their male counterparts . This data is consistent with higher ACL injury rates in females. Males and females demonstrated nearly the same frequency of lower extremity injury risk when visually assessed using the Lateral Step Down Test. Further research is needed to provide a standardized assessment for consistently determining an athlete's risk of injury and appropriately using these data to develop quality prevention programs.

1684 Board #337 June 2, 8:00 AM - 9:30 AM  
**12 Day Adventure Run Training at Altitude Improves Sea Level 5km Performance - A Pilot Study**

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High-altitude (HA) training for 3-6 weeks has been an integral part of many elite endurance training programs for the past few decades. However, less is known about performance changes after only 12 days and what this might mean for sea level performance. **PURPOSE:** Therefore, we measured the effect of a 12-day adventure running camp at altitude on 5 km time trial (TT) performance and hypothesized an improvement would occur. **METHODS:** A group of 5 individuals (22-32 years old; 3 male, 2 female) volunteered. All runners began the study with at least 2-months of consistent training (e.g., 3-4 days and 10-30 mi-wk<sup>-1</sup> of running per week). In a standardized fashion, 5km TT run, maximal volume of oxygen uptake (VO<sub>2</sub>max), running economy (RE), and a complete blood chemistry (CBC) assessment were measured at sea-level prior to and immediately after the running camp. VO<sub>2</sub>max and RE were tested simultaneously with an incremental treadmill protocol. Blood was drawn by certified phlebotomists in the antecubital vein of individual's preferred arm in a well hydrated and rested state. Natural altitude exposure (i.e., 7,000 to 14,000 ft ASL) occurred in Colorado where runners engaged in prescribed, low-moderate intensity (e.g., approximately 50-60% heart rate max) and long duration (i.e., 2-7 hrs-day<sup>-1</sup>) exercise for 12 days. Sleeping was maintained at 7,000 ft ASL. After 12 days, runners traveled to sea-level and post-testing within 2-days of leaving altitude. Paired t-tests were utilized to describe differences between pre- and post-tests with p ≤ 0.05 set for significance. **RESULTS:** In relation to select CBC parameters, significant changes occurred (p < .05) and are as follows from pre- to post-altitude, respectively: hemoglobin concentration (HC; 13.8 ± 2.2 & 15.04 ± 2.1 g/dl), red blood cell count (RBC; 4.83 ± 0.47 & 5.09 ± 0.43 x 10<sup>6</sup>/ul), and hematocrit (Hct; 41.9 ± 5.6 & 44.8 ± 5.7 %). Mean 5 km TT performance also changed significantly from pre to post, respectively (21.49 ± 2.7 & 20.85 min ± 2.7). There was no significant (p > 0.05) difference observed for VO<sub>2</sub>max or RE. **CONCLUSION:** Since 5km TT performance improved, our hypothesis was

supported. Because no significant change occurred with respect to VO<sub>2</sub>max and RE, positive blood changes, such as increased HC, RBC, and Hct, may have contributed to improved TT performance.

1685 Board #338 June 2, 8:00 AM - 9:30 AM  
**Relationship Between Grip Strength and Seated Medicine Ball Throw in Young Adult Distance Runners**

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Grip strength (GS) and seated medicine ball toss (MB) have been used as simple, inexpensive, safe, and reproducible methods of assessing upper extremity strength and power in a broad spectrum of populations.

**PURPOSE:** The purpose of this investigation was to examine the relationship between grip strength dynamometer test results and seated medicine ball throw results in young adult distance runners.

**METHODS:** Young adult male (n = 18; 65.6 ± 3.9 kg; 177.1 ± 5.4 cm; 19.8 ± 1.2 yrs; 20.9 ± 1.1 BMI) and female (n = 17; 53.5 ± 7.0 kg; 162.2 ± 6.7 cm; 20.3 ± 1.6 yrs; 20.3 ± 1.7 BMI) endurance trained Division I cross-country athletes volunteered to report to the Human Performance Lab (HPL) on one occasion for GS and MB. The GS was performed with the participant standing with their arm bent 90 degrees at the elbow. Participants were instructed to squeeze the dynamometer as hard as possible for 3 to 5 seconds. Participants alternated between dominant (DOM) and non-dominant (NDOM) hands with one-minute rest in between trials and the best of three trials used for the analysis. For the MB, participants were seated with their back against a wall and legs extended out in front. Participants held the ball at their chest and threw it as far as possible with both hands three times with the best score used for analysis. Twelve participants made a second visit a short time later to the HPL for Interclass Correlation Coefficient (ICC) testing of the MB. Pearson's Product-Moment Correlation Coefficient was used to determine the relationship between grip strength and seated medicine ball throw.

**RESULTS:** Test-retest reliability assessment revealed an ICC = 0.96 and SEM = 22.24 cm. Mean values were found to be: DOM = 35.11 ± 8.17 kg, NDOM = 33.80 ± 8.11 kg, MB = 449.90 ± 100.55 cm. There was a significant correlation between MB distance and DOM handgrip strength (r = 0.851, p < 0.001) as well as between MB distance and NDOM handgrip strength (r = 0.913, p < 0.001).

**CONCLUSION:** The MB was found to be reliable and highly correlated with GS of both hands with this group of young endurance athletes. Future work is needed in continuing to establish the validity and reliability of GS and MB as an assessment of upper body strength and power in athletic groups.

1686 Board #339 June 2, 8:00 AM - 9:30 AM  
**Responses of Biochemical Routine Measures to 216 km Ultra-Marathon Running**

Renate M. Leithauser<sup>1</sup>, Heinz J. Roth<sup>2</sup>, Michael Doppelmayr<sup>3</sup>, Serge P. Von Duvillard, FACSM<sup>4</sup>, Lawrence A. Golding, FACSM<sup>5</sup>, Ralph Beneke, FACSM<sup>1</sup>. <sup>1</sup>*Philipps-University, Marburg, Germany.* <sup>2</sup>*Limbach Laboratory, Heidelberg, Germany.* <sup>3</sup>*Johannes Gutenberg University, Mainz, Germany.* <sup>4</sup>*University of Salzburg, Salzburg, Austria.* <sup>5</sup>*University of Nevada, Las Vegas, NV.*  
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Ultra-endurance running puts enormous strain on the human body. Previous research has indicated that in ultra-endurance exercise some exercise-induced effects accumulate gradually over time whilst others show different responses to given stages of the exercise. **PURPOSE:** To assess changes in biochemical routine markers related to muscle breakdown, hepatic and kidney damage as well as lipid profile after given sub-sections of a one-stage ultra-marathon race.

**METHODS:** Venous blood samples were obtained from five highly-trained male ultra-endurance athletes (mean±SD: age 53.8±10.4 yrs, height 175.8±11.1 cm, body mass 75.9±8.4 kg) before the start of the race (km0), after completion of one (km42), two (km84) and three (km126) marathon distances and after termination of the race (km216) for the analysis of serum enzymes creatine kinase (CK), aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma-glutamyl transferase (GGT) and lactate dehydrogenase (LDH) in addition to creatine (CREA) and cystatine C (CYSC) as well as concentrations of total cholesterol (CHOL), HDL-CHOL (HDL), LDL-CHOL (LDL) and triglycerides (TG).

**RESULTS:** All measures except GGT and CYSC revealed a significant time effect (p<0.01). In response to exercise ALT, AST, LDH, CK and CREA were increased (p<0.05) at all measuring points compared to km0. Furthermore, serum enzymes at km216 were higher (p<0.05) compared to km42 (AST, ALT, LDH, CK), km84 (AST, ALT, CK) and km126 (AST, ALT, LDH). Compared to km0 the lipid profile was not

significantly changed up to km84 but then CHOL, TG and LDL decreased and HDL increased significantly so that at km216 values were different compared to previous distances (all  $p < 0.05$ ).

**CONCLUSIONS:** In a selection of biochemical routine measures significant changes occur in response to ultra-marathon running whilst only CYSC and GGT remain unaffected by the physical stress. The clear increase in serum enzymes CK, LDH, AST and ALT from the first marathon distance throughout the remaining race with unchanged GGT and CYSC indicates skeletal muscle tissue damage rather than hepatic or kidney damage. The changes in the lipid profile with a decrease in TG, CHOL and LDL and an increase in HDL seem to underline the beneficial effect of endurance exercise.

Supported by Limbach Laboratory, Heidelberg, Germany

**C-46 Free Communication/Poster - Skeletal Muscle**

Thursday, June 2, 2016, 7:30 AM - 12:30 PM  
**Room:** Exhibit Hall A/B

1687 Board #340 June 2, 9:00 AM - 10:30 AM

**Effects of a Resistance Band Training Program on Muscle Soreness During Pregnancy with Limited Intervention**

Erin E. White<sup>1</sup>, Melissa Richards<sup>2</sup>, Ashley Kloeckner<sup>1</sup>, Taylor Kuhn<sup>1</sup>, Jalana Larson<sup>1</sup>, Kayleigh McClure<sup>1</sup>, Emily Passint<sup>1</sup>, Evan Peterson<sup>1</sup>, Kaila Potting<sup>1</sup>, Megan Williams<sup>1</sup>. <sup>1</sup>Winona State University, Winona, MN. <sup>2</sup>Winona Health, Winona, MN. (Sponsor: James Pivarnik, FACSM)  
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Mothers often experience muscle soreness after delivery; however, few studies have examined how this is affected by resistance band training performed during pregnancy. **PURPOSE:** To determine the effects of resistance band training on muscle soreness when performed with limited intervention during the second and third trimesters of pregnancy.

**METHODS:** Pregnant women were recruited from a local hospital. Once enrolled, they took a pre-intervention (~16 wk gestation) survey regarding upper & lower body muscle soreness (1 = normal, 10 = very, very sore). Women were randomized to exercise (EX) (n = 9) or standard-care (SC) (n = 6) groups. The EX group performed a 15 week resistance band training program 3 times/wk. One session was supervised while the other sessions were done independently with follow-up via text messages. Participants then completed a post-delivery survey on muscle soreness. Maternal, newborn, and delivery outcomes were measured. Change scores (pre minus post) were calculated for muscle soreness. Comparisons were made using independent t-tests and chi-square tests.

**RESULTS:** Fifteen women participated, mean age at delivery was  $27.2 \pm 3.9$  years and mean prepregnancy BMI was  $25.5 \pm 4.8$  kg/m<sup>2</sup>. There were no significant differences in newborn outcomes (weight, length, Apgar scores,  $p > 0.05$ ). There was a significant difference between groups in the change score of lower body muscle soreness (EX Mean =  $-1.0 \pm 2.2$ , SC =  $-4.4 \pm 3.2$ ;  $t(12) = -2.4$   $p = 0.02$ ) and mode of delivery (vaginal vs. cesarean section)  $\chi^2(2, n = 15) = 6.3, p = 0.02$ .

**CONCLUSION:** A low-intensity resistance band training program with limited intervention performed during pregnancy was associated with a significant decrease in the amount of change in lower body muscle soreness from early pregnancy to post delivery. In addition, a higher percentage of women in the EX group had vaginal deliveries. Adherence to the training program was high (>98%) and evidence showed no adverse results. However these findings need to be confirmed in a larger and more diverse sample. The use of resistance bands is a practical and cost-effective training program accommodating individual lifestyles. Thus, practitioners should consider encouraging women to participate in a similar prenatal resistance band training program to reduce lower body muscle soreness after delivery.

1688 Board #341 June 2, 9:00 AM - 10:30 AM

**An Examination of Muscle Activation and Power Characteristics While Performing the Deadlift Exercise with Straight and Hexagonal Barbells**

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 (No relationships reported)

The deadlift is commonly performed to develop strength and power, and to train the lower body and erector spinae muscle groups. However, little is known about the acute effects of using a hexagonal vs. a straight barbell.

**PURPOSE:** To examine the hexagonal barbell in comparison to the straight barbell by analyzing electromyography (EMG) from the vastus lateralis, biceps femoris, and erector spinae, as well as peak force, peak power, and peak velocity.

**METHODS:** Twenty men completed a one-repetition maximum (1RM) test with each barbell on two separate occasions. Three repetitions at 65% and 85% 1RM were performed with each barbell on a third trial.

**RESULTS:** There was no significant difference for 1RM values between the barbells (mean  $\pm$  SD in kg =  $181.4 \pm 27.3$  vs.  $181.1 \pm 27.6$ , respectively) ( $p > 0.05$ ). Significantly greater normalized EMG values were found from the vastus lateralis for both the concentric ( $1.199 \pm 0.22$ ) and eccentric ( $0.879 \pm 0.31$ ) phases of the hexagonal compared to the straight barbell deadlift ( $0.968 \pm 0.22$  and  $0.559 \pm 1.26$ ), while the straight barbell led to significantly greater EMG values from the bicep femoris during the concentric phase ( $0.835 \pm 0.19$ ) and the erector spinae ( $0.753 \pm 0.28$ ) during the eccentric phase compared to the corresponding values for the hexagonal barbell deadlift ( $0.723 \pm 0.20$  and  $0.614 \pm 0.21$ ) ( $p \leq 0.05$ ). The hexagonal barbell deadlift demonstrated greater peak force ( $2,553.20 \pm 371.52$  N), peak power ( $1,871.15 \pm 451.61$  W), and peak velocity ( $0.805 \pm 0.165$ ) compared to the straight barbell deadlift values ( $2,509.90 \pm 364.95$  N,  $1,639.70 \pm 361.94$  W, and  $0.725 \pm 0.138$  m/s) ( $p \leq 0.05$ ).

**CONCLUSIONS:** The barbells led to different patterns of muscle activation, and the hexagonal barbell may be more effective at developing maximal force, power, and velocity.

1689 Board #342 June 2, 9:00 AM - 10:30 AM

**Chest Press Exercises with Different Stability Requirements Result in Similar Muscle Damage Recovery**

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Free weight and machine resistance exercises are distinct regarding movement control and stabilization requirements. These differences influence muscle force production and neuromuscular activity. Studies have reported higher force production using guided machines, yet higher muscle activation using free weights. These results suggest that levels of mechanical strain, muscle damage, and time course of muscle damage recovery may be different between free weight and machine resistance exercises for the same muscle group.

**PURPOSE:** This study investigated the time course up to 96 hours of muscle recovery after three different chest-press exercises with different stability requirements in highly resistance-trained men. **METHODS:** Twenty-seven men ( $23.5 \pm 3.8$  yrs) were randomly assigned to one of three groups: 1) Smith machine (chest-press exercise guided); 2) barbell (chest-press exercise with free weights); or 3) dumbbell (chest-press exercise with free weights). Participants performed 8 sets of 10 repetition maximum chest-press exercise with 2 min rest between sets. Muscle thickness, peak torque (PT), and soreness were measured pre, post, 24, 48, 72 and 96 h following exercise. **RESULTS:** The load lifted by the free weight dumbbell group ( $62.8 \pm 9.5$  kg) was 18.6% lower than the free weight barbell group ( $74.5 \pm 12.5$  kg,  $p = 0.042$ ) and 15.2% lower than the Smith machine group ( $72.4 \pm 9.7$  kg,  $p = 0.05$ ). However, there were no differences in PT or muscle thickness recovery of shoulder horizontal adductors ( $p = 0.98$  and  $p = 0.91$ , respectively) or elbow extensors between groups ( $p = 0.07$  and  $p = 0.86$ , respectively). Muscle soreness recovery of the pectoralis major was also not different between groups ( $p > 0.05$ ). The Smith machine and barbell groups recovered from triceps brachii muscle soreness by 72h post-exercise ( $p > 0.05$ ), while the dumbbell group did not present any triceps brachii muscle soreness after exercise ( $p > 0.05$ ). **CONCLUSION:** Highly resistance-trained men experience similar muscle damage recovery following Smith machine, barbell and dumbbell chest-press exercise. However, muscle soreness of the elbow extensors takes longer to recover after barbell chest-press exercise.

THURSDAY, JUNE 2, 2016

1690 Board #343 June 2, 9:00 AM - 10:30 AM

**Comparative Impacts of Plate-Loaded and Cable Resistance Machines on Muscle Activity and Joint Kinematics**

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(No relationships reported)

Cable machines (CABLE) have become increasingly popular tools for resistance training; however, the relative impacts of plate-loaded machines (PLATE) versus CABLE on muscle utilization patterns and related kinematics is unclear. **PURPOSE:** To examine differences in muscle activity and kinematics between CABLE and PLATE. **METHODS:** Healthy participants (9M, 6F, height = 1.75 ± .07 m, mass = 75.70 ± 11.79 kg, age = 24.33 ± 4.88 yrs) completed 5 repetitions of overhead press, bicep curl, and chest press exercises with 8-RM loads on PLATE and CABLE in a randomized order. Muscular activities (rmsEMG,  $\mu$ V) of the pectoralis major (PM), anterior deltoid (AD), biceps brachii long head (BB), rectus abdominus (RA), external oblique (EO), and triceps brachii lateral head (TB) were measured using surface electromyography. Joint range of motion (ROM, rad) of the shoulder, elbow, hip, and knee was recorded using a high speed camera and assessed using Kinovea biomechanical analysis software. Independent-samples t-tests were conducted to examine the differences in rmsEMG and ROM between the CABLE and PLATE for each exercise. **RESULTS:** Significantly higher rmsEMG values were observed during the biceps curl on CABLE in the PM ( $M_{diff} \pm SE = 68.99 \pm 25.55, p = .017$ ) and AD ( $M_{diff} \pm SE = 77.31 \pm 24.10, p = .06$ ), along with greater shoulder ROM ( $M_{diff} \pm SE = 7.51 \pm 3.44, p = .036$ ). The chest press produced significantly higher rmsEMG on CABLE in the BB ( $M_{diff} \pm SE = 120.24 \pm 26.59, p < .001$ ), RA ( $M_{diff} \pm SE = 39.78 \pm 17.47, p = .039$ ), and EO ( $M_{diff} \pm SE = 16.05 \pm 5.93, p = .017$ ), and significantly higher rmsEMG on PLATE in the TB ( $M_{diff} \pm SE = 157.35 \pm 31.33, p < .001$ ). CABLE also displayed significantly greater hip ROM ( $M_{diff} \pm SE = .037 \pm .011, p < .001$ ), knee ROM ( $M_{diff} \pm SE = .107, p < .001$ ), and shoulder ROM ( $M_{diff} \pm SE = 1.277 \pm .080, p < .001$ ) for this exercise. The overhead press produced higher rmsEMG on the CABLE in the BB ( $M_{diff} \pm SE = 117.32 \pm 25.82, p < .001$ ) and EO ( $M_{diff} \pm SE = 11.60 \pm 3.82, p = .009$ ) and significantly greater hip ROM ( $M_{diff} \pm SE = .037 \pm .011, p < .001$ ), knee ROM ( $M_{diff} \pm SE = .107, p < .001$ ), and shoulder ROM ( $M_{diff} \pm SE = 1.277 \pm .080, p < .001$ ) than PLATE. **CONCLUSION:** Our results argue for the use of CABLE over PLATE for increased muscle activation and ROM; however, their relative impacts on power, strength and functionality remain undetermined.

1691 Board #344 June 2, 9:00 AM - 10:30 AM

**Activation Of Lower Limb Deep Muscles During Deep Squats On Different Unstable Surfaces**

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(No relationships reported)

Although there are many studies about the effect of unstable conditions on surface muscles during deep squats, a key human movement, the conclusions were not consistent, e.g., while some studies showed that unstable conditions decreased force generation and the muscular activities increased with the level of instability, others concluded that there were not significant changes in muscle patterns among unstable surfaces.

**PURPOSE:** To evaluate the effect of unstable conditions on both deep and surface muscles activation during deep squat posture.

**METHODS:** Eighteen healthy males (22.3±1.8 years, height: 173±4 cm, mass: 67.4±5.8 kg) volunteered for the experiment. One repetition maximum (1RM) tests (69.5±7.6 kg) were performed for squats on stable surface. The sEMG of the tibialis anterior (TA) and rectus femoris (RF) were collected by a Trigno EMG system when holding the deep squat posture (thigh and calf at an 80 degree angle) for 5s on Balance Disc (BD, unstable) and on ground (stable) with 30%RM. The thickness of TA, RF, hallucis longus (HL) and shares muscle (SM) were measured by APLIO Doppler 400 at the same time. A polar heart rate monitor was used to ensure participants' heart rates were under 100 beats/minute. Paired t-test and effect size (ES, Cohen's d) were calculated to evaluate the difference between stable and unstable conditions. **RESULTS:** 1. sEMG and thickness of muscle responded similarly during deep squatting. 2. Significant difference was observed for TA, HL, and SM between stable and unstable surfaces (Table 1).

Measurement	Muscle	Ground	BD	ES	p value
sEMG	TA	26.48±6.76	21.56±6.17	-0.76	0.03
	RF	25.14±8.08	26.57±8.09	0.18	0.60
Thickness (cm)	TA	1.25±0.13	1.17±0.09	-0.72	0.04
	HL	1.40±0.24	1.58±0.28	0.67	0.05
	RF	2.06±0.45	2.10±0.39	0.09	0.78
	SM	1.90±0.25	2.11±0.26	0.82	0.02

**CONCLUSIONS:** Compared with the stable condition, deep muscle activation increased to adapt to the unstable condition.

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1692 Board #345 June 2, 9:00 AM - 10:30 AM

**Effects of AquaTitan Bracelet on Quadriceps Muscles Recovery after Fatiguing Muscular Strength and Endurance Exercise**

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(No relationships reported)

Recovery is important to athletes' success in performance and many use AquaTitan during training for faster recovery after exercise. **PURPOSE:** To investigate the effect of Phiten's Rakuwa S Cross Bracelet on 24-hour recovery of quadriceps muscles from exercise-induced fatigue. **METHODS:** 15 recreationally active male volunteers (age: 23.87±1.55yrs, height: 174.09±5.06cm, weight: 68.69±9.7kg) participated in exercise trials conducted over five weeks. Exercise trials had three experimental conditions (EC): AquaTitan (AT), Placebo (PC) and Control (CC), with a five-day washout period between trials. Participants performed a pre test (PRE) before and a post test (P) after a fatiguing exercise (FE), which consisted of 100 repetitions of isokinetic contraction at 60o/s. Post-1 (P1) and Post-2 (P2) were conducted 5 minutes and 24 hours after FE respectively. Isometric peak torque and time-to-exhaustion were measured with an Isokinetic Dynamometer. The OMNI Resistance Exertion Scale (RES) was used to measure perceived exertion for all tests. **RESULTS:** Friedman test revealed no significant differences between EC for RPE, indicating maximal effort for MS: (AT: 8.91±0.29, PC: 8.58±0.28, CC: 8.76±0.27, p=0.38) and ME (AT: 9.27±0.25, PC: 9.33±0.23, CC: 9.31±0.22, p=0.75). Repeated Measures ANOVA revealed significant differences between PRE and P1 (MS: 244.09±6.98Nm vs. 178.11±6.65Nm, p<0.05; ME: 63.42±3.29sec vs. 40.42±2.23sec, p<0.05), and between P1 and P2 (MS: 178.11±10.55Nm vs. 241.78±10.78Nm, p<0.05; ME: 40.42±3.46sec vs. 61.67±5.77sec, p<0.05). No significant differences were found between PRE and P2 (MS: 244.09±6.98Nm, 241.78±10.78Nm, p=0.55; ME: 63.42±3.29sec, 61.67±5.77sec, p=0.31), and between EC: (MS: AT: 224.60±11.53Nm, PC: 221.89±9.23Nm, CC: 217.49±10.19Nm, p=0.44; ME: AT: 51.02±3.88sec, PC: 55.91±4.93sec, CC: 58.58±6.09sec, p=0.118). **CONCLUSION:** Participants were able to recover within 24-hour after FE under all EC. Results suggest that the AquaTitan bracelet is similar to participants not using it and may not assist in faster 24-hour full recovery with better performance in MS and ME activities.

1693 Board #346 June 2, 9:00 AM - 10:30 AM

**Effect of Two Different Isokinetic Training Protocols on Functional Hamstrings-to-Quadriceps Ratios**

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(No relationships reported)

Functional hamstrings-to-quadriceps (H:Q) strength ratio is frequently assessed by isokinetic dynamometry in order to calculate the relationship between knee flexors and knee extensors and therefore determine knee muscle balance. This ratio approximates functionality because it considers hamstrings eccentric (ECC) strength in the deceleration of anterior tibial shear or rotation induced by quadriceps concentric (CON) strength. However, little is known about the effect of different strength training protocols on functional H:Q ratios.

**PURPOSE:** To compare 2 different training protocols on functional H:Q ratio.

**METHODS:** Twelve untrained subjects (age 23.75 ± 2.56 yrs, mass 72.53 ± 10.74 kg, ht 174.78 ± 6.02 cm) performed 6 weeks of strength training of their dominant

knee flexors and extensors on a Biodex isokinetic dynamometer. They were randomly assigned to 3 training groups; concentric quadriceps and eccentric hamstrings (CON/ECC), eccentric quadriceps and eccentric hamstrings (ECC/ECC), and no training (CNTRL). Training began with 1 set of 10 maximal repetitions at 210°/s concentrically and 60°/s eccentrically. Intensity of training was increased every week by decreasing the angular velocity for concentric and increasing it for eccentric in 30°/s increments. Volume of training was increased by adding 1 set each week. All training sessions were separated by at least 48 hours. Concentric quadriceps and eccentric hamstrings strength were tested 72h before and after training, and functional H:Q ratios were calculated. **RESULTS:** There were no significant differences between groups for functional H:Q ratios at pre test (ECC/ECC = 0.79 ± 0.04; CON/ECC = 0.84 ± 0.15; and CNTRL = 0.66 ± 0.15). However, ECC/ECC group had a greater functional H:Q ratio at post test (0.86 ± 0.05), compared to CON/ECC (0.65 ± 0.04) and CNTRL (0.70 ± 0.15). **CONCLUSIONS:** These findings suggest that ECC/ECC training is more effective at increasing the H:Q functional ratio. This may be due to exclusive eccentric hamstrings strength training with no quadriceps concentric strength training. Eccentric training increases eccentric strength, therefore increasing the functional H:Q ratio.

1694 Board #347 June 2, 9:00 AM - 10:30 AM  
**Muscle Activation Patterns Of Sun-salutation B During High-speed Versus Low-speed Yoga**  
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Yoga has become an increasingly popular mode of exercise and has been used to target different needs such as improving flexibility, muscle strength and endurance, and body composition; however, few studies have compared variations in poses, posing patterns and movement speeds as they relate to muscle utilization patterns during practice. Results showing differences in muscle activities across different patterns of practice can help instructors and practitioners modify their training to match the personal goals or specific needs of special populations. **PURPOSE:** To quantify differences in average muscle activations of eight selected muscles during the commonly practiced yoga sequence, Sun-Salutation B, during high-speed (HS) (3sec intervals) or low-speed (LS) (12 second intervals) performances. **METHODS:** Seven subjects (2M, 5F) (31.43 ± 1.92 years) performed eight minutes of multiple Sun-Salutation B yoga sequences on two separate days using HS versus LS patterns. Performance speeds were randomly assigned over the two days. Eight muscles (middle trapezius (TRAP), thoracic erector spinae (ES), pectoralis major (PM), external oblique (EO), lateral triceps (TRI), middle deltoid (DELT), vastus medialis oblique (VMO), medial gastrocnemius (GAS)) were evaluated on the participants' dominant side using surface electromyography (EMG). Normalized root mean square (rmsEMG) was used to analyze the difference in muscle activation between the two speed conditions. **RESULTS:** The TRAP ( $\eta^2=.299$ ), TRI ( $\eta^2=.343$ ), DELT ( $\eta^2=.457$ ), ES ( $\eta^2=.470$ ), all exhibited moderate to large effect sizes with results favoring the HS condition; while results for the EO ( $\eta^2=.582$ ;  $p=.028$ ), GAS ( $\eta^2=.633$ ;  $p=.018$ ) and VMO ( $\eta^2=.849$ ,  $p=.001$ ) favoring HS exhibited large effect sizes and reached significance. The failure of many of these comparisons to reach statistical significance was likely due to the small sample size. **CONCLUSION:** These results indicate that HS training can produce higher muscle activity levels than LS training despite shorter pose holds and time for transition. This supports the idea that HS training can serve as a viable alternative to LS training when targeting different fitness factors.

1695 Board #348 June 2, 9:00 AM - 10:30 AM  
**Muscle Mass And Training Status Do Not Affect The Number Of Repetitions During Resistance Training**  
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 (No relationships reported)

**PURPOSE:** to compare the number of repetitions performed at 60, 75%, and 90% of one repetition maximum (1RM) in 4 different upper limb exercises: bench press, triceps, unilateral row, and unilateral arm curl in trained and untrained subjects. **METHODS:** thirty subjects (15 trained and 15 untrained men) volunteered to participate in this study and attended to six separate occasions, each separated by at least 48 h. In the first three sessions, the 1RM of each exercise was evaluated. The last three sessions were designed for the performance the maximum number of repetitions (RM's) tests, in which three different percentages were used in each exercise: 60% 1RM, 75% 1RM and 90% 1RM. Each day the participants performed one percentage of each exercise; the exercise order and intensities performed in each session were randomized. Performance time for each repetition was controlled by an electronic metronome. **RESULTS:** the results are presented at table 1. There were no significant differences between T and UT in any of the exercises at a given exercise intensity. Moreover, comparing exercises with different muscle mass (i.e., bench press vs. skull

crusher, and row vs. arm curl), the same number of repetitions in each percentage evaluated were performed in those that utilize greater muscle mass (i.e., bench press and row) compared to the exercises with less amount of muscle mass ( $p>0.05$ ). **CONCLUSION:** using a same percentage of 1RM, trained and untrained subjects performed similar RM's in upper limb exercises with different amounts of muscle mass.

Table 1: Number of repetitions at 60, 75, and 90% 1RM in trained (T) and untrained (UT). Means ± SD.

	60%1RM		75%1RM		90%1RM	
	T	NT	T	NT	T	NT
Bench press	15.56 ± 1.55	16.07 ± 1.33	10.44 ± 1.67	10.08 ± 0.95	4.69 ± 0.95	4.93 ± 1.03
Row	13.81 ± 1.28	14.15 ± 1.21	9.25 ± 1.29	9.33 ± 0.98	4.88 ± 0.62	4.67 ± 0.82
Skull crusher	16.25 ± 1.57	16.07 ± 1.33	11.19 ± 1.6	10.53 ± 1.3	4.74 ± 1.0	5.23 ± 1.17
Arm curl	16.63 ± 2.78	16.43 ± 1.45	9.69 ± 1.14	10.21 ± 1.93	4.31 ± 0.7	4.73 ± 0.8

1696 Board #349 June 2, 9:00 AM - 10:30 AM  
**Effectiveness of TENS Unit on Quadriceps Muscular Endurance During Weight Bearing Exercise**  
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**PURPOSE:** To examine the effectiveness of TENS use on quadriceps muscular endurance during weight bearing exercise for healthy populations. **METHODS:** Fifteen male and fifteen female volunteers (Fifteen male and fifteen female volunteers (N = 30; AGE = 21.6 ± 3.0 yrs; HT = 172.1 ± 9.0 cm; BM = 72.8 ± 12.6 kg) provided informed consent prior to participation. In Session 1, participants height, body mass, and one repetition maximum (1-RM) for non-dominant quadriceps was assessed using a knee extension machine. In Session 2, participant's baseline maximum repetitions of non-dominant knee extensions at 40% of 1-RM was attained. Participants were then randomly selected into three groups: EXP: TENS unit with TENS activation; CON: no TENS unit with no TENS activation; PLA: TENS unit with no TENS activation. In Session 3, EXP, CON, and PLA participants performed maximum repetitions of non-dominant leg at 40% of 1-RM on the knee extension machine. Participant characteristics were examined using ANOVA for continuous and chi-squared for categorical variables. Analysis of covariance (ANCOVA) was used to compare the change in repetitions from session 2 and session 3 between each treatment group, while controlling for baseline repetitions. Tukey Post-Hoc test was used to determine the location of significance between treatment groups. **RESULTS:** No significant differences were found between groups in number of repetitions achieved at baseline ( $p=0.703$ ). The EXP group were able to perform significantly more repetitions (change=2.40 ± 3.27) than participants in either the CON group (change=-1.30 ± 2.31) ( $p=0.001$ ) or PLA group (change=-0.20 ± 1.14) ( $p=0.011$ ) when controlling for baseline repetitions. **CONCLUSION:** The use of TENS during weight-bearing quadriceps muscular endurance activity significantly improves the number of repetitions performed by healthy populations.

1697 Board #350 June 2, 9:00 AM - 10:30 AM  
**Core Muscle Activation During Unstable Overhead Squat Using a Water-Filled Training Tube**  
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**PURPOSE:** Stability and balance are essential components for functional movement. While these components are often developed by exercising on unstable surfaces, another alternative is to use an unstable implement. The purpose of this study was to use a novel water-filled implement ("slosh tube") to assess the degree of muscle instability created during an overhead squat. **METHODS:** Eight men (age= 20.1 ± 1.0y, ht=179.8 ± 4.8cm, mass= 89.2 ± 6.9kg) completed three 30s trials of an overhead squat using an 11.4 kg tube that was partially filled with water. A central valve allowed three conditions of water movement: 50% open, 100% open, and a stable(S), closed valve setting. Subjects completed 8-10 repetitions within each condition using a counter-balanced design. Muscle activation was assessed on the right side, with passive EMG electrodes placed over the belly of the vastus lateralis (VLAT), deltoid, rectus abdominus (AB), and paraspinal muscles. Integrated EMG was measured for each repetition and converted to a %MVC for each muscle. Instability was determined using the natural log of the coefficient of variation across repetitions. A two way repeated measures ANOVA across (contraction, condition) was used to examine concentric and eccentric contractions in each muscle. %MVC was also assessed.

**RESULTS:** No significant instability was seen in any muscles for both CON and ECC. LnCV ranged from 3.0-3.5. Percent MVC activated was significantly greater for the Paraspinal muscle (CON= 53.6 ± 7.4, ECC = 45.1 ± 9.7%) and VLAT (CON= 332.3 ± 147.5, ECC= 288.8 ± 114.5) but not for the AB (CON= 10.6 ± 5.1, ECC= 9.2 ± 4.6) or the Deltoid (CON= 41.3 ± 19.4, ECC = 39.7 ± 17.7)

**CONCLUSIONS:** We conclude that the overhead squat using an unstable, water-filled tube maintains deltoid and abdominal muscle activation throughout the squat, but does not induce activation instability across the four muscles studied.

1698 Board #351 June 2, 9:00 AM - 10:30 AM  
**Changes In Upper-body Strength Are Dependent On Gender And Training Mode But Independent Of Fat-free Mass**

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Recent studies on men and women have suggested that changes in upper-body strength are greater when training on machine weights than on free weights. Furthermore, strength changes appear to be independent of initial strength and amount of fat-free mass (FFM). However, no study has been conducted on men and women simultaneously to determine the influence of gender on strength improvement.

**PURPOSE:**

To compare the effect of free-weight and machine-weight resistance training on upper-body strength gains in untrained men and women with different levels of FFM.

**METHODS:** Untrained men and women were assigned to groups with low FFM (LM, n = 142), average FFM (AM, n = 152), and high FFM (HM, n = 124) based on the 33th and 67th percentiles of gender-specific distributions. Participants were randomly assigned to free weight (FW, n = 141), seated horizontal press (SHP, n = 164), or supine vertical press (SVP, n = 113) groups and measured for mode-specific 1RM chest press performance. Training was conducted 3X/week for 12 weeks using a linear periodization program of increasing loads and decreasing repetitions. In addition, subjects performed 3 sets of 10RM for supplemental arm and leg exercises during each training session.

**RESULTS:** A gender x mode x FFM level ANOVA on strength gain indicated that [1] men (9.7 ± 6.1 kg) made significantly greater improvement than women (7.5 ± 5.6 kg), [2] strength gain was significantly different by mode: SHP (10.6 ± 6.3 kg), SVP (8.7 ± 5.4 kg), and FW (6.1 ± 4.9 kg), and [3] LM (8.1 ± 5.3 kg), AM (9.3 ± 5.4 kg), and HM (8.3 ± 7.1 kg) groups were not significantly different (p = 0.06) in strength gain. Gender x mode was the only significant interaction, showing that men using SVP (10.5 ± 5.0 kg) made significantly greater gains than women (6.8 ± 5.3 kg) using the same device. When expressed as percent gain in strength, [1] women (22 ± 17%) made significantly greater gains than men (14 ± 9%), [2] SHP (24 ± 15%) made significantly greater gain than SVP (16 ± 11%) and FW (13 ± 12%), and [3] LM (19 ± 15%) and AM (20 ± 13%) made significantly greater gains than HM (15 ± 14%).

**CONCLUSIONS:** Untrained men experience greater absolute strength gain and women experience greater relative strength gain when initially utilizing machine weights as opposed to free weights with only minor influences of FFM.

1699 Board #352 June 2, 9:00 AM - 10:30 AM  
**Muscle Activation During Squat and Push-up Exercise on Stable and Unstable Surfaces**

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>Performing strength exercises on unstable surfaces (US) in comparison to stable surfaces (SS) is purported to enhance balance, coordination, flexibility, and muscular endurance more than the same exercise performed on a SS. This is based on the premise that a greater muscle activation is necessary to maintain stability. **PURPOSE:** The purpose of this study was to compare muscle activation (MA) between stable and unstable surfaces during push-up and squat exercise. **METHODS:** 20 physically active subjects (age 24 ± 4 ht 174.1 ± 9.8, body mass 79.0 ± 14.6, 15♂) volunteered for EMG electrodes to be placed on the triceps (T), anterior deltoid (AD), and pectoralis (P) muscles during the push-up (PU) trial, and on the rectus femoris (RF) and biceps femoris (BF) muscles during squat (S) trial. Normalization of the EMG signal was obtained by maximal voluntary contractions (MVC) performed for each of the aforementioned muscles using Nautilus resistance machines. Each trial consisted of 5 repetitions of either P or S exercise at a movement cadence of 3:1:3 sec (concentric: pause: eccentric) under the following conditions: on the floor (F), flat side of a BOSU ball (FB), and the round side of the BOSU ball (RB). All trials were conducted in a randomized order w 20 minutes between trials. **RESULTS:** % MVC for PU were

52.7 ± 16.8, 53.9 ± 23.9 and 51.01 ± 29.8 for P, 37.0 ± 18.0, 39.4 ± 25.7 and 41.8 ± 21.7 for AD, and 49.9 ± 29.8, 51.4 ± 29.0 and 31.6 ± 22.3 for T, and for S were 17.4 ± 11.1, 18.3 ± 12.5 and 16.5 ± 11.8 for RF, and for BF were 13.4 ± 16.4, 15.6 ± 11.6 and 14.3 ± 9.7 for RB, FB, and F conditions, respectively. Statistical analysis by ANOVA revealed no significant difference (p > .05) by muscle group during any condition except T activation was significantly greater during the FB condition. **CONCLUSION:** Except for tricep MA during a push-up, muscle activation of prime movers as indexed by EMG were virtually indistinguishable during the performance of two common body weight exercises on stable and unstable surfaces. The use of moderate unstable base exercise may offer variety in training with no advantage to fiber recruitment. Extreme instability (FB) may require ancillary muscle activation to assist in maintaining stability during the performance of the push-up, but the value of this enhanced activation is indeterminate.

1700 Board #353 June 2, 9:00 AM - 10:30 AM  
**The Effects of Post-Activation Potentiation in Conjunction with Blood Flow Restriction on Sprint Performance**

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>Blood Flow Restriction (BFR) training is a process by which external pressure is applied over the proximal portion of an extremity to maintain arterial inflow while occluding venous outflow. Post-Activation Potentiation (PAP) is the phenomenon by which muscular performance may be enhanced as a result of previously completed muscular contractions. Independently, PAP and BFR have been studied, but the two have yet to be combined in reference to sprint performance. **PURPOSE:** The purpose of this study was to determine if a combination of BFR and PAP of the lower extremities will improve 36.6 meter sprint performance (S) in college-aged adults. **METHODS:** 26 subjects (22.8 ± 1.8 yr, 1.73 ± 0.10 m, body mass 76.6 ± 16.6 kg, 15♂) were familiarized with the sprint activity, BFR and PAP techniques, and had their lower extremity blood pressure (BP) assessed. Following the familiarization trial, subjects were randomly assigned to either the experimental (BFR) or control (C) trial in a cross-over design. Trials were preceded by a five minute warm-up of treadmill walking at 80.4 m/min (1% grade). In the BFR trial, a thigh BP cuff was applied to each leg and inflated to 10 mmHg below resting systolic BP. With the cuffs remaining on the legs, subjects completed 5 maximal effort vertical jumps (VJ). BP cuffs were immediately removed and the subject rested for 8 minutes prior to S. S time was obtained with a stopwatch. Identical procedures were conducted for the C trial with the exception of BFR prior to the VJ. On separate days, the same subjects performed a reliability trial of each condition in order to ensure intra-rater reliability. There were less than 72 hours among the familiarization, reliability, experimental, and control trials. **RESULTS:** Statistical analysis by paired T-test revealed a significant difference (p < .05) between sprint times, when comparing each subject's control and BFR trials (p = .033). There was also a high within-subject correlation between the two performances of each trial (BFR: 0.954, control: 0.937). **CONCLUSION:** An acute intervention that combines BFR and PAP of the lower extremities improved sprint performance in college-aged adults. An 8 minute hiatus between the BFR/PAP and the performance supports the practical application to some sport activities, such as track and field.

1701 Board #354 June 2, 9:00 AM - 10:30 AM  
**Upper-Extremity Eccentric Exercise: Increases in Muscle Strength and Power While Training at Moderate Intensities**

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Resistance exercise via negative eccentrically-induced work (RENEW) serves as a high-force, low-cost, exercise for improving lower-extremity muscle conditioning (size, strength, power, mobility) in athletic and patient populations. **PURPOSE:** To extend the RENEW model to the upper-extremities (RENEW-U) and evaluate the effectiveness of a 7-week intervention to improve upper-extremity muscle conditioning. **METHODS:** Healthy individuals performed either RENEW-U (n=8) or traditional concentric-based exercise (TRAD, n=6) training (3x/wk) while duration and intensity progressively increased in the same manner for both groups (5-20 min, ~60-70% of HR<sub>peak</sub>, perceived exertion of "fairly light" to "somewhat hard"). For RENEW-U participants resisted the reverse moving handles of a motor-driven arm cycle ergometer. For TRAD participants propelled the handles of the ergometer in the

traditional forward direction. Exercise-induced muscle soreness was assessed before each training session using an analog scale (0-10 cm). Maximum elbow extensor strength (10 RM) and upper-extremity arm cranking power were assessed before and after training. **RESULTS:** During the final week of training total work for RENEW-U was over twice that of TRAD ( $162 \pm 25$  vs.  $68 \pm 10$  kJ,  $P < 0.01$ ). Muscle soreness associated with the training was minimal for RENEW-U and TRAD ( $0.42 \pm 0.11$  vs.  $0.21 \pm 0.11$  cm, respectively,  $p = 0.21$ ). Compared to pre-training, maximum elbow extensor strength increased by  $14 \pm 3\%$  ( $p < 0.01$ ) and maximum power increased by  $\sim 6 \pm 3\%$  ( $p = 0.05$ ) for RENEW-U. There were no improvements in maximum elbow extensor strength and maximum power for TRAD. **CONCLUSION:** These preliminary results suggest that repetitive multi-joint eccentric contractions with the upper-extremities can improve muscle conditioning even while training at moderate intensities, which parallels previously reported RENEW findings in the lower-extremities. We envision that RENEW-U could have applications in rehabilitation and sport training.

1702 Board #355 June 2, 9:00 AM - 10:30 AM  
**Longitudinal Assessment of Muscle Peak Power Generated in Vertical Jump During Middle Childhood**

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Physical activity in children consist mostly of high intensity short burst requiring muscle power. However, the factors influencing the production of peak power (PP) in middle childhood are still unclear. **PURPOSE:** To assess the production of PP generated in a vertical jump during middle childhood and to identify potential limiting factors. **METHODS:** Forty-two participants (24 boys and 18 girls;  $6.3 \pm .48$  years of age), were assessed in 1st grade and for the next two consecutive years. Counter-movement vertical jump height was determined using an electronic platform and converted to PP (W) using the following equation:  $(65.1 \times \text{jump height (cm)}) + (25.8 \times \text{weight (kg)}) \times 21,413.1$  (Canavan & Vecovi, 2004). Participation in extracurricular sports was determined in a questionnaire. Height, weight and skinfolds (triceps and calf) were also measured. Repeated measures ANOVA were performed to determine differences by year of study and Pearson correlations to evaluate relationships between peak power and body composition variables. Independent sample t-test was used to detect differences between gender and extracurricular sports participation. **RESULTS:** Jump height and PP (W) increased with age ( $PP = 1080 \pm 329$ ,  $1196 \pm 261$ ,  $1411 \pm 316$  W for the 1st, 2nd, and 3rd year respectively,  $p < .05$ ). No differences were found in PP between boys and girls per year ( $1069 + 383$  vs  $1093 + 250$ ,  $1191 + 292$  vs  $1201 + 221$  and  $1441 + 343$  vs  $1371 + 282$  W, respectively). A negative correlation was found between sum of skinfolds (SSF) and jump height ( $r = -.41, -.47, -.58$ , for years 1 to 3 respectively  $p < .0001$ ), as well as between sum of skinfolds and relative PP (W/kg) ( $r = -.54, -.65, -.73$ , for years 1 to 3 respectively,  $p < .0001$ ). No significant differences were found in PP between extracurricular sports participants vs. non participants for the 2nd and 3rd year ( $1214 \pm 296$  vs  $1165 \pm 196$  W,  $p = .56$ ; and  $1468 \pm 348$  vs  $1297 \pm 208$  W,  $p = .10$ , respectively). **CONCLUSION:** These results suggest that during middle childhood jump height and PP increase with age, are negatively influenced by body fat accumulation and are not affected by gender or extracurricular sports participation. Further studies addressing potential limiting factors of muscle peak power production during middle childhood are needed.

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1703 Board #356 June 2, 9:00 AM - 10:30 AM  
**Mechanomyographic Response For The Biceps Brachii During A Sustained Maximal Isometric Contraction**

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The surface mechanomyographic (MMG) signal corresponds to the mechanical properties of skeletal muscle function. In addition, there is evidence that suggests a relationship exists between the MMG signal and global motor unit activity (i.e., motor unit recruitment and firing rate). Therefore, by examining the MMG response to a sustained maximal effort force task, valuable information regarding muscle fatigue and motor control may be considered.

**PURPOSE:** To examine the linearity of the MMG amplitude and frequency responses for the biceps brachii during a sustained maximal isometric contraction.

**METHODS:** Twelve habitually active males (mean  $\pm$  SD: age =  $24.8 \pm 3.1$  years; height =  $180.2 \pm 4.4$  cm; mass =  $91.0 \pm 14.0$  kg) volunteered for this study and were familiarized with the testing procedures prior to testing. Before the fatigue test, the subjects performed three maximal voluntary contractions (MVC) of the dominant forearm flexors, the highest force value from the three trials was designated as the

baseline MVC (MVCb). The subjects then sustained a maximal voluntary isometric contraction of the forearm flexors until force output could not be maintained above 50% MVCb. MMG activity was detected from the biceps brachii with a piezoelectric accelerometer. The linearity of the MMG amplitude and MMG mean frequency versus time relationships were examined with linear regression models.

**RESULTS:** The results indicated significant linear relationships for MMG amplitude across time for 8 of the 12 subjects: (mean  $\pm$  SD: slope =  $-48.1 \pm 47.6$  microvolts/sec; Y-intercept =  $2772.3 \pm 1920.1$  microvolts;  $r^2 = 0.37 \pm 0.28$ ). Additionally, 5 of the 12 subjects displayed significant linear relationships for MMG mean frequency across time: (mean  $\pm$  SD: slope =  $-0.27 \pm 0.42$  Hz/sec; Y-intercept =  $48.2 \pm 20.5$  Hz;  $r^2 = 0.18 \pm 0.19$ ).

**CONCLUSIONS:** These results demonstrate that the MMG signal can be used to monitor fatigue-induced changes in muscle function. There was a tendency for both the MMG amplitude and the MMG mean frequency to decrease across time. However, the divergent patterns of response between individuals may be due to unique motor control strategies related to the demands of the fatigue task.

1704 Board #357 June 2, 9:00 AM - 10:30 AM  
**Effect Of Training Frequency On Muscle Mass, Strength And Power Performance During Reduced Resistance Training**

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**Effect of training frequency on muscle mass, strength and power performance during reduced resistance training**

Reduced resistance training (RRT) has been suggested to maintain muscular adaptations (e.g. muscle hypertrophy, muscle strength power). The RRT may be applied after a period of high intensity resistance training (HIRT) by reducing training volume and changing frequency. Several studies have shown positive RRT effects when training volume is decreased 50-60%. However, the effects of different training frequencies during RRT on muscle mass, muscle strength and power performance remain unknown.

**PURPOSE:** To investigate the effect of different training frequencies on muscle mass, strength and power performance during a period of RRT.

**METHODS:** Thirty three physically active male subjects were submitted to 8 weeks of upper limbs high intensity resistance training (HIRT) divided into two 4-wk periods (i.e. 2.d.wk<sup>-1</sup> the first 4 wk and 3.d.wk<sup>-1</sup> the last 4 wks). After that they randomly assigned to three experimental groups: reduced resistance training 2 (RRT2 = two sessions per week), reduced resistance training 1 (RRT1 = one session per week), and detraining (DT = interrupted training). RRT1 and RRT2 reduced training session volume by 50-55% and DT group detrained for 8 more weeks. Triceps brachii cross sectional area (TCSA), maximal dynamic strength (1RM), and muscle power (PPw) in the bench press exercise were measured before, after RT, and after RRT.

**RESULTS:** RRT1, RRT2, and DT showed similar increases in the TCSA after the HIRT period [ $16.5\% (\pm 3.6)$ ,  $15.9\% (\pm 2.7)$ , and  $17.1\% (\pm 4.6)$  ( $p < 0.01$ ), respectively]. The 1RM and PPw also increased similarly for all three groups [ $17.2\% (\pm 2.9)$ ,  $41.1\% (\pm 6.4)$ , and  $41.8\% (\pm 5.1)$  and  $15.8\% (\pm 6.4)$ ,  $15.3\% (\pm 5.4)$ , and  $18.2\% (\pm 7.3)$ , respectively]. After the RRT period, RRT1 and RRT2 groups were able to maintain their TCSA, 1RM and PPw performance while DT showed significant decreases in TCSA ( $13.1 \pm 4.2\%$ ), 1RM ( $23.7 \pm 6.8\%$ ), and PPw ( $15.7 \pm 5.3\%$ ).

**CONCLUSION:** The results showed that RRT performed once or twice a week but with similar training volume is able to maintain muscle hypertrophy, strength and power performance obtained after 8 weeks of HIRT.

1705 Board #358 June 2, 9:00 AM - 10:30 AM  
**Effect Of Thorstensson Test Data Collection Window On Synergist Between-muscle EMG Amplitude Relationships**

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 (No relationships reported)

Repeated maximal effort isokinetic knee extension tests are common in fatigue research. The theory of common drive dictates that surface electromyographic (EMG) amplitude should be highly correlated between synergist muscles. However, researchers collect EMG data from different ROM (range-of-motion) windows. Different data collection windows will inherently result in different datasets from each trial. This may change the interpretation of the same test. **PURPOSE:** Quantify the relationship magnitudes of EMG RMS between the knee extensor muscles and determine if those relationships are affected by the ROM in which data is collected.

**METHODS:** Nine healthy males and nine healthy females (age=21.1±1.4 y; height=173.8±12.4 cm; mass=72.1±14.7 kg) completed one bout of 50 repeated maximal effort concentric knee extensions at 180°/s with passive flexion on an isokinetic dynamometer. Position and EMG were sampled at 10k Hz. Custom LabVIEW software was used to analyze data. For the vastus lateralis (VL), rectus femoris (RF), and vastus medialis (VM), EMG data were captured in 3 different ROM windows: full ROM (F), 120°-150° (M), and load range (L). EMG amplitude was quantified via normalized root mean square (RMS) of the EMG signal in each ROM window. Between-muscle EMG amplitude Pearson correlations of the VL-VM, VL-RF, and RF-VM combinations over each window were calculated. Pearson correlation coefficient (r) values were analyzed via a two-way 3 (window) x 3 (muscle combination) ANOVA. Alpha was set at .05. **RESULTS:** There was no significant interaction between window and muscle. There was no main effect of muscle. There was a main effect of window where the F and LR windows yielded stronger between-muscle correlations than the M window. RMS amplitude data from F windows yielded stronger between-muscle correlations than LR windows. **CONCLUSION:** When processing repeated isokinetic knee extension data, surface EMG RMS data from the full concentric range of motion results in the strongest between-muscle correlations of synergist muscles. Assuming the task does not deviate from the theory of common drive, EMG RMS data gathered from larger ROM windows are probably better representative of the EMG amplitude during repeated maximal effort isokinetic knee extensions.

1706 Board #359 June 2, 9:00 AM - 10:30 AM  
**Effect Of Thorstenson Data Collection Window And Muscle On EMG Median Power Frequency Slope**

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Repeated maximal effort isokinetic knee extension tests are commonly used to examine fatigue. Electromyographic (EMG) median power frequency (MPF) is thought to be related to peripheral fatigue. Multiple synergist muscles contribute to knee extension torque, and multiple range-of-motion (ROM) windows have been used to collect surface EMG data. MPF data taken from different ROM windows could alter the interpretation of magnitude of muscle-specific fatigue. **PURPOSE:** Quantify the EMG MPF slopes of three knee extensor muscles over three ROM windows commonly used in isokinetic tests. **METHODS:** Nine healthy males and nine healthy females (age=21.1±1.4 y; height=173.8±12.4 cm; mass=72.1±14.7 kg) performed 50 maximal effort concentric knee extensions at 180°/s, with passive flexion, on an isokinetic dynamometer. Custom LabVIEW software collected position and EMG data for each repetition at 10 Hz. For the vastus lateralis (VL), rectus femoris (RF), and vastus medialis (VM), normalized EMG MPF data were captured in 3 different ROM windows: full ROM (F), 120°-150° (M), and load range (L). Pearson correlations of normalized EMG MPF and repetition number were calculated for each muscle over each ROM window. Pearson correlation coefficient (r) values were analyzed via a two-way (3) muscle x (3) window ANOVA. Alpha was set at .05. **RESULTS:** There was no interaction between muscle and window. There was no main effect of window on EMG MPF slope across repetitions. There was a main effect of muscle, where normalized EMG MPF slopes for RF were more negative than VL (95% CI for difference: -.244 to -.103) and VM (95% CI for difference: -.212 to -.016). There was no difference between VL and VM EMG MPF slopes (95% CI for difference: -.074 to .102). **CONCLUSION:** EMG MPF slope data suggests that, during a 50-repetition repeated maximal effort knee extension test, the RF muscle experiences more fatigue than the VL and VM muscles. Furthermore, when analyzing EMG MPF, ROM window does not affect the interpretation of MPF slope.

1707 Board #360 June 2, 9:00 AM - 10:30 AM  
**Effects of Short-Term Strength Training on Maximal Velocity Parameters and Rate of Muscle Activation**

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 (No relationships reported)

It has been suggested that training-related increases in maximal velocity parameters (MVPs) may be mediated through neural mechanisms, however; little evidence exists regarding training induced changes in early-phase muscle activation and MVPs.

**PURPOSE:** To examine the effects of short-term strength training (ST) on MVPs and rate of muscle activation. **METHODS:** Twenty males who had not performed ST within the past 6 months participated in this study. A training group (TG; n = 13, age = 22 ± 1.9 yrs.) performed 3 sessions per week of unilateral isokinetic ST of the dominant leg for 4 weeks. A control group (CG; n = 7, age = 23 ± 4.3 yrs.) only participated in the testing sessions. ST sessions consisted of maximal concentric contractions of the knee extensors at 45°·s<sup>-1</sup> for 4 sets of 10 repetitions. Subjects were

instructed to “kick out as hard and fast as possible” during each ST session. Maximal concentric isokinetic testing of the knee extensors at 500°·s<sup>-1</sup> (IsoK<sub>500</sub>) was performed before (pre), at week 2 (mid), and after week 4 (post) of ST. There was no resistance during IsoK<sub>500</sub> with the exception of lever arm mass, as this velocity was above all subjects’ maximum velocity. The highest velocity attained (PV) and the linear slope of the velocity-time curve from the onset of contraction to PV (RVD) were recorded for each IsoK<sub>500</sub>. Surface electromyography (EMG) of the vastus lateralis was recorded in order to obtain the linear slope of the rectified EMG-time curve for a 100 ms period after the onset of contraction (RER). The contraction producing the highest PV was used for subsequent analysis of all dependent variables (DVs). Non-parametric statistics were used to make baseline comparisons between the TG and CG as well as comparisons across time in the CG. A one-way repeated measures ANOVA was used to examine changes across time in the TG. **RESULTS:** There were no baseline differences between the TG and CG for any of the DVs (p = 0.191-0.405). There were no changes in any of the DVs across time in the CG (p > 0.05). PV (p = 0.448), RVD (p = 0.378), and RER (p = 0.168) remained unchanged across time in the TG. **CONCLUSION:** The results revealed that low-velocity ST performed with a ballistic intent had no effect on RVD, PV, or RER. Although it is unclear, this may be due to the low-velocity used for training and the possibility of velocity-specific adaptations.

1708 Board #361 June 2, 9:00 AM - 10:30 AM  
**Individual Characteristics and Their Effect on Execution of a Standardized Partial Curl-Up Test**

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**Background:** According to the Standard Canadian Society of Exercise Physiology (SCSEP), individuals <45 yr are to complete the partial curl-up test at a reach distance of 12 cm. **Purpose:** This study aimed to investigate the effect of spinal flexibility, arm length, height, and torso length on execution of the SCSEP curl-up test, as factors not previously studied according to the knowledge of the researchers, and in addition to previously studied variables of age, waist circumference, plank time and reported physical activity. To the best of our knowledge, no study has assessed all of these variables at varying reach distances of 8, 10, and 12 cm. **Methods:** Maximal plank time and anatomical assessments were recorded for 45 [age 22 (18-36)] subjects. Each subject completed a partial curl-up test following the SCSEP protocol as defined in the ACSM’s Guidelines for Exercise Testing and Prescription, Ninth Edition, at reach distances of 8, 10, and 12 cm in randomized order and 24-48 hours apart. A one-way MANOVA was calculated examining the effect of individual characteristics on performance of the three curl-up tests. **Results:** A significant effect was found for age (Lambda (30, 94.6) = .252, p<.05) on execution of the curl-up test [Lambda (99, 27.8) = .001, p<.05]. Follow-up univariate ANOVAs indicated that execution of the curl-up test at 10cm and 12cm were significantly diminished (F(10, 34) = 3.063, p < .05], [F(10,34) = 3.348, p<.05], respectively). Execution of the curl-up test was not significantly affected by spinal flexibility, arm length, torso length, waist circumference, maximal plank hold time, and reported physical activity. **Conclusion:** The decline in execution of the curl-up test with increasing age has been reported previously, however, it appears age may impact performance earlier than 45 yrs, warranting further research examining smaller age increments and their effect on curl-up execution. In subjects <45 yr, spinal flexibility, arm length, and torso length do not appear to impact execution of the curl-up test at any of the reach distances examined.

1709 Board #362 June 2, 9:00 AM - 10:30 AM  
**Passive Muscle Movements Combined With Blood Flow Restriction Can Induce Muscle Hypertrophy**

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**Background:** Low load exercise training combined with blood flow restriction (BFR) can induce muscle hypertrophy, whereas the application of BFR alone in absence of exercise movement does not appear to elicit muscle hypertrophy. However, it is unknown whether muscle hypertrophy can be induced by passive muscle movement, similar to that used post knee surgery, when combined with BFR. This scenario would seem to present a stimulus that is less than low load voluntary exercise but greater than no exercise movement. **Purpose:** To investigate whether passive knee joint movement combined with BFR would induce thigh muscle hypertrophy. **Methods:** Nine young adults were seated on an isokinetic dynamometer (Biodex System 4) and received 23 minutes of unilateral passive knee joint movement, twice a day, 5 days per week, for 2 weeks, with one leg combined with BFR (P-BFR) and the other receiving the passive motion only (P-CON). Muscle thickness of the anterior thigh and isometric knee extension strength were measured before and after the intervention period. **Results:** Two-way repeated measures ANOVA showed that a significant (p<0.05) condition

× time interaction existed in thigh muscle thickness and maximal isometric knee extension strength. Thigh muscle thickness and maximal isometric knee extension strength significantly increased ( $p < 0.01$ ) after the passive motion intervention period in P-BFR (3.2%, 5.9%, respectively) whereas did not significantly change for P-CON (0.0%, 2.3%, respectively). However, the effect sizes of muscle hypertrophy (0.20) and strength gain (0.26) in P-BFR were small. **Conclusion:** Thigh muscle hypertrophy and strength gain can be induced by the combination of repeated passive knee joint movement combined with BFR.

1710 Board #363 June 2, 9:00 AM - 10:30 AM  
**Effects of Unilateral and Bilateral Plyometric Training on Leg Strength and Rate of Force Development**

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Plyometric training is commonly used to improve lower limb explosive strength. Due to the fact that force generated when the muscles of both legs act simultaneously (bilateral), is lower than the sum of force generated by each limb acting separately (unilateral), it was hypothesized that unilateral plyometric training would be more effective compared to bilateral. **PURPOSE:** To evaluate the effects of 6 weeks of unilateral (U) and bilateral (B) lower limb plyometric training on maximal strength and rate of force development (RFD).

**METHODS:** Fifteen moderately trained university students (8 males and 7 females) were randomly divided into a U ( $n=7$ ) and a B group ( $n=8$ ). Participants trained twice weekly for 6 weeks, with maximal plyometric leg exercises (6 exercises per session, with 2-3 sets of 10 repetitions per set) plus 2-3 sets of knee extensions and flexions at 60%-90% of 1 repetition maximum. Participants in the U group performed all plyometric and knee flexion/extension exercises with both legs, while those in the B group performed half the number of repetitions with each leg, so that the total exercise volume was similar in the two groups. Maximal isometric leg press strength and RFD (knee angle set at 90°) of each leg acting separately and of both legs, were measured using a force platform before and after training. Data were analyzed using 2-way ANOVA with repeated measures in one factor and Tukey's post-hoc test.

**RESULTS:** At baseline, the sum of right and left leg maximal strength was  $12.6 \pm 6.8\%$  and  $14.6 \pm 3.9\%$  higher ( $p < 0.001$ ), for the B and U groups, respectively, compared with maximal force of both legs. After training, maximal isometric force of both legs was increased similarly in the two groups (B group:  $20.1 \pm 6.5\%$ , U group:  $19.9 \pm 6.2\%$ ,  $p=0.95$ ). However, when testing was performed with each leg separately, the sum of maximal force of the two legs increased more in the U compared with the B groups ( $23.9 \pm 9.1\%$  vs.  $13.3 \pm 6.2\%$ ,  $p=0.018$ , respectively). RFD was only increased in the U group (by  $24.4\%$ ,  $p=0.023$ ) but not in the B group ( $12,576 \pm 5,300$  vs.  $13,052 \pm 3,914$  N/s,  $p=0.67$ ).

**CONCLUSIONS:** Unilateral plyometric and strength/power training of the lower limbs may be more effective when exercises performed with each limb separately, since both unilateral and bilateral maximal strength and RFD are improved.

1711 Board #364 June 2, 9:00 AM - 10:30 AM  
**Influence That Lower Limbs Blood Flow Restriction Exerts On Muscular Activity Of Hip Abductor Muscles**

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**INTRODUCTION:** In the blood flow restriction (BFR) training to which the base of limbs is pressed with the cuff, the amount of the muscular activity on not only limbs but also the truncus sides increased (Yasuda et al 2010). It is guessed that the tiredness at the early stage of the muscle of the distalis pressed the muscular activity of the proximally from the cuff. We set up and verified the hypothesis of not showing the influence in the amount of the muscular activity of the hip abductor in hip joint abduction that the tiredness at the early stage in the distal portion is not accompanied from the belt installation part.

**PURPOSE:** To compare the EMG activity of blood flow restricted (distal) and non-restricted (proximal) muscles during hip abduction exercise with and without restricted leg muscle blood flow.

**METHODS:** Nine healthy adults, mean age (SD) age: 31.0 (4.5) yrs, performed 3 sets of hip abduction exercise during two different conditions: restricted leg muscle blood flow (R) and non-restricted (NR). A specially designed cuff in the condition of R was placed at the most proximal position of the thigh and inflated to a pressure to 220(21)

mmHg. Surface EMG was recorded from the muscle belly of the gluteus medius (GM), tensor fasciae latae (TFL) and rectus femoris (RF) muscles, and mean RMS. RMS; normalized as the relative exercise intensity (%).

**RESULTS:** During 3 sets of exercise, gradual increases in RMS were not observed ( $p < 0.05$ ) in all muscles in both conditions, GM: 53.6 (22.9), 49.2 (22.8), 49.8 (25.2) in R and 53.1(21.8), 46.7 (21.8), 51.8 (23.0) in NR, TFL: 34.1 (23.3), 35.2 (27.1), 34.1(25.5) in R and 37.0 (21.6), 34.0(19.6), 34.4 (21.2) in NR. RF: 7.4(7.9), 6.6(7.2), 6.4 (4.9) in R and 7.7 (5.6), 6.1(3.8), 5.0 (3.1) in NR.

**CONCLUSIONS:** In the resistance exercise with BFR, it was suggested that the increase of the amount of the muscular activity from the distal be necessary as a condition of pressing the rise of the amount of the muscular activity from the proximal.

1712 Board #365 June 2, 9:00 AM - 10:30 AM  
**The Effect of Suspension Exercise on Neuromuscular Control of Trunk Muscle in Healthy Adults**

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 (No relationships reported)

Research indicates that coherence between motor cortex and muscles (corticomuscular coherence) could represent the capacity of the functional link between brain and muscle. Greater coherence suggests better neuromuscular control. We will utilize corticomuscular coherence as an indicator for quantifying functional connectivity between motor cortex and trunk muscles (transversus abdominis/internal oblique muscle), and determine the effects of suspension exercise on trunk neuromuscular control.

**PURPOSE:** To determine the effects of suspension training intervention on neuromuscular control in healthy adults.

**METHODS:** Six healthy adults ranging in age from 21 to 29 years old, received six weeks suspension exercise training (2 times / week, 40 minutes / times). Outcome measurements were assessed before and after the six weeks intervention. During ten times of rapid arm movement tasks, collecting transversus abdominis/internal oblique muscle surface Electromyographic (sEMG) data and Electroencephalography (EEG) data. The paired-samples t-test was used to compare pretest and posttest coherence value.

**RESULTS:** Corticomuscular coherence value of beta band area (13-30 Hz) increased after six weeks of suspension exercise training ( $0.1191 \pm 0.0598$  vs.  $0.1846 \pm 0.0551$ ,  $p < 0.05$ ).

**CONCLUSIONS:** Suspension exercise training could improve neuromuscular control of transversus abdominis/internal oblique muscle.