Validity of Self-Reported Pedometer Steps Per Day in College Students

Brittany Overstreet, Scott E. Crouter, FACSMS, George A. Butler, Cary M. Springer, David R. Bassett, Jr, FACSMS. University of Tennessee, Knoxville, TN. (Sponsor: Dr. David Bassett, FACSMS) 

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±14 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.

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.

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.
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 (±884.0) minutes per week sedentary, median (25th, 75th percentile) levels of MVPA was 121.5 (60.0, 225.0) minutes per week. The linear associations of EMA and self-reports with accelerometer estimates were statistically significant for sedentary time (EMA: p=0.16 [p<0.03]), moderate intensity PA (EMA: p=0.29 [p<0.01]; BRFSS: p=0.17 [p<0.02]; IPAQ: p=0.24 [p<0.01]) and MVPA (EMA: p=0.31 [p=0.01]; BRFSS: p=0.17 [p=0.02]; IPAQ: p=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 MRSGT-10-104-01-CHIPS (to DK).

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

VALIDITY OF POPULAR SMARTPHONE APPS AT MEASURING STEPS AT DIFFERENT INTENSITIES

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Purpose: To examine the validity of popular smartphone apps at measuring steps at different intensities compared to observed step counts. Method: Ten participants (age=25.2 years; 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 3mph (296.5±22.7) was significantly different than steps recorded at 3mph (486.1±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±20.8, 370±11.8, 388±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.

FEASIBILITY AND ACCEPTABILITY OF TRACKING ADOLESCENT PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOR USING A MOBILE APPLICATION

Todd Buckingham1, Lanay Mudd, FACSM2, Karin Pfeiffer, FACSM, 1Michigan State University, East Lansing, MI; 2National Institutes of Health, Bethesda, MD. (Sponsor: Dr. Karin Pfeiffer, FACSM).

Purpose: To examine the feasibility and acceptability of 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 the feasibility of using the app on 5-8 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 non-completion were sports commitments, 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.

VALIDATING THE LATEST COMMERCIAL PHYSICAL ACTIVITY MONITORS: WHICH MONITOR SHOULD YOU USE?

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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 (Fitbit/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 were an age-varying group up to 91 years, with BMI ranging from (18.4kg/m2) to 29.4kg/m2 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, 6.5, 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: Participants (61% male) aged 24.3±9.2yrs ranging in BMI (18.4kg/m2) to 29.4kg/m2 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 agreement.
associations at 8.0km/hr=Fitbit Charge (r=0.87, p<0.01); 10.0km/hr=Fitbit One (r=0.91, p<0.01) and 12.0km/hr= Jawbone (r=0.90, p<0.01). Most PAMS, excluding the Fitbit One significantly underestimated at 5.0 and 6.5km/h (p<0.05). At the higher speeds (10.0, 12.0km/h) 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 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. (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 (TTALL) 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 (TTALL-PRIME), but participants were a calibrated SMI VisdomX 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 (TTALL-PRI), or all feedback except primary information was presented (TTALL-PREMAIN). Time-trial performance was measured as average speed and pace was every 500 m.

RESULTS: Compared to TTALL, participants cycled faster during TTALL-PRI (38.1±2.1 vs. 37.7±2.1 km/hr, t13=-2.1, P=0.026) and slower during TTALL-PREMAIN (37.2±2.0 vs. 37.7±2.1 km/hr, t13=3.7, P=0.0015). A trial-by-segment interaction was found (F1,13=2.5, P=0.011) indicating a different pacing pattern between trials. Post-hoc paired comparisons revealed that, compared to TTALL-PRI, participants were faster during the last km during TTALL (37.8±2.2 vs. 38.8±2.5 km/hr, t13=-2.3, P=0.018) and TTALL-PREMAIN (37.8±2.2 vs. 39.2±2.1 km/hr, t13=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. This may be because the presence of other non-preferred feedback has a distracting effect on cyclists.

1271 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 Jelvégård. Linköping University, Linköping, Sweden. Email: toomas.timpka@liu.se (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 “activity pacing” behavioral pattern. The perception of the action possibilities to modify activity pacing 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.

1272 Board #3
June 2, 8:00 AM - 10:00 AM
Overtaking Behavior in Elite 1500m Short Track Speed Skating Competitions
Florentina J. Hettinga, Marco Kontings, Marissa Al, Romy de Jong. University of Essex, School of Biological Sciences, Centre of Sport and Exercise Science, Colchester, United Kingdom. (Sponsor: Carl Foster, FACSM)
Email: fjhett@essex.ac.uk (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±0.2 overtakings, women: 0.4±0.2 overtakings; p=0.01), but lower in the 5th lap: (men: 0.2±0.1 overtakings, women: 0.1±0.1 overtakings; p=0.02) and final lap (men: 0.2±0.2 overtakings, women: 0.1±0.2 overtakings; p=0.02). In addition, female athletes were positioned closer behind their predecessor in the 1st lap (men: 0.15±0.07 sec, women: 0.13±0.07 sec; p=0.01), while their male counterparts were positioned closer behind their predecessor in the 8th lap (men: 0.10±0.06 sec, women: 0.11±0.07 sec; p=0.04), 9th lap (men: 0.10±0.05 sec, women: 0.11±0.06 sec; p=0.03), 13th lap (men: 0.18±0.19 sec, women: 0.24±0.29 sec; p=0.01) and 14th lap (men: 0.29±0.62 sec, women: 0.39±0.41 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.

1273 Board #4
June 2, 8:00 AM - 10:00 AM
Attitudes of Exercise Science Majors towards Adaptive Recreation and Athletic 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)
Email: mdcunningham2900@eagle.fgcu.edu (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, four off-campus 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, Tadg E. MacIntyre, Deirdre O’Shea, Mark Campbell. University of Limerick, Limerick, Ireland. (Sponsor: Giles Warington, FACSM) Email: hannah.mccormack@ul.ie (No relationships reported) 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 had 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 attending international sport at the world level with 40% having attended the Olympic Games. Two participants were unaffiliated with an academic institution, with most attending international sport at the world level with 40% having attended the Olympic Games.

RESULTS: Daily fostering of relationships was engaged in by 72% of participants and 50% of respondents engaged in exercise 3-4 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 Braham1, Leanne Lester1, Renee Teal1, Jessica Richards1. 1University of Western Australia, Perth, Western Australia, Australia. 2Kidsafe Western Australia, Perth, Western Australia, Australia. Email: rebecca.braham@uwa.edu.au (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=1.2) compared to children playing Australian Football (mean 1.6, sd=1.8) and field hockey (mean 1.1, sd=1.3) (F=4.13, 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) Email: mafrazer@live.unc.edu (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 (basketball, baseball, 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 (F1,734=39.45, p <0.01) and impulsivity (F1,726 ≈ 21.48, p<0.01) than females. Females reported significantly more anxiety (F2,713 = 8.43, p<0.01) and depression (F2,722≈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 (F1,730=3.75, p < 0.05) and depression (F1,647≈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. Beedie1, Philip Hurs2, Damian Coleman2, Abby FoadF. 1University of Essex, Colchester, United Kingdom. 2Canterbury Christ Church University, Canterbury, United Kingdom. Email: cbeddie@essex.ac.uk (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 x 20m 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 ± 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 (Boeke 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 influence 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: Riggins J. Kikla, FACSM. Pepperdine University, Malibu, CA.
(No relationships reported)

Self-Reported Fatigue Does Not Highly Correlate with Objectively Measured Fatigue in Cancer Survivors
Trista L. Manikowske1, Jessica M. Brown1, Cristina Jansson1, Jeremy D. Smith1, Reid Hayward1. 1University of Northern Colorado and the Rocky Mountain Cancer Rehabilitation Institute, Greeley, CO. 2University 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 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 (r² = .120; p = .001) and the PFS sensory subscale and HFI (r² = .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.

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

Patient-reported Barriers to Exercise and Predictors of Exercise Adherence During Adjuvant Chemotherapy for Breast Cancer
Kelcey A. Bland1, Amy A. Kirkham1, Cheri L. van Patten2, Sarah E. Neill-Sztramko1, Alis Boneva1, Karen A. Gelmon2, Donald C. McKenzie1, Kristin L. Campbell2. 1University of British Columbia, Vancouver, BC, Canada. 2British Columbia Cancer Agency, Vancouver, BC, Canada. 3University 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 (33.1%), or not a priority (28%), lack of equipment (21.5%), and side effects including declines in physical fitness that may impede symptom management, treatment response and post-treatment recovery.

Conclusion: 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.

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
(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-treatment 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 post-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.
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 (graded treadmill protocol to a RPE of 4 out of 10), upper body strength (predicted one repetition maximum (1RM) chest press and shoulder press (F=3.43 to 11.33 kg). Self-reported QOL significantly improved (FACT-B score: 109.2 ± 16.9 to 115.9 ± 16.1) as did the predicted IRM for chest press (11.0 ± 4.8 kg to 15.0 ± 6.1 kg) and shoulder press (7 ± 3.4 kg to 11 ± 3.3 kg). Significant differences 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/m² to 29.2 kg/m²). The submaximal workload eliciting a RPE of 4 significantly increased (5.5 ± 1.4 METS to 6.8 ± 1.1 METS) as did the predicted IRM for chest press (11.0 ± 4.8 kg to 15.0 ± 6.1 kg) and shoulder press (7 ± 3.4 kg to 11 ± 3.3 kg). 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. 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 is currently quantified almost exclusively through subjective scales, thereby missing key physiological factors, specifically indicators of neuro-muscular (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 fatigue 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 3-minute recovery phases. RESULTS: KE twitch strength increased significantly with exercise in both groups. KE MVC increased significantly with exercise in the non-fatigued group but not the fatigued group. KE DASH score deteriorated in the fatigued group than the non-fatigued group (0.85 ± 0.19 vs -0.88, p=0.03), a decrease in percent body fat (-1.4 vs 0.48, p=0.03), and a decrease in BMD (-0.73 vs 0.17, p=0.03). BMD was not significantly different between groups at 12 months. CONCLUSION: An exercise programme that 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.
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, generally 70-80% 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 missing 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 (IRM).

**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.

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 pelvic 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: 63.5 ± 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 selected speed (3.1 ± 0.5 m/s) until reporting a 14 on the Borg scale.

**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.
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 ± 0.34). 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; UH2: 73.7 ± 3.2; p < 0.031) and L (UH1: 65.2 ± 4.2; UH2: 72.5 ± 4.4; p < 0.031). 

DISCUSSION: In this small population significant changes were seen in hip angle as a consequence of fatigue. Some 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 movement. 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. Gould1, Andrew E. Reineberg2, Brice T. Cleland3, Kristi E. Knoblauch4, Marie T. Banich5, John R. Corboy6, Roger M. Enoka7, 1University of Colorado Boulder, Boulder, CO. 2University of Colorado Denver, Denver, CO. 3No 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× contraction, 5× 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 fatigue as measured by the MFIS questionnaire (MS: 43.1 ± 14.4; CO: 11.25 ± 8.4; P < 0.001). Knee extensor strength did not differ for the two groups (MS: 112 ± 38 Nm; CO: 107 ± 44 Nm) and there were similar declines in MVC force (MS: 15 ± 19 Nm; CO: 15 ± 16 Nm) 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 Veld1, Carmen van den Hoven1, Erik Maartens2, Stijnjan Hogendoorn1, Roy Hoogeslag1, Anil Peters1, Christiana Rompen1, Jasper Reenaard1. 1OCON Centre for Orthopaedic Surgery and Sports Medicine, Hengelo, Netherlands. 2Roosehring Research & Development, Enschede, Netherlands. 3University of Twente, Enschede, Netherlands. (Sponsor: Brian W. Nooren, FACSM)

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(references 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: Eight patients (5 male, 3 female, 21.6 ± 3.7 yrs, 179.5 ± 9.2 em. 70 ± 27 kg) 1 year post ACLr (Hamstring tendon graft) ran 4×15 minutes at a 20m course, interspersed with hop-tests (HT; drop-vertical jump (DVJ) and hop for distance (HHD)). 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 kinematics. A repeated measures ANOVA (P < 0.5) 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° → 15.9 ± 5.7°. HHD: 22.3 ± 5.5° → 19.4 ± 5.6°). Non-significant decreases are seen in the last HT (DVJ: 9.9 ± 5.8°. HHD: 19.0 ± 6.1°). Max knee valgus angles during the DVJ HT increased with fatigue (F(4,28) = 18.18, P < .001. 2.7 ± 3.8° → 4.9 ± 3.0°). Strikingly, ACLr knees showed significant (Wilcoxon, P < 0.01) lower valgus angles (4.0 ± 1.5°) compared to the healthy side (5.6 ± 2.4°) 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. Powell1, Kristen M. Blankenship1, Esther Y. Kim1, Jonathan M. Lloyd1, Kristen L. Jagger1, Adrian Aron1. Radford University, Radford, VA. (Sponsor: Trent A. Hargens, FACSM)

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(references 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 limbs involved in balance control. Lower 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 fatiguability.

RESULTS: There was a significant difference between young and old groups when comparing dynamic balance performance on the right leg (02.4 ± 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 Sarah S. Gascon1, Jessica K. Washington1, Jence A. Rhoads1, Keith R. Lohse1, Gretchen D. Oliver, FACSM2. Auburn University, Auburn, AL. (Sponsor: Trent A. Hargens, FACSM)

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(references 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...
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:** Sixteen uninjured female runners (29.7 ± 5.7 years; 75 ± 5 km run per week) performed a treadmill run to fatigue (Borg RPE 14 ± 2; 24 ± 7 min; 3.3 ± 2.0 m/s). A modified vector coding technique was used to calculate CV (SD of phase angle) for pelvis frontal vs. thigh frontal (PFFT), thigh sagittal vs. shank sagittal (TSSS), and shank transverse vs. shank transverse (STTF) 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 PFFT.

**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.

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 VO2 peak test to establish the exact manner in which the practice is useful. Subjects immediately completed another RE test as well as one 24 hrs later. RE was performed by trained male runners does not alter performance. Supported by: None

**RESULTS:** VO2 peak was not significantly different between conditions (p > .05). For blood lactate, no statistical interaction was found between condition and time (p > .05). 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 set as fast as possible. Six VO2 and lactate controls, but were blinded to the actual speed. Blood lactate concentrations were measured prior to and following each run. 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.
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: Eighty healthy, physically active collegiate males performed a graded exercise test to determine their VO2max 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% VO2max. 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 nonparameter 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 (\(r = .013, p = .57\)). However, no significant correlations were found between cTnI and body mass index, VO2max, 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 cTn.

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 for runners.

Methods: 51 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: VO2 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 effect sizes were used to compare each variable before and after training for all groups.

Results: Plasma cTnI concentration was significantly increased following exercise. The delta cTnI was positively correlated with delta lactate (\(r = .013, p = .57\)). However, no significant correlations were found between cTnI and body mass index, VO2max, 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 cTn.

The self-paced VO2max test (SPV) has been shown to be a effective alternative to an incremental graded exercise test (GXT) in assessing maximal oxygen consumption (VO2max) 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-h⁻¹ increases every 2 min until the attainment of VO2max. Participants in the GXT group then completed a time-to-exhaustion (TTE) effort at velocity at VO2max (\(\text{VO2max} \times 0.95\)) to determine the time for which VO2max could be maintained (\(T_{\text{VO2max}}\)). 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-h⁻¹ 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 \(T_{\text{VO2max}}\) and ‘mean speed at RPE 20’ in the SPV group. \(\text{VO2max},\) LT and CS were then retested post-training: Results: In the GXT group, VO2max 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⁻¹ min⁻¹ and 54.1 ± 8.3 vs. 57.4 ± 6.5 mL kg⁻¹ min⁻¹ 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⁻¹ min⁻¹). Conclusion: The present study has shown that the SPV is effective in prescribing training to improve VO2max and that ‘mean speed at RPE 20’ is an effective alternative to \(\text{VO2max}\), as a training parameter for interval training.
The extramyocellular (EMCL) and intramyocellular (IMCL) lipid depots continue to emphasize more constant training and higher weekly mileage.

RESULTS: Five females and 6 males completed all measures. Mean age and BMI were 68.6±7.7YO and 25.5±4.9kg/m², respectively. Mean 25(OH)D concentrations increased significantly in subjects receiving vitamin D (45 ± 19) vs. placebo (11± 9)(p<0.05). 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 rVO₂ during full recovery in DAT compared 8% in AT and an average reduction in rVO₂ (-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 depot and altering tissue-level VO₂. 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.

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/m²) and 14 controls (mean age: 26.0 ± 6.5 years; BMI: 21.1 ± 1.7 kg/m²) 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 (QOF) 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⁻², 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. 1855 ± 1046 kcal/day,1, 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 QOF 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.

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 samples, which were sent to a commercial laboratory (Omega-3 Fatty Acid Assay, South 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 α-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 1-20), and a mental toughness scale (MTS; range 11-55). Spearman’s rho coefficients 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]).

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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, 34.0% (30.4-12.1%). 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.

The biologically active vitamin D metabolite (1α-dihydroxyvitamin D) has been studied globally, there is limited research on the use of nutrition and supplements in amateur athletes. 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 June 2015. 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 non-competitive, extrapolation was made that cycling is a popular sport in South Africa. It was 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.

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RESULTS: Body fat percent for male and female triathletes was 11.24% (±4.03%) and 21.3% (±5.0%) respectively. Average daily energy intake for males was 2614 ±1036 kcal and 19 female triathletes (32 ±6.9 years old). Body composition was determined using 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% (±4.03%) and 21.3% (±5.0%) respectively. Average daily energy intake for males was 2614 ±1036 kcal and 1709 ±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.

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 25(OH)D concentration was a significant determinant of LL-37 concentration after adjusting for season of sampling. RESULTS: Median [IQ] 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 (β=0.052, P=0.611) or healthy controls (β=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.

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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 athletes’ health and optimize the adaptation to training load, 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 female synchronized swimmers from the Brazilian National Team. METHODS: 14 female elite athletes (19±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), taking into account the proportional contributions of macronutrient to total energy intake. PARTICIPANTS: Participants were 19 female (36.9 ±10.36 years old) and 19 female triathletes (32 ±6.9 years old). Body composition was determined using 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% (±4.03%) and 21.3% (±5.0%) respectively. Average daily energy intake for males was 2614 ±1036 kcal and 1709 ±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.
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±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 addition, coaches and peers as they are important information sources for YEA should be integrated into low-threshold nutritional education programs.
Reliability of both hip and ankle locations was highest in 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, accelerometer 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 VO2 was expressed in absolute or relative terms. Seventeen were between 0.40-0.59, and four were between 0.60-0.79. Highest validity was seen with the ankle accelerometer during a picking up toys activity (PCC=0.73 for absolute and 0.67 for relative VO2). 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. Totozy de Zepetnek1, Jason S. Au1, Adrienne L. Hol1, Janice J. Eng1, Maureen J. MacDonald1. 1McMaster University, Hamilton, ON. 2University 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 (VO2peak) 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 C1-4, 2 years post-injury 13±10 years) completed an increasing arm VO2peak 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 VO2peak and 6MAT assessments. Regression analysis yielded the following equation to predict VO2peak from end-stage 6MAT VO2: VO2peak (ml·kg⁻¹·min⁻¹) = 1.501(6MAT VO2) - 0.940. Correlation between measured and predicted VO2peak was excellent (r=0.89). No significant difference was found between measured (17.41±7.44 ml·kg⁻¹·min⁻¹) and predicted (17.42±6.61 ml·kg⁻¹·min⁻¹) VO2peak (p=0.97). When cross-validated with a sample of 10 individuals with SCI, correlation between measured and predicted VO2peak remained high (r=0.89), with no differences between measured (18.81±8.35 ml·kg⁻¹·min⁻¹) and predicted (18.73±7.27 ml·kg⁻¹·min⁻¹) VO2peak (p=0.75). Conclusions: Results suggest that 6MAT VO2 can be used to predict VO2peak 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
Meng Ni1, Joseph Signorile2, 1Harvard Medical School, Boston, MA. 2University of Miami, Miami, FL. (Sponsor: Arlette Perry, FACSISM)

(No relationships reported)

Meng Ni1, Joseph F. Signorile2
1University of Miami, Coral Gables, FL, 33146; 2Harvard Medical School, Boston, MA, 02138

Motor function as measured by the Unified Parkinson’s Disease Scale motor subscore (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 to have a strong relationship with UPDRS-motor, we attempted to identify attributes in which changes led to clinically meaningful differences (CMR) 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: 69±4 years) 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 (p=1.14, 95% CI 2.7, 4.43, p=0.032).

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.

(No relationships reported)

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 VO2peak. 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 disturbance. 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) 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 = 62, p < .05, 95%CI 0.7 to 0.88. 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 programs 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
Andrew Watson, Kristin Haraldsdottir, Stacey Brickson, Carol Coutinho, Marlowe Eldridge. University of Wisconsin, Madison, WI.

(No relationships reported)

The relationship between aerobic fitness, physical maturity, ventricular 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 (LVS), and ejection fraction (LVEF) and maximal anaerobic power testing for determination of maximal aerobic capacity (VO2max). 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 VO2max median split and variables were compared between groups. Finally, multivariate regression was used to determine the independent predictors of VO2max using Tanner, REEVD, LVEDV, RVFAC, and LVEF as covariates.

Results: No significant differences were identified between Tanner 3, 4 and 5 with respect to VO2max (2.97 ± 2.31 vs 3.54 L/min, respectively, p=0.18), REEVD (2.4 ± 2.5 v 2.9 cm, p=0.415), RFACV (47.0 ± 43.5 vs 42.5 ± 6.65, p=0.625), TAPSE (2.45 ± 2.40 v 2.35 cm, p=0.67), or LVEF (64.0 ± 61.0 v 65.5 ± 9.07, p=0.347), while increases across Tanner stage were noted in LVEDV (76.0 ± 76.5 v 85.5 ± 6.35, p=0.033), and LVM (95.7 ± 99.2 v 124.2 ± 10.0, p=0.001). Compared to low fit, high fit participants had significantly greater REEVD (p=0.3 v 2.4 cm, p=0.002), but not LVEDV (77.5 ± 76.0 ± 0.319), LVM (110.5 ± 100.6 g, p=0.49), LVEF (58.0 ± 62.5%, p=0.192), RFACV (p=0.42 v 45.0
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±sd: age 9.3±1.5 yrs; BMI percentile 68.6±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±2.54, CON: -0.91±2.51, p=0.01). The mean change in SR time was significantly slower for INT compared to CON (INT: 0.47±1.18, CON: -0.85±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 and a longer intervention program delivered in school settings.

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

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

**Room:** 202

**Chair:** Andrea Stracciolini, FACSM. **Children's Hospital Boston, Boston, MA.**

**Discussant:** Jim MacIntyre, FACSM. **Center for Orthopedic and Rehabilitation Excellence, West Jordan, UT.**

**Discussant:** Kelly Lynne Roberts Lane, FACSM. **Fix It Physical Therapy, Mahtomedi, MN.**

**Discussant:** Carl H. Russell, James B. Robinson. **University of Alabama, Tuscaloosa, AL.**

Email: chrussell@cchs.ua.edu

(No relationships reported)

**Purpose:** To assess differences in physical literacy (PL) domain scores between Canadian children meeting Canada's physical activity (PA) guidelines and those not meeting the guidelines. **Method:** 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 (≥10 h wear time/day). Children were grouped for analysis based on those meeting Canadian PA guidelines (≥12,000 steps ≥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. After controlling for age, sex and seasonality, children meeting PA guidelines had significantly higher physical competence (F= 21.01, p<0.0001) and motivation and confidence (F= 67.92, 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.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

THURSDAY, JUNE 2, 2016

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)
Email: errequa@gmail.com
(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
Pain on the dorsum of his foot after sprinting and felt a pop during Junior season.
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 tendinitis
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

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.
2. She was placed in a post-operative boot 6-8 weeks with partial weightbearing during the early healing period.
3. Weight-bearing 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. Dein1, Lara Atwater1, Paul Talusar1, Cesar Cesar Netto2, Moses Lee1, Talal Zahoor1, Lew C. Schoen1. (Johns Hopkins University School of Medicine, Baltimore, MD.) 2University of Michigan, Ann Arbor, MI. 1Union Memorial Hospital, Baltimore, MD. (Sponsor: Andrew Tucker, FACSM)

Email: edeinl@jhmi.edu

(Historically 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 peroneal longus tendon was palpable upon erosion and intact. No instability. The left heel strike is 5 to 10 degrees of varus with splitting 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 bursa tear
3. Peroneal tenosynovitis
4. Fracture/divertis 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)
Lower Extremity Weakness in a Soccer Athlete

Marie A. Schaefler, Thomas Pommering. Nationwide Children’s Hospital, Dublin, OH.

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

DIFFERENTIAL DIAGNOSIS:
1. Viral myositis
2. Inflammatory myopathy
3. Guillain-Barre syndrome
4. Neuroparalytic 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, CFSE, 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-Barre 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.

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

Brennan J. Boettcher, Jeffrey A. Strommen. Mayo Clinic, Rochester, MN.

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 him 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; Adductors 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 hyporeactive but symmetric in the upper extremities at +1; Patellar were +3; Ankle reflexes were +4 bilaterally with sustained clonus. Babinski upgoing bilaterally. Moderate vibration and proprioception deficits at the bilateral MTP joints.

Able to ambulate but locked his knees for stability.

DIFFERENTIAL DIAGNOSIS:
Extramedullary compression of cord (tumor or infection)
Intramedullary tumor or infection
Spinal stenosis
Transverse Myelitis
Central Nervous System Demyelinating Syndrome
Paraneoplastic Syndrome
Vascular Malformation

TEST AND RESULTS:
An MRI was obtained and an intramedullary 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 corticosteroid was attempted but patient continued to progress neurologically. 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. Corticosteroid sub acromial injection
2. Sub acromial impingement
3. Cervical radiculopathy
4. Thoracic outlet syndrome
5. Stretch injury of brachial plexus
6. Parsonage Turner syndrome

TREATMENT AND OUTCOMES:
MRI left shoulder:

1. Sub acromial injection
2. Corticosteroid sub acromial injection
3. Shoulder pain - Registered Nurse

Srikanth Nithyanandam. University of Kentucky, Lexington, KY.

Email: sri.niss89@uky.edu

(No relationships reported)
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 weightlifting 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 dyskinesis 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  
5. TENS unit  

Patient: Patient has a history of persistent right arm fatigue during exercise and with overhead swimming strokes.

Physical exam:  
1. Long thoracic nerve palsy: no evidence of paralysis  
2. Neuralgic Amyotrophy: no evidence of muscle atrophy  
3. Brachial plexus injury: no evidence of sensory or motor deficit  
4. Mass Lesion: no evidence of mass effect  
5. TENS unit: no evidence of electrical stimulation effect

Final Diagnosis: Neuralgic Amyotrophy (Parsonage Turner Syndrome)

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. Ultrasound - Right long thoracic neuropathy with diffuse enlargement of long thoracic nerve, atrophy of right serratus anterior muscle, and no brachial plexus abnormalities.

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

HISTORY: 21-year-old NCAA Division 1A 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 2016 season.

Elbow Injury - Baseball  
Shawn D. Felton, Arie J. van Duijn. Florida Gulf Coast University, Fort Myers, FL. (Sponsor: Mitchell L. Cordova, FACSM)  
Email: sfelton@fgcu.edu  
(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 posteriorly. 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 paller.


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.

FACSM (No relationships reported)
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: Valgas Extension Overload, Varus and Valgas Stress, O’Brien and O’Driscoll.

DIFFERENTIAL DIAGNOSIS:
1. Medical Collateral ligament strain
2. Ulnar Neuritis
3. Common Flexor Tendon Pathology
4. Medial Epicondylitis
5. Valgas Extension Overload

TEST AND RESULTS:
Elbow AP/Lateral/OBlique Radiographs:
- Moderate posterior olecranon osteoarthritis, 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 valgas 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.

1346 June 2, 9:20 AM - 9:40 AM
Elbow Injury-golf
Alex B. Behar1, Daniel R. Bunzol2. 1Rush University Medical Center, Chicago, IL. 2University of Illinois at Chicago, Chicago, IL.
Email: Alex_b_Behar@rush.edu

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 epicondyliitis 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 valgas 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 medium 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.
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 neurogenic thoracic outlet syndrome is a poorly understood condition that may be associated with specific symptoms such as upper extremity pain, numbness, tingling or weakness.

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 scapular 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.

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, 1,382 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 ORA. Percentiles were calculated and a factorial ANOVA was used to determine the difference in the mean %BF values between age groups and sex. RESULTS: The results of the study were: 1) 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. Therefore, no significant changes in %BF were observed with the two older age groups.

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.

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 ASM and handgrip strength in the whole sample or in any age group separately (r = 0.056; p = .256). In people over 80, usual gait speed and physical performance were not associated with ASM (p > 0.05). ASM was only associated with handgrip strength in the group of obese elderly women (BMI > 30kg/m²; r = -0.154, p = 0.039). CONCLUSION: In elderly women without obesity, ASM 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.

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 provided a cross-sectional investigation in 100 middle-aged and older Japanese men (56 ± 12 years). We used two indexes for sarcopenia: 1) Appendicular skeletal muscle mass (ASM) divided by height squared (ASM/Ht, kg/m²) 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, kg/m²) and 3) body fat percentage (% fat, %). MetS risk score was derived by standardizing and then summing the following continuously-distributed variables: fasting blood glucose (<0.8 m/s) and 20% had low HGS (<20kg female and <30kg male). Participants who had low HGS also demonstrated the same reductions. HGS was positively correlated with arm, leg and total lean mass, and ALM/h² (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 muscle function. 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.

The coexistence of sarcopenia and obesity is referred to as sarcopenia 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±16 years) and women (n=9, 59±3 years) were examined in this study. The skeletal muscle index (SMI, appendicular muscle mass/height³) was calculated by dual-energy X-ray absorptiometry. Sarcoopenia was defined as values one standard deviation below the sex-specific mean 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 (p=0.0138). However, there was no significant difference with the lower and higher SMI group. The baPWV in men was observed significantly positive correlation with WC (r=0.472, P=0.0414), but not with SMI. On the other hand, 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.

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 independently linked with impaired function, and increased morbidity and mortality. Regardless of these functional measures, how much, 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 ± SD.

RESULTS: A total of 66 participants (age 62.8 ± 8.0 years; 65% female) completed the study. Participants were classified according to the EWGSOP guidelines as guidelines had appendicular lean mass (kg)/height² (ALM/h²) below the proposed cutoff 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 ± 1.63 vs 10.74 ± 1.50; P<0.001) and reduced Stair Climb power (251 ± 92 vs 296 ± 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/h² (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 muscle function. 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.

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 (CFV). Partial correlation coefficients were computed between RTL and BF% controlling for CFV. RESULTS: Mean values for Bivariate correlations between RTL and BF% (Normal: r = 0.445, p
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.

Obstructive Sleep Apnea Increases Visceral Fat Deposition but Not Total Body Fat Percentage

Ryan A. Martin1; Gabrielle E. W. Giersch1; Courtney Stosnider1; Jacob D. Ridings1; Christopher J. Womack, FACSM1; Trent A. Hargens, FACSM1
1Human 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 ± 6.7 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.
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.

### Table 1. Mean for RLV(L) across trials on land and submerged in water, and of FIR, ROW, and WIN in each condition. There was no significant difference between submerged. The LOW were obtained in a mean of 4 trials, significantly more trials than (1.19L, 1.13L, and 1.05L respectively) on land, and significantly less than FIR (1.11L) trials necessary to satisfy criteria FIR, ROW, WIN and LOW. The alpha level was

<table>
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<tr>
<th>Trial</th>
<th>RLV Land (±SD)</th>
<th>RLV Submerged (±SD)</th>
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<tbody>
<tr>
<td>Trial 1</td>
<td>1.00 ± 0.36</td>
<td>0.93 ± 0.29</td>
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<tr>
<td>Trial 2</td>
<td>0.99 ± 0.45</td>
<td>0.93 ± 0.26</td>
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<tr>
<td>Trial 3</td>
<td>0.92 ± 0.30</td>
<td>0.92 ± 0.34</td>
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<tr>
<td>Trial 4</td>
<td>0.95 ± 0.36</td>
<td>0.90 ± 0.30</td>
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<tr>
<td>Trial 5</td>
<td>0.98 ± 0.46</td>
<td>0.93 ± 0.33</td>
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<tr>
<td>Trial 1</td>
<td>1.00 ± 0.39</td>
<td>0.96 ± 0.26</td>
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<tr>
<td>Trial 2</td>
<td>2.00 ± 0.00</td>
<td>2.00 ± 0.00</td>
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<tr>
<td>Trial 3</td>
<td>0.97 ± 0.33</td>
<td>0.91 ± 0.30</td>
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<tr>
<td>Trial 4</td>
<td>2.35 ± 0.71</td>
<td>2.65 ± 1.13</td>
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<tr>
<td>Trial 5</td>
<td>0.96 ± 0.33</td>
<td>0.91 ± 0.29</td>
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<tr>
<td>Trial 1</td>
<td>2.30 ± 0.70</td>
<td>2.43 ± 0.82</td>
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<tr>
<td>Trial 2</td>
<td>0.89 ± 0.37</td>
<td>0.87 ± 0.28</td>
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<tr>
<td>Trial 3</td>
<td>4.33 ± 0.37</td>
<td>3.95 ± 0.98</td>
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CONCLUSION: These results indicate that a dose of 7 Gy gamma irradiation may blunt myogenesis following cardiotoxin injury but does not alter fiber CSA up to 14 days following exposure.

### Table 2. Mean for RLV(L) across trials on land and submerged in water, and of FIR, ROW, and WIN in each condition. There was no significant difference between submerged. The LOW were obtained in a mean of 4 trials, significantly more trials than (1.19L, 1.13L, and 1.05L respectively) on land, and significantly less than FIR (1.11L) trials necessary to satisfy criteria FIR, ROW, WIN and LOW. The alpha level was

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<td>2.00 ± 0.00</td>
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<td>Trial 2</td>
<td>1.13 ± 0.26</td>
<td>1.02 ± 0.28</td>
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<tr>
<td>Trial 3</td>
<td>2.75 ± 0.95</td>
<td>2.65 ± 1.01</td>
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<tr>
<td>Trial 4</td>
<td>2.65 ± 0.86</td>
<td>2.44 ± 0.63</td>
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<td>Trial 5</td>
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<tr>
<td>Trial 1</td>
<td>1.19 ± 0.28</td>
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<td>Trial 2</td>
<td>1.11 ± 0.31</td>
<td>1.09 ± 0.31</td>
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<td>Trial 3</td>
<td>1.13 ± 0.31</td>
<td>1.09 ± 0.27</td>
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<td>Trial 4</td>
<td>1.12 ± 0.29</td>
<td>1.12 ± 0.33</td>
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<tr>
<td>Trial 5</td>
<td>1.19 ± 0.28</td>
<td>1.11 ± 0.29</td>
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<td>1.12 ± 0.30</td>
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<tr>
<td>Trial 2</td>
<td>1.14 ± 0.28</td>
<td>1.08 ± 0.27</td>
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<tr>
<td>Trial 3</td>
<td>1.11 ± 0.31</td>
<td>1.09 ± 0.31</td>
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<td>Trial 4</td>
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<td>1.09 ± 0.27</td>
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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

**Title:** Muscle Fiber Cross-sectional Area Is Unaffected 14 Days Following A Clinical Dose Of Radiation

**Authors:** Krishan Bhakta1, Vinny Alvionita1, Michael S. Yee, Ryan G. Kunkle, Ronald K. Hetzler, FACSM. University of Hawaii, Manoa, Honolulu, HI. (Sponsor: Dr. Ronald K. Hetzler, FACSM)

**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/6) 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 cosin staining. Approximately 140 fibers of each muscle sample were analyzed with Image 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 gamma irradiation may blunt myogenesis following cardiotoxin injury but does not alter fiber CSA up to 14 days following exposure.

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**SUMMARY:**

- **Objective:** 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).
- **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 standardized diet (1g protein kg⁻¹ day⁻¹) for 2d prior to the intervention. After an overnight fast, L-[ring-¹³C₆] 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.

**Conclusions:** These results indicate that a dose of 7 Gy gamma irradiation may blunt myogenesis following cardiotoxin injury but does not alter fiber CSA up to 14 days following exposure.
MPS relative to baseline (ADT=0.0631 ± 0.0085, CON=0.0833 ± 0.0262 %·hr⁻¹). 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-α) and pro-atrophic genes (Atrogin, MURF3).

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.
group. RT was simulated using an elevated food model. After 6 weeks of training, the soleus (SOL) and extensor digitorum longus (EDL) were exercised and placed in a tissue bath containing Krebs buffer (K) where initial twitch force was measured. Muscles were then incubated with either new K or K containing DOX (24 μM) 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 O2 Pulse across Upper Body Resistance Exercises
Swapan Mookerjee, Sam Meske, Vincenzo G. Nocera. Bloomsburg University, Bloomsburg, PA. (Sponsor: Eric Rawson, FACSM)
Email: smookerj@bloomu.edu

No relationships reported

Purpose: To compare O2 pulse (VO2/HR) between selected upper body resistance exercises, as well as sex differences. METHODS: A total of 24 subjects (12 ♂, 12 ♀) mean age (±SD) 21.4 (±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 (No relationships reported)

1368 Board #21 June 2, 8:00 AM - 9:30 AM
Heterogeneous Circulating Angiogenic Cell Responses to Maximal Exercise
Email: jenkinsn@uga.edu

No relationships reported

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 ± 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 (CD262E+), 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 lympho/hemo-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
Debra K. Tacadà, Jacob W. Manning¹, Jeffery Montes², Elizabeth Tanner¹, Damon McCune¹, Tessa Koschel¹, Ashley Tovar¹, Julie Taylor¹, James W. Navalta¹, Mark DeBeliso, FACSM¹, John C. Young, FACSM¹, ¹University of Nevada, Las Vegas, Las Vegas, NV. ²Southern Utah University, Cedar City, UT. (Sponsor: John C. Young, PhD, FACSM)

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 levels, and this exercise-induced decrease in arterial blood pressure may contribute to 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 examined the extent of PEH in an applied-setting, such as a trail run.

PURPOSE: To determine the prevalence 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=22.6 ± 2.7 yrs; height=172.1 ± 11.8 cm; mass=69.8 ± 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 5358 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
Nathan M. Garvin, James A. Pawlczyn, FACSM. The Pennsylvania State University, University Park, PA. Email: mg5181@psu.edu

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 isometric handgrip varies considerably between individuals, even when experimental conditions are standardized. The possible foundation for these differences may be neutral (e.g., affulent, 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. Bemben, 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, and stress hormone levels. METHODS: Nine females (age: 23.8 ± 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, and flexibility was measured using the sit and reach test before and after the warm-up and post testing. The passive dicro 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<0.01) and time main effect (p<0.01) for SBP in the LF/HA DYN condition; the decrease observed in SBP occurred from pre to post. There was a significant time main effect (p<0.01) for HR from pre to post. A time main effect (p<0.05) 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 chancemoreceptor 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, Chris Abbiss, Andrew Maiorana, Jeremiah Peiffer, Murdoch University, Murdoch, Australia. Edith Cowan University, Joondalup, Australia. Curtin University, Bentley, Australia. Email: N.Gordon@murdoch.edu.au (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 ± 8 yrs, height: 1.71 ± 0.07 m, body mass: 72.2 ± 11.9 kg, VO2max: 37.1 ± 10.0 mL/kg/min-1; mean ± 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 haemoglobin saturation (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 ± 20.8 mL/kg-1 min-1 and SL: 101 ± 12.2 mL/kg-1 min-1; p<0.01) compared with DL cycling while power output (DL: 6.29 ± 1.53 W/kg-1 and SL: 6.01 ± 1.48 W/kg-1) was not different between trials. Total haemoglobin concentration (DL: 9.75 ± 10.75 g/dL and SL: 14.09 ± 5.05 g/dL) and tissue oxygenation index (DL: 65.79 ± 1.94% and SL: 66.72 ± 5.44%) were not different between DL and SL cycling. Additionally, cardiac output (DL: 14.3 ± 3.2 L/min-1 and SL: 12.3 ± 2.7 L/min-1; p<0.01) was higher during DL compared with SL cycling while mean arterial pressure (DL: 107 ± 10 mmHg and SL: 103 ± 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
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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±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, 67g) with two full-water bottles. Condition testing order was randomized. A portable gas analyzer and heart rate monitor collected minute ventilation (Ve), rate of oxygen use (VO2), non-protein respiratory quotient (RQ), energy cost and heart rate (HR).

Abstracts were prepared by the authors and printed as submitted.
RESULTS: The HALF condition generated the highest VE 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 the BELT condition compared to HALF, FULL, and CON (157 bpm vs 151 bpm, 158 bpm and 143 bpm, respectively; p = 0.029). VO2 energy and value costs 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 in 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 Conwell, Mitchel Samels, Branden Everding, Sheryl Livington, Margot Morris, Michael Williams, Louis Whitworth, Benjamin Levine, FACSM. JEEM, 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, Justin Lawley, Erin Howden, Satyam Sarma, William Conwell III, Mitchel Samels, Branden Everding-Sheryl Livington, Margot Morris, Michael Williams, Louis A Whitworth and Benjamin D. Levine, 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 (Nextfin). Stress on the cerebral arteries was assessed by calculating the cerebrovascular transmural pressure gradient (CVP: ABP - 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 (Δ-6±6 mmHg) and ICP (Δ±1±3 mmHg) rose slightly. The VM caused sABP (Δ9±5 mmHg) and ICP (Δ1±2±3 mmHg) to increase, whereas the MM resulted in a small reduction in sABP (Δ-8±11 mmHg) and minimal change in ICP (Δ±3±4 mmHg). This resulted in an average reduction in CVP irrespective of breathing maneuver (SP, 10±5; VM, 8±11; MM, 10±9). However, the VM caused a dramatic peak increase in sABP (28±10), which was not counteracted by ICP (15±10) and caused a transient increase in sABP (∆12±3 mmHg) to increase, whereas the MM resulted in a small reduction in sABP (∆5±3 mmHg) and ICP (∆5±3 mmHg) rose slightly. The VM caused sABP (∆9±15 mmHg) to increase, whereas the MM resulted in a small reduction in sABP (∆6±9 mmHg) and minimal change in ICP (Δ3±4 mmHg). This resulted in an average reduction in CVP irrespective of breathing maneuver (SP, 10±5; VM, 8±11; MM, 10±9). However, the VM caused a dramatic peak increase in sABP (28±10), which was not counteracted by ICP (15±10) and caused a transient increase in sABP (∆12±3 mmHg) to increase, whereas the MM resulted in a small reduction in sABP (∆5±3 mmHg) and ICP (∆5±3 mmHg) rose slightly.

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 (ΔO2) to the higher VO2 that past studies observed with stability ball (SB) sitting during arm ergometry. METHODS: Following IBF 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, CO2 rebreathing, and a heart rate monitor measured VO2, VCO2, cardiac output (Q), and HR at rest and two stages of submaximal arm ergometry. SV and ΔO2 were calculated from results: SV = Q*HR, ΔO2 = VO2/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 VO2 (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 ΔO2 (p = 0.016).

Table 1. Mean ± SD

<table>
<thead>
<tr>
<th></th>
<th>VO2 L/min</th>
<th>HR b/min</th>
<th>SV mL/b</th>
<th>CAO2 mL/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest-SB</td>
<td>0.280 ± 0.069</td>
<td>91 ± 15</td>
<td>61.8 ± 19</td>
<td>5.2 ± 0.8</td>
</tr>
<tr>
<td>Rest-C</td>
<td>0.270 ± 0.063</td>
<td>89 ± 15</td>
<td>61.5 ± 19.1</td>
<td>5.2 ± 0.9</td>
</tr>
<tr>
<td>Stage 1-SB</td>
<td>0.725 ± 0.146</td>
<td>120 ± 15</td>
<td>74.2 ± 21.7</td>
<td>8.4 ± 1.0</td>
</tr>
<tr>
<td>Stage 1-C</td>
<td>0.685 ± 0.148</td>
<td>116 ± 15</td>
<td>73.4 ± 22.9</td>
<td>8.3 ± 1.0</td>
</tr>
<tr>
<td>Stage 2-SB</td>
<td>1.002 ± 0.227</td>
<td>144 ± 18</td>
<td>74.2 ± 20.7</td>
<td>9.6 ± 1.1</td>
</tr>
<tr>
<td>Stage 2-C</td>
<td>0.892 ± 0.219</td>
<td>137 ± 16</td>
<td>72.7 ± 20.6</td>
<td>9.1 ± 0.9</td>
</tr>
</tbody>
</table>

CONCLUSION: Replacing a chair with a stability ball can elevate cardiorespiratory parameters, with oxygen extraction the dominant 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 central 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 ± 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, 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±5 years, Body Mass Index (BMI) 26±7 kg∙m−2; 9 female) completed a screening visit and two separate, randomized experimental visits. For experimental visits, all participants completed cognitive testing and underwent measurements 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.
3180 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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Email: cm.mcclean@ulster.ac.uk

(No relationships reported)

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 ± 4.6 years; 179.7 ± 5.6 cm; 79 ± 10.6 kg; VO₂max m³.7± 7.1 ml·kg⁻¹·min⁻¹) 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% VO₂max) and (2) continuous moderate walking exercise (60% VO₂max for 30 minutes). Each trial was separated by 7 days. Venous blood samples were obtained at baseline and immediately, 2, 4, 6, 24 h and 48 h post-exercise for determination of markers of inflammation (IL-6 and TNF-α), lipid soluble antioxidants and oxidative stress (LOOH, H₂O₂ and the ascorbyl radical).

RESULTS: Lycopene decreased 2 h post-exercise during the intermittent vigorous walking exercise trial compared to baseline (P<0.05) and post-exercise (P<0.05). A main effect for time was detected for increases in α-tocopherol (P<0.05, Pooled data). Main effects for time were also observed for increases in IL-6 and TNF-α following exercise (P<0.05, Pooled data, respectively). No changes were detected for LOOH, H₂O₂ 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-α), 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.

THURSDAY, JUNE 2, 2016

Abstracts were prepared by the authors and printed as submitted.
participants (5 m, 3 f), (mean ± SD: 22 ± 2 yr; 172 ± 6 cm; 70 ± 9 kg) performed a CON and ECC ramp incremental test to the limit of tolerance on a step ergometer (Eccentron; ITE, 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 (VO2)) rate, set at 90% of the CON lactate threshold (i.e., moderate-intensity). All tests were undertaken > 48 hours apart. Breath-by-breath VO2, heart rate (HR), and blood pressure (BP) responses were measured throughout. RESULTS: During constant exercise at 36 ± 6.2 W, i.e., in a steady-state was attained, compared with CON, ECC ΔVO2 was 64 ± 9% lower (22 ± 0.07 vs. 62.0 ± 0.17 l•min-1; P < 0.05), ΔHR was 51 ± 13% lower (14.6 ± 5.9 vs. 29.9 ± 7.2 beats.min-1; P < 0.05) and Δ mean arterial pressure was 56 ± 18% lower (7 ± 3 vs. 16 ± 5 mmHg; P < 0.05). The ECC WR predicted to match for metabolic rate (VO2, 1.2 ± 0.1 l•min-1) was 66 ± 19% higher (60.0 ± 13.2 vs. 36.2 ± 6.2 W; P < 0.001), and allowed a greater volume of work to be accumulated; however, VO2, 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 VO2, was tolerable, and allowed a greater volume of work to be accumulated, VO2, and HR increased throughout the exercise, suggesting this was performed at a higher exercise intensity, which may be contraindicated in some populations.

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 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 with 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 (86) %MVC mechanical; p = 0.05] and ECU [528 (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.

**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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Email: richard.burden@smuc.ac.uk

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 (runners n=7, O2max 70.7 ± 3.7 ml·kg−1·min−1, sFe 74.0 ± 22.7 µg·L−1; male runners n=17, O2max 78.3 ± 2.6 ml·kg−1·min−1, sFe 64.1 ± 26.3 µg·L−1). Traditional RBC indices were derived from the CBC, along with the following RCPD variables modelled from the raw CBC data file: reticulocyte volume reduction (β), reticulocyte haemoglobin (Hb) content reduction (β), erythrocyte volume and Hb content reduction (α); magnitude of variation in the rate of volume and Hb reduction (D and Dc, respectively); critical volume for cell clearance (v); RESULTS: D and were significantly different between female runners and male rowers (0.182 ± 0.002 vs. 0.021 ± 0.003, p=0.006 & 0.780 ± 0.006 vs. 0.773 ± 0.006, p=0.008, respectively). No further differences between sports for RCPD variables were identified. There were significant relationships between v and red cell distribution width (RDW) in male rowers (r=0.835, p=0.020), male runners (r=0.933, p<0.001) and a trend was observed in female runners (r=0.544, p=0.084). There were no significant relationships between any RCPD variables and sFe or serum iron (sFe) in either sport. CONCLUSION: Maturation rates and clearance thresholds of erythrocytes differ between sports and this is independent of sFe and sFe. The association between v 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.
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 ± 3.0 yrs) and 24 females (22.5 ± 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 Square of Successive Differences (lnRMSSD) was used to quantify vagal tone.

RESULTS: Repeated measures ANOVA revealed several significantly different points following PRE values. The Stick time point was significantly lower than PRE (1.69 ± 0.23 ms² vs. 1.63 ± 0.26 ms²; p < 0.05), while time points 2-min (1.76 ± 0.22 ms²), 4-min (1.74 ± 0.23 ms²), 5-min (1.74 ± 0.24 ms²), 6-min (1.75 ± 0.23 ms²), 8-min (1.74 ± 0.24 ms²), and 9-min (1.75 ± 0.24 ms²) where 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 ± 0.23 ms² vs. 1.72 ± 0.24 ms²; 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.

Abstracts were prepared by the authors and printed as submitted.

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 workload is unknown.

PURPOSE: We aimed to investigate the amplitude response and phase response of SBRS during cycling exercise with sinuoidally-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 30 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 SAP performed each of those three sinusoidal load exercise on separate days in random order. SBRS 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 < 0.01), approximate entropy (ApEn) (p < 0.01), and baseline HR (p < 0.01). Both baseline ApEn and resting HR were negatively correlated with VO2max (r = 0.49, p = 0.009; 0.52, p = 0.005, respectively) and HR at 2 min (r = 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 VO2max. 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 HRV 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.

Support provided by NIMH 58144, NICHD R01 HD078346-01A1
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 guidance, 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. 23.8% of participants were pre-hypertensive. There was a significant interaction between physical activity and smoking and systolic blood pressure (p<0.01). 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.

Changes in plasma volume (as calculated by changes in hemoglobin and hematocrit) are important to document, since hemocoagulation 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 quadraplicate) and hematocrit (Hct - using StatSpin centrifuge, in triplicate). All statistical analysis was done by repeated measures ANOVA. RESULTS: Data presented as means ± SD; Hgb = hemoglobin in mg/dl, Hct = hematocrit in %, Δ 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 ± SD = D - 1.011 ± 0.006, DC - 1.010 ± 0.004, S - 1.011 ± 0.005, SC - 1.013 ± 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.
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.

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

**METHODS:** Fifteen healthy male subjects (age: 21.3 ± 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, 3×16 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 (F30,659=25.23, p<0.0001). From the baseline values, peak blood flow volume increased nearly four times (F30,658=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 (F30,658=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.

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

**METHODS:** Participants (n=4 [22.5±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 the non-dominant evertor muscles demonstrating a greater increase than that of the dominant evertors undergoing BFRT.

**RESULTS:** There were non-significant increases (p=0.125) in frontal plane isometric ankle strength.

**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 show any significant data results.

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±1yrs) and 16 older adults (66±2yrs), underwent an 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.

**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 ± 5 yr, body mass: 81 ± 12 kg) were exposed 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·cm² UV-A light (UV A10), or (iii) 20 J·cm² UV-A light (UV A20). UV A20 is comparable to 20 J·cm² 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).

**RESULTS:** Plasma nitrate [NO⁻] and nitrite [NO⁻] were later analysed via HPLC (n=7). Statistical differences are reported together with effect sizes (Cohen’s d). There were no changes in plasma nitrate [NO⁻] or nitrite [NO⁻] between pre- and post-exposures in all conditions (p>0.05). Plasma [NO⁻] was moderately higher after UV A20 exposure compared to CON (Δ 29%, 178 ± 299 nM, P=0.04), but did not change with UV A10 (P=0.26, 0.26 ± 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 UV A20 (A 7%, 112 ± 143 kcal/day; Δ=8%, 78 ± 316 kcal/day, P<0.001) and UV10 (A 4% 134: 159 kcal/day, Δ=0.84, P<0.07) while no significant differences were observed in the CON group (P=1.0). From pre- to post-light exposure, VO₂ declined with UV A20 (A 6%, 13 ± 19 ml/min, P=0.04), but did not change with UV A10 (P=0.26) or CON (P=0.44).

**Conclusion:** The present data suggests that a 20 J·cm² dose of UV-A light increases [NO⁻] and decreases REE and VO₂ to a greater extent than 10 J·cm². Although speculative, it is probable that reductions in REE and VO₂ 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.
Supported by The Mentholathum Company #RH05071

Cooling effect of menthol-based gel. However, the likely mode of action was from the 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 to the skin. PURPOSE: To establish tissue temperature and blood flow responses following application of menthol cooling gel to the anterior thigh. METHODS: Twenty (age: 30-7 years, 13 males and 2 females) performed in a random order an incremental maximal exercise test 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 the test and T30, t, 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 A10, A20, A30, A60 sec, P<0.05), but similar in the long-term phase (HRR at A120, A180, A240 and A300 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 IE in healthy young participants. 

Board #53
June 2, 8:00 AM - 9:30 AM
The Effects of Topically Applied Menthol Cooling Gel on Intramuscular and Skin Temperatures
Angus M. Hunter, Adam Wade. University of Stirling, Stirling, United Kingdom.
Email: a.m.hunter1@stir.ac.uk
(No relationships reported)

Poitiers, France. Institute, Montreal, QC, Canada. 2University of Poitiers, Poitiers, France.

Cooling was measured using a Pt100 temperature sensor inserted 3 cm deep and the signal was amplified using a Eurotherm model 6060 temperature controller. The temperature was recorded every 5 sec for 300 sec with a datalogger (Omega). Skin cooling was measured using a Pt100 temperature sensor on the skin of the anterior thigh 3 cm deep. The temperature was recorded every 5 sec for 300 sec with a datalogger (Omega). The temperature was recorded every 5 sec for 300 sec with a datalogger (Omega).

The effects of menthol gel were evaluated in a randomized, double-blind, placebo-controlled manner. The gel was applied to the anterior thigh of the participant, and the temperature was recorded over a 300 sec period. The results showed that the menthol gel significantly decreased the temperature of the skin and muscle compared to the placebo gel. The muscular temperature decreased by 8.8°C, while the skin temperature decreased by 4.2°C. The results suggest that the menthol gel is effective in cooling the skin and muscle.

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 CPI 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.

Board #53
June 2, 8:00 AM - 9:30 AM
The Influence of ABO Blood Type on Hemostatic Activation Following A Marathon
Lauren M. Lambert1, Amanda L. Zaleski1, Kevin D. Ballard2, Gregory A. Panza1, Antonio B. Fernandez3, Ji Yeon Jung2, Paul D. Thompson, FACSM4, Linda S. Pescatello, FACSM5, Aaron L. Baggish1, Christopher Troyanos5, Beth A. Taylor2. 1University of Connecticut, Storrs, CT. 2Hartford Hospital, University of Connecticut, Hartford, Storrs, CT. 3Hartford Hospital, Miami University, Hartford, Oxford, CT. 4Hartford Hospital, Hartford, CT. 5Massachusetts General Hospital, Boston, MA. 6Boston Athletic Association, Boston, MA. (Sponsor: Dr. Linda Pescatello, FACSM)

(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 contraceptives) may disproportionately activate the coagulation cascade without proportional compensation by fibrinolysis, therefore increasing the risk of deep vein thrombosis in otherwise healthy athletes. Individuals without type-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 young (35.8±6.5 years), healthy (23.0±6.3 kg·m⁻²) female oral-contraceptive users 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=0.33) did not differ between blood types. 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.

1402 Board #55 June 2, 8:00 AM - 9:30 AM Topical Menthol Application Augments Cutaneous Microvascular Blood Flow

Daniel H. Craighead, Lacy M. Alexander, FACS
The Pennsylvania State University, University Park, PA.

(Most 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 receptor potential melastatin 8 (TRPM8) receptors on sensory nerves, eliciting a cold sensation and potentially vasoconstriction. Menthol activates transient receptor potential melastatin 8 (TRPM8) receptors on sensory nerves, eliciting a cold sensation and potentially vasoconstriction. Menthol activates transient receptor potential melastatin 8 (TRPM8) receptors on sensory nerves, eliciting a cold sensation and potentially vasoconstriction. Men...
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 enable 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 ± 2.4 years, height 155.6 ± 16.6 cm, mass 56.3 ± 22.3 kg, LL 74.1 ± 9.0 cm) participated in this study. O2 consumption was measured by a K4 portable metabolic system (Cosmed). Individual participants completed an incremental treadmill protocol 0.22-2.23 m/s, in 0.22 m/s increments. The square root of the metabolic data (mL/kg-1min-1) were compared with all ambulatory speed measures: STD, Fr and DLS. The Aikea 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: AICA 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 enable the ability to provide public health recommendations based on objectively measured gait parameters. Funded by Eunice Kennelly Shriver National Institute of Child Health and Human Development (1R21HD073807-01A1)

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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. The ActivityStat hypothesis suggests that when physical activity (PA) is increased in schools, 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 ($HR_{max}$) every 18 minutes; (2) 8 hours of sitting interrupted with 2-minute moderate-intensity activity breaks (50% $HR_{max}$); (3) 8 hours of sitting interrupted with 2-minute high-intensity activity breaks (75% $HR_{max}$); and (4) 8 hours of sitting interrupted with 2 minutes of sedentary screen time. PAEE was assessed via accelerometer 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- ($HR_{max}$ 22±0.05 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. 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, I² = 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. Previous studies have found that school-aged children increase body mass index (BMI) 25.0 to 29.9 kg/m² and obese (BMI ≥30.0 kg/m²) women are at risk for obesity and co-morbidities. PURPOSE: To determine maternal weight retention and body fatness at 1 year. METHODS: Marilyn B. Duggan1, Paulette E. Kruisingh1, Michelle F. Mottola1, FACSM1, Stephanie-May Ruchat2, Harry Prapavessis2, Isabelle Girou3, Maggie Sopper1, Jo-Anne Hammond4, Ruth McManus1, Robert Gratton1, Stewart Harris1, Trevor R. Tooley1, Rebecca E. Hasson2, Anthony Hanley4. 1University of Western Ontario, London, ON, Canada. 2Université du Québec à Trois-Rivières, Trois-Rivières, QC, Canada. 3University of Ottawa, Ottawa, ON, Canada. 4University of Toronto, Toronto, ON, Canada. Email: mmottola@uwwo.ca (No relationships reported) Babies born to overweight (OW) or obese (OB; pre-pregnancy BMI ≥30.0 kg/m²) women are at risk for obesity at 6, 12 months 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 nutrition and exercise program 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). 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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 and 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 (706 ± 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 (WHHR) 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 $\alpha = 0.66$ to $\alpha = 0.82$. Differences between weight groups and WHHR groups could be found in the total score as well as in all subscales ($p < .05$). 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 program. ESCRS: 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.
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 portable indirect calorimetry (Oxycon Mobile). 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 (mean ± SD age 60.9 ± 12.5 yrs; mass 82.0 ± 19.6 kg; ht 167.7 ± 10.1 cm), 10-m gait speed 0.790 ± 0.31, and twenty-three subjects were categorized as normal functioning (age 51.2 ± 17.6 yrs; mass 73.4 ± 15.7 kg; ht 168.1 ± 10.2 cm; 10-m gait speed 1.200 ± 0.33). 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 [0.136-0.990] ml/kg/m) compared to the NFG (0.173 [0.127-0.222] 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**

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: VO2max 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) 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 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

**CONCLUSIONS** Energy balance and appropriate macronutrient intake are essential 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.
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: “3lb 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 ± 4.0 kg for 10lb claim, 55.8 ± 4.1 kg for 7lb claim, 53.5 ± 1.8 kg for 5lb claim, 56.6 ± 1.1 kg for 3lb claim. No significant differences were apparent between any jockey group for height (p=.856), body mass (p=.440), BMI (p=.363), LM (p=.394), LMI (p=.522), FM (p=.818), FMI (p=.913) or percentage bodyfat (p=.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.

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 of non-Caucasian descent; therefore, it is unknown if race plays a role in the incidence and underlying etiology of the Triad, especially in athletes of non-Caucasian descent. 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±5.5 years; height: 167.0±7.2 cm; weight: 62.0±7.1 kg), African American athletes (n=19; age: 21.2±3.8 years; height: 168.1±5.7 cm; weight: 65.8±13.0 kg), Caucasian controls (n=22; age: 25.5±4.8 years; height: 164.1±5.8 cm; weight: 62.3±9.9 kg) and African American controls (n=12; age: 22.3±3.0; height: 164.9±7.2; weight: 62.3±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. Conclusions: No significant differences were apparent between any jockey group for height (p=.856), body mass (p=.440), BMI (p=.363), LM (p=.394), LMI (p=.522), FM (p=.818), FMI (p=.913) or percentage bodyfat (p=.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.

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Purpose: Aerobic and resistive 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, 45.3±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 6MWT. 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 anthropometrics 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±16 vs T12:71.2±15 p=0.005); of the BMI (T0:25.5±7 vs T12:25.1±7 p=0.008); of the waist circumference (T0:101.2±11 vs T12:98.3±11 p=0.007) and of the hip circumference (T0:107.6±10 vs T12:104.7±10 p=0.006). CONCLUSION: No relationships reported.
Board #76
June 2, 8:00 AM - 9:30 AM
Physical Reconditioning Training “In Field” On A Group Of Solid Organ Transplant Recipients
Marco Petranelli1, Alessandro Pacini2, Marcello Marchioni2, Giuseppe di Pietro2, Carlo Tempestini1. 1University of Florence, Firenze, Italy; 2Local Health Trust of Florence, Firenze, Italy; 3Arno Sporting Club Association, Firenze, Italy; 4Hospital S. Giovanni di Dio, Firenze, Italy.
Email: marco.petranelli@unifi.it

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.

Method
The Egoscue Method's Effect on Nonspecific Chronic Low Back Pain and Functional Disability
Email: bill_myrer@byu.edu

Objectives
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.

Visit 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 VAS 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 VAS were found in both groups after both 2 (EM p=0.01 and PT p=0.03) and 4 wks (p<0.001) 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.

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
Email: marco.petranelli@unifi.it

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/m2) 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 accelerateometry) (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 proinsulineic responses to the meal test (T PRE: 8817±5638 μU/mL/min and 6495±2219 pmol/L/min, POST: 6678±2442 μU/mL/min and 5209±2518 pmol/L/min, p=0.06 and p=0.02, respectively, PRE vs. POST).

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.
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-dimensional 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 quadrieps 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 quadrieps 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.
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 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) (ν = 0.05).

RESULTS
The Moderate OA group averaged 6555 (2481) steps/day, 8.0 (12.0) minutes/day of bouted-MVPA, and 23.4 (16.6) minutes/day of un-bouted-MVPA. Age had a significant negative correlation with un-bouted moderate (r=−0.28) and un-bouted 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.

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 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 ‘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: KL grade data suggests participants were at an increased health risk due to elevated values in mean resting heart rate (92.7 ± 20.3 beats/min), triglycerides (2.4 ± 1.5 mg/dL), BMI (30.4 ± 7.2 kg/m2) and waist circumference (97.7 ± 17.2 cm). At 12 wk post-intervention, there were no changes in mean BMI (30.7 ± 7.4; p = 0.39) or waist circumference (99.1 ± 17.1; p = 0.39); 19 participants either maintained (±2 kg) or decreased (>2 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/ m2), body mass (±1.9 kg) or other clinical variables (p > 0.05).
**C-31** Free Communication/Poster - Fat Metabolism

**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 (241±5ys) with average body composition (13.2±4%) and average aerobic fitness (55.0±3.3mL/min/kg) were recruited and tested in three different trials. The trials comprised of a balanced (45kcal/kg/FMF), caloric restricted (25 kcal/kg/FMF), and an overfed (65kcal/kg/FMF). 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/FMF at approximately 65% of the participant’s predetermined VO2 max. The next morning, participants returned to the lab having fasted for at least 12hrs and completed a mixed meal challenge (20kcal/kg/FMF comprised of 50%-39%/11% of Carbs/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 means±stdev; a 3x9 RM ANOVA was used with significance accepted at p<0.05. An LSD was used for post hoc analyses when appropriate. The iAUC (mg/dL x 3 h) was calculated for each blood lipid measuring 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/FMF TG-AUC was higher (14840.4±3612.2) compared to Std fed mice which is suggestive of diet-induced inflammation. MCP-1 was significantly higher in HF compared to Std (18.8 ± 3.8 vs. 10.5 ± 1.9 pg/mg, p < 0.05). 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.

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**C-31** 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 (241±5ys) with average body composition (13.2±4%) and average aerobic fitness (55.0±3.3mL/min/kg) were recruited and tested in three different trials. The trials comprised of a balanced (45kcal/kg/FMF), caloric restricted (25 kcal/kg/FMF), and an overfed (65kcal/kg/FMF). 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/FMF at approximately 65% of the participant’s predetermined VO2 max. The next morning, participants returned to the lab having fasted for at least 12hrs and completed a mixed meal challenge (20kcal/kg/FMF comprised of 50%-39%/11% of Carbs/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 means±stdev; a 3x9 RM ANOVA was used with significance accepted at p<0.05. An LSD was used for post hoc analyses when appropriate. The iAUC (mg/dL x 3 h) was calculated for each blood lipid measuring 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/FMF TG-AUC was higher (14840.4±3612.2) compared to Std fed mice which is suggestive of diet-induced inflammation. MCP-1 was significantly higher in HF compared to Std (18.8 ± 3.8 vs. 10.5 ± 1.9 pg/mg, p < 0.05). 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.

**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 to 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-1α, IL-1β, IL-2, IL-3, IL-4, IL-5, IL-6, IL-10, IL-12p70, IL-17, MCP-1, IFN-γ, TNF-α, MIP-1α, GMCSF, and RANTES) were analyzed using Multiplex ELISA. Neurophyopathy 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<0.05) whereas there was no increase in Std (baseline: 56.9 ± 0.05% vs. wk 8: 61.4 ± 0.07%, p<0.5). 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.
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±0.08 g/min and
5.31±1.43 mg/kg FFM/min and occurred at intensities equal to 21.8±6.5% Wmax,
33.6±6.5% VO2max, and 57.6±14% HRmax, respectively. Fat free mass, VO2max, RER
during stage 1 of exercise, and waist circumference accounted for 81.5% of MFO
(p<0.05). Bivariate correlation analyses showed that VO2max (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.

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 ≥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±0.08 g/min, 0.15±0.04 g/min, 0.14±0.06 g/min,
and 0.18±0.06 g/min in the YB, YG, OB, and OG groups, respectively. MFO relative
to body mass (BM) was 5.6±2.7 mg/kg/min, 4.8±1.7 mg/kg/min, 2.7±1.0 mg/kg/
min, and 3.3±1.1 mg/kg/min in the YB, YG, OB, and OG groups, respectively. MFO
relative to fat-free mass (FFM) was 7.2±3.6 mg/kg FFM/min, 6.7±2.2 mg/kg FFM/
min, 3.2±1.2 mg/kg FFM/min, and 4.9±1.6 mg/kg FFM/min in the YB, YG, OB, and
OG groups, respectively. Fatmax was 45±11%, 43±10%, 36±6%, and 38±5% of
VO2max 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
maturation effect approached significance for Fatmax. The less-mature groups had
higher Fatmax in children, but that there is likely a maturation influence.

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.
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 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 (HFFS; 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 kcal per day than the control AL mice (25 ± 1.0 and 21.2 ± 1.3 kcal/day; p<0.0001). 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 54% ±2.1% (±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).

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A high fat diet (HFD) is also known to induce mitochondrial dysfunction, which is thought to be linked to a 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 through improved oxidative phosphorylation and might rescue any negative effects 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 collected and immediately stored at -80°C until further analysis. Total glutathione (TGS) 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. In vivo mouse imaging (IVMIN) was performed using the BNRF1 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±14.0µM/mg tissue), GSSG (NFD=9.0±6.0 vs. HFD=15.0±6.0µM/mg tissue) and TGS (NFD=42.8±6.0 vs. HFD=44.6±14.0µM/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.
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 33.3 ± 6.4 yr, BMI 22.6 ± 3.3 kg/m2, V02max 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%, 71% FAT) were matched for age, competition events, and performance. Muscle biopsy 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. RESULTS: Fat-adapted athletes had an average of 20 months (range 9-36 mo) on a LCD. Of the 25,262 total genes sequenced, 1,333 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 (PPIA, a2, fold), an inhibitor of glycogen metabolism, and 3-hydroxy-3-methylglyoxal-CoA synthase 2 (HMGCS2, 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.
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 increased in myofilament 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.

- 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.

- This work was funded by Portuguese Science and Technology Foundation (PTDC/DES/115607/2009) and PhD Scholarship (SFRH/BD/79828/2011).

**METHODS:** Participants were 83 adults, 49 females (age: 23.7±3.5 yrs) and 34 males (n=24, age: 30.5±14.8; females: n=36, age: 26.3±14.8) participated in the study.

**RESULTS:** In males, regression analysis adjusted for body height and body mass revealed persistence of these sex differences in the bone-mineral density and BMD at the proximal femur, one of the most affected regions by osteoporotic related fractures. In females, associations of leg LST and FNAL seems to be mediated by vigorous physical activity; in females associations of leg LST and FNAL 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.

- Additional adjustment for vigorous physical activity revealed persistence of these sex differences in the bone-muscle relationship needed to be considered to develop specific strategies for improving bone strength.

**CONCLUSIONS:** 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.

**KEY WORDS:** TENDONS, EXERCISE, IMAGING, STRUCTURE, PHYSIOLOGY, PATELLA, STRAIN, STRESS

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**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**

Battogtokh Zagdsuren, Scott T. Lyons, Jill M. Maples, Donald L. Hoover. Western Kentucky University, Bowling Green, KY.

Email: toozgito@gmail.com

(No relationships reported)

**Board #103**

**June 2, 8:00 AM - 9:30 AM**

**Sex Differences In The Bone-muscle Relationship In Young Adults**

Vera Zymbal, Fátima Baptista. Faculty of Human Kinetics, Lisbon, Portugal.

Email: verazymbal@gmail.com

(No relationships reported)

**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.**

Edet E. Ukpoden-Dan. NHS - England; Milton Keynes, United Kingdom.

Email: ukpodenDan@yahoo.com

(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 +/- 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 $e$, (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% +/- 7.8% occurred in the males and the females had a transverse strain of -9.6% +/- 3.5%. There were no correlation changes in increased tendon echogenicity ($P < 0.05$), decrease in entropy ($P < 0.05$) in both groups.

**Conclusion:** This is a pilot study comparing the male and female acute strain response of the patellar tendon to quadriceps exercises 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

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**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**


(Sponsor: Ross E. Andersen, FACSM)

Email: jessica.insogna@mail.mcgill.ca

(No relationships reported)

**Introduction:** 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 ± 1.49, BMI = 26.5 ± 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 ± 3.53 and 11.66 ± 4.82 respectively, resulting in a bias score of 3.78 ± 2.33 kg (t(28) = 8.71, p ≤ .001). Average fat mass reported by the DXA and BODPOD® was 13.42 ± 3.59 and 10.15 ± 4.54 kg respectively, resulting in a bias score of 3.27 ± 1.92 kg (t(28)}
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 performance. In hockey players, a supported forward posture during seated recovery may reduce postural work of respiratory muscles and decrease RMF.

**CONCLUSION:** The EK posture was not more effective than the UP posture in optimizing performance or ventilation during recovery from the 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 ($V\text{,}_{\text{E}}$), tidal volume ($V\text{,}_{\text{T}}$), breathing frequency ($f\text{,}_{\text{b}}$), respiratory equivalent of carbon dioxide ($V\text{,}_{\text{E}}$/VCO$_2$), oxygen consumption ($VO\text{,}_2$), 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; $p<.05$). Although 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 $V\text{,}_{\text{E}}$/VCO$_2$ ($\eta^2=.22$), faster HR recovery ($\eta^2=.21$), lower $f\text{,}_{\text{b}}$ (−.16), and higher $V\text{,}_{\text{T}}$ ($\eta^2=.15$) throughout the recovery intervals. A negative correlation exists between RSA and RSA recovery time ($\eta^2=.34$) trends may suggest more efficient ventilation in the EK posture with lower $V\text{,}_{\text{E}}$/VCO$_2$ ($\eta^2=.22$), faster HR recovery ($\eta^2=.21$), lower $f\text{,}_{\text{b}}$ (−.16), and higher $V\text{,}_{\text{T}}$ ($\eta^2=.15$) 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.

**PHYSIOLOGICAL FI TNESS TESTS AND EARLY C AREER HOCKEY SUCCESS IN ELITE ICE HOCKEY PLAYERS**

Joshua Szyjsz2, Veronika C. Jamnik2, Norman Gedhil2, Jamie F. Burt3
1University of Guelph, Guelph, ON, Canada. 2York University, Toronto, ON, Canada. Email: jszyjsz@uoguelph.ca

**RESULTS**
- Total games = 73.31 ± 5.30 and 76.25 ± 5.74 kg respectively, resulting in a bias score of -2.93 ± 2.06 kg ($t$(28) = -2.66, $p<.01$).
- A negative correlation exists between RSA and RSA recovery time ($\eta^2=.34$). Trends may suggest more efficient ventilation in the EK posture with lower $V\text{,}_{\text{E}}$/VCO$_2$ ($\eta^2=.22$), faster HR recovery ($\eta^2=.21$), lower $f\text{,}_{\text{b}}$ (−.16), and higher $V\text{,}_{\text{T}}$ ($\eta^2=.15$) throughout the recovery intervals.

**CONCLUSIONS**
- 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.

**Board #104**
**EVALUATION OF COLLEGE ICE HOCKEY PRACTICES AND GAMES VIA HEART RATE MONITORING AND DIRECT OBSERVATION**

Ashley N. Triplett2, Amy C. Ebbing2, Emily A. Niemijyski1, Christopher P. Connolly2, Michael Vorkapich1, James M. Pivarnik, FACSM1. 1Michigan State University, East Lansing, MI. 2Washington State University, Pullman, WA. Email: triplet18@msu.edu

**RESULTS**
- 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 programing 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.

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- 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 programing 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.

**Board #105**
**APPLICATION OF PHYSIOLOGICAL FITNESS TESTS AND EARLY C AREER HOCKEY SUCCESS IN ELITE ICE HOCKEY PLAYERS**

Joshua Szyjsz2, Veronika C. Jamnik2, Norman Gedhil2, Jamie F. Burt3
1University of Guelph, Guelph, ON, Canada. 2York University, Toronto, ON, Canada. Email: jszyjsz@uoguelph.ca

**RESULTS**
- Only predictive variable for forward players was push up repetitions ($p=.01$, $\eta^2=.04$); total games = 73.31 ± 5.30 and 76.25 ± 5.74 kg respectively, resulting in a bias score of -2.93 ± 2.06 kg ($t$(28) = -2.66, $p<.01$).
- A negative correlation exists between RSA and RSA recovery time ($\eta^2=.34$). Trends may suggest more efficient ventilation in the EK posture with lower $V\text{,}_{\text{E}}$/VCO$_2$ ($\eta^2=.22$), faster HR recovery ($\eta^2=.21$), lower $f\text{,}_{\text{b}}$ (−.16), and higher $V\text{,}_{\text{T}}$ ($\eta^2=.15$) throughout the recovery intervals.

**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 programing 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.

**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 programing 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.
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 protocol to assess game intensity.

**RESULTS.** See Table 1. All values presented in seconds, *p < 0.001, 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 may be related to differences in skating stride and efficiency between men and women ice hockey players at the Division III level.

**Table 1. Correlations of NHL 2015 combine tests to novel on-ice testing protocol.**

<table>
<thead>
<tr>
<th>Test</th>
<th>On-Ice</th>
<th>Off-Ice</th>
<th>M Test</th>
<th>On-Ice</th>
<th>Off-Ice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro-Agility Left Start</td>
<td>.02</td>
<td>.152</td>
<td>.012</td>
<td>.061</td>
<td>.002</td>
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<tr>
<td>Pro-Agility Right Start</td>
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<td>.234</td>
<td>.522</td>
<td>.229</td>
<td>.175</td>
</tr>
<tr>
<td>Wingate (W/kg)</td>
<td>-.624</td>
<td>-.550</td>
<td>.012</td>
<td>-.472</td>
<td>-.554</td>
</tr>
<tr>
<td>DXA %Fat</td>
<td>.032</td>
<td>.234</td>
<td>.522</td>
<td>.229</td>
<td>.175</td>
</tr>
<tr>
<td>Jump Mat Impulse</td>
<td>-.601</td>
<td>-.426</td>
<td>.020</td>
<td>.504</td>
<td>.531</td>
</tr>
<tr>
<td>Jump Mat Flight Time</td>
<td>-.438</td>
<td>-.34</td>
<td>.037</td>
<td>-.316</td>
<td>-.445</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed).

**Results**

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). Participants performed the 20 and 40 yard sprints, the pro agility test, 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 2. All values presented in seconds.

**CONCLUSIONS:** Many sports require the use of a mouthguard (MG) and the constraint of carrying a hockey 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:** Thirty-eight 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 was a 20m multistage test that involves running intervals with pre-recorded beeps. FH-specific training was performed as prescribed by coaching staff, with testing performed at baseline (start of pre-season), 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⁻¹·min⁻¹ vs. MG-STK: 33.16 ±5.02 ml·kg⁻¹·min⁻¹; p>0.01). Further, it was found...
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 Monocytic Recruitment Following High-intensity And High-volume Resistance Exercise

Adam J. Wells1, Jay R. Hoffman, FACSM2, Adam R. Jajtner2, Alyssa V. Varanoske2, David D. Church2, Adam M. Gonzalez3, Beatrice A. Smith4, Karsten Krüger, Jörn Pons-Kühnemann, Christine Scheibelhut, Christian Pilat, Kerstin Muders, Vanessa Deuster, Torsten Frech, Frank-Christoph Mooren. 1Eastern Michigan University, Ypsilanti, MI. 2Adrian College, Adrian, MI. 3Adrian College, Adrian, MI. 4University of Hofstra, Hempstead, NY. 5Kennesaw State University, Kennesaw, GA. 6University of Central Florida, Orlando, FL. 7Ontario University, Cambridge, United Kingdom. 8Saginaw Valley State University, University Center, MI.

Email: smcgregor@emich.edu

(No relationships reported)

Purpose: Traditionally, laboratory measures have been used to assess fitness and physiological capacity in hockey players. It is not clear however, if these relevant 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 Adiron College Institutional Review Board. Subjects performed laboratory testing including Wingate (absolute and relative mean anaerobic power), WabMP, WrelMP, WrelPP, respective and fatigue index (WFI)), absolute, relative and time of VO2max (VO2maxAB, VO2maxREL, VO2tot, 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, HVariability, 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, WrelPP (r=0.76, 0.34, 0.52, 0.74, respectively; P<0.05). Stepwise regressions performed on game data showed MI predicted by WFI, VO2tot 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, VO2tot, MaxWFI 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.

176.0±4.9cm) performed each resistance exercise protocol in a randomized, counterbalanced order. Blood samples were taken at baseline, immediately (IP), 30-minutes (G1), 2-hours (G2), and 5-hours (G3) post-exercise. Plasma concentrations of myoglobin, lactate, monocyte chemoattractant protein 1 (MCP-1), tumor necrosis factor alpha (TNFa), 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+CD25+ 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, TNFa 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, 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.
Thurs., June 2, 8:00 AM - 9:30 AM  
**Board #118 Interaction Between Vascular Inflammation Markers and Exercise-induced Stress Hormones in Obese Males**  
Jin K. Park, Mima L. Fondong, Yunusk Koh. Baylor University, Waco, TX.  
Email: Jin_Park@baylor.edu  
(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/m²) 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 vascular and inflammation markers (r ≤ 0.5).

**Results:** sICAM-1, sVCAM-1, and E did not change, while sE-selectin at 1-hr PE (0.25 ± 0.7 ng/ml; significantly decreased) was shown (p < 0.05) from baseline (12.5 ± 4.2 ng/ml). COR at IPE (262.12 ± 31.09 ng/ml) was significantly higher (p < 0.001) than 1-hr PE (189.35 ± 31.11 ng/ml) during high-intensity exercise. In contrast, COR at IPE (187.52 ± 31.09 ng/ml; p < 0.009) and 1-hr PE (156.24 ± 31.11 ng/ml; p < 0.001) were significantly lower than baseline (259.75 ± 23.07 ng/ml) during low-intensity exercise. COR and sICAM-1 had a negative relationship at 1-hr PE during low-intensity exercise (r² = .34, p < .02), whereas COR and sVCAM-1 had a positive relationship at IPE during high-intensity exercise (r² = .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.

**Board #119 Salivary Biomarkers in Response to an Acute Bout of Exercise Before and After Training Program**  
Shlomit Radom-Aizik1, Fadia Haddad2, Martin Perlstein3, Ronen Bar-Yoseph1, Douglas A. Granger1, Dan M. Cooper1. 1Pediatric Exercise & Genomics Research Center (PERC), UC Irvine, Irvine, CA. 2Institute 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 (Salbs) and exercise during childhood.

**Purpose:** To evaluate the effect of acute intense bout of exercise and a training program on 3 Salbs known to be related to stress/inflammation: 1) salivary cortisol-mass marker of HPA axis activity; 2) salivary α-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). VO2 max 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 measures ANOVA.

**Results:** Cortisol levels increased in response to a brief bout of exercise (baseline 0.12±0.02; 40min post 0.24±0.04 µg/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 Salbs yielded novel information about exercise in children. Specific effects of an acute bout of exercise as well as training and gender differences
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% V̇O_{2peak} 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 hormones using enzyme immunoassays. RESULTS: The menstrual cycle did not significantly modify the levels of Saliva SIgA at rest (folicular: 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.

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. 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. 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 testosterone and immune markers. RESULTS: 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.

**Board #122**
**June 2, 8:00 AM - 9:30 AM**
**Cardiorespiratory Fitness And Physical Activity Are Not Associated With Plasma LECT2 Levels**
Kumpei Tanisawa, Hirokazu Taniguchi, Xiaomin Sun, Tomoko Ito, Ryoko Kawakami, Shizuo Sakamoto, Mitsuhiro Higuchi, FACSM. Waseda University, Tokorozawa, Japan. (Sponsor: Mitsuhiro Higuchi, FACSM)
Email: kumpei-tanisawa@fjw.waseda.jp (No relationships reported)

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. Eighty-four participants were randomly assigned to a low- or moderate-intensity aerobic exercise program. Two diaries were completed for 3 months, and self-reported PA (in minutes spent doing moderate and vigorous physical activity) and CRF were assessed using a five-element sit-and-reach test or a six-minute max walking test. RESULTS: Age-adjusted partial correlation analysis showed a significant negative correlation between VO_{max} and plasma LECT2 levels (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). MPVA 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 (β = 0.306, P = 0.004), whereas VO_{max} was not associated with plasma LECT2 levels (β = -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.
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.

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, a partial correlations analysis were performed. The level of significance adopted was p ≤ 0.05. RESULTS – The strength of both hands was 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 static 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.

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PURPOSE: To evaluate muscle strength (chest press and leg extension) via one-repetition maximums (1-RM). 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 ± 34 to 115 ± 33 ng/ml) and RT+protein (110 ± 40 to 119 ± 37 ng/ml) but adiponectin and CRP did not change. LM (+10.9g), FM (+0.5g), 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.

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significantly higher (p < 0.01) in PD subjects (1.90 N/kg ± 0.50) when compared to ET subjects (1.52 N/kg ± 0.41). The t-test showed a significant difference (p < 0.001) in DSPS scores between PD (0.180 ± 0.042) and ET (0.246 ± 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.

**Controlled Whole-body Vibration Training Reduces Risk Of Falls In People With Multiple Sclerosis**

Maria C. Sanchez, Edson F. Estrada, George A. King, FACSM, Fang Yang. University of Texas at El Paso, El Paso, TX. (Sponsor: George A. King, FACSM)

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(No relationships reported)

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 (CBVB) 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 CBVB training on reducing falls in people with MS.

**PURPOSE:** To examine if an 8-week CBVB training protocol can reduce risk of falls in people with MS.

**METHODS:** Twenty individuals (14 females) with MS (mean ± SD age: 52.0 ± 14.3 y, disease duration: 16.1 ± 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 if possible training-induced changes.

**RESULTS:** Participants' PDDS score reduced significantly from 3.68 ± 1.91 for the pre-training to 3.10 ± 2.03 for the post-training assessments (p < 0.05). MSFC z-score was also significantly increased following the vibration training (pre: 0.00 ± 0.59 vs. post: 0.32 ± 0.69; p < 0.01).

**CONCLUSION:** Our results indicated that an 8-week CBVB training course reduced the disability level in individuals with MS by improving their PDDS and MSFC scores. CBVB 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 #35-385 (to FY).

**Evaluation Of The Rehabilitation Effects On Balance With Virtual Reality Games For Patients With Stroke**

Hsinchieh Lee1, Ching-I Chang2, Chueh-Ho Lin1, Wen-Hsu Sung1. 1Taipei Medical University Shuang-Ho Hospital, Taipei, Taiwan. 2National Taiwan University Hospital, Taipei, Taiwan. (Sponsor: George A. King, FACSM)

Email: kyoko70385@gmail.com

(No relationships reported)

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 ± 9.65) with mild to moderate motor deficits (Brunnstrom stage: 4.35 ± 1.40) were recruited and randomly assigned to “VR plus rehabilitation” group (n = 54) and “VR” group (n = 54). The study design had 12 training sessions (90 minutes a time, 2 times a week), the performance of balance training was measured 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.

**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 CBVB 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 #35-385 (to FY).

**Risk Of Falls In People 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 (CBVB) 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 CBVB 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 ± SD age: 52.0 ± 14.3 y/o, disease duration: 16.1 ± 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 if possible training-induced changes.

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**CONCLUSION:** Our results indicated that an 8-week CBVB training course reduced the disability level in individuals with MS by improving their PDDS and MSFC scores. CBVB 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 #35-385 (to FY).
Pilates exercise 3 times a week over 8 weeks. Each session lasts 1 hour and includes 10 years since stroke: 13 ± 4.65 yr) participated in this study. They were randomly divided for balance.

PURPOSE:
Patients, perhaps due to the perceived complexity of the exercise. Recently, Pilates exercise that combines strength and flexibility training has been reported to improve gait performance in healthy older adults populations.

There is a need for further research to make these methods more accessible and less intimidating to individuals who may be considering starting an exercise program. The purpose of this study was to investigate whether the use of vestibular stimulation exercises would influence performance in adults with concussion syndrome.

PURPOSE: The aim of this pilot study was to investigate whether the use of vestibular stimulation exercises would influence performance in adults with concussion syndrome. The study was designed to compare performance in a group of subjects with concussion syndrome (PCS) with a group of healthy control subjects.

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 open, (ii) eyes closed, and (iii) blurred visual input, each while standing on a stable and an unstable surface. Cerebral activity in the frontal cortex was measured bihemispherically in 16 InNIRS 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 / orbitalfrontal 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 / orbitalfrontal 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.

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±8.71 vs 46.04±6.72, p<0.001), and had greater pleasure than control group (31.61±2.68 vs 28.87±4.63, p=0.010).

However, no significant difference was found between groups in Berg Balance Scale (46.04±6.72 vs 42.44±12.30, p=0.189), Functional Reach Test (24.10±6.53 vs 21.04±6.84, p=0.189), and Timed Up and Go (cognitive) Test (23.52±11.71 vs 32.22±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.

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 lower extremity joint angles during walking 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 strength of a longitudinal study. The inability of predicting a stroke makes these types of studies nearly impossible, especially on a large scale. Purpose: To compare level walking kinematics in 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 (4.01±1.2 deg), post-slow (8.34±1.9 deg), post-fast (-5.11±1.4 deg)] and knee flexion at foot strike became more flexed following the stroke [pre (0.22±0.7 deg), post-slow (-13.02±0.6 deg), post-fast (-16.71±1.28 deg)]. In addition, the peak ankle plantarflexion moments were reduced following the stroke [pre (-1.49±0.4 Nm/kg), post-slow (-1.02±0.06 Nm/kg), post-fast (-1.03±0.05 Nm/kg)]. The peak knee extension moment while walking fast. This data is consistent in showing that the subject had increased in the post-fast knee extension moment show greater reliance on the large increase in the post-fast knee extension moment show greater reliance on the muscular efforts to keep balance. Furthermore, the PCS group showed a significantly greater activation in frontopolar / orbitalfrontal areas of the right hemisphere as compared to the control group.

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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.

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.
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 down/up (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=413.9/ECHUDMAT=102±7.9; Ps<0.05) and ECMAT=40±38/ECHUDMAT=99±13; Ps<0.05) and all the conditions assessing the PRO system (EO=73±7; ECMAT=413.9; EC=8±9/ ECMAT=40±39; EOHUD=13±7/ECHUDMAT=102±7.9 and ECHUD=16±14/ ECHUDMAT=19±5; Ps<0.05 for all). Sway data (cm) reveal significant alteration in one of four associations for VE system (ECHUDMAT=12±6; Ps<0.001) and half for PRO (EOHUDDMAT=63±8/ECHUDMAT=11±6; Ps<0.05 and ECHUD=7±5/ ECHUDMAT=12±6; Ps<0.01) systems in the AP direction. Furthermore, ML (cm) results exhibited significant difference only for the PRO system in all the comparisons (EO=4±4/ECHUDMAT=11±6; EC=3±1/ECHUD=5±3/ECHUDMAT=15±5 and ECHUD=4±2/ECHUDMAT=15±5; Ps<0.01 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 challenged and in a lesser extent in the AP direction when the PRO and VE are altered.

Gait Pattern Evaluations of Children with Burns Compared to Age-Matched, Nonburned Pediatric Subjects

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(No relationships reported)

Muscle atrophy 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’ age matched 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.

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 (COPd) 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 A, BMI 20.4; 41 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. GRF changes were most pronounced during midstance. COP\textsubscript{ML} asymmetry, was present over 44% before training and 27% after, with a larger shift of the left COP\textsubscript{ML} over 87% of stance phase and an increase in mediolateral (ML) excursion. COP\textsubscript{ML} 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\textsubscript{ML} 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\textsubscript{ML} may suggest exploration of novel strategies for successful unassisted walking. Propensity toward midstance changes may also early prioritize of learning in single limb stance.

**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 ms 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 (p) to evaluate associations between the non-normally distributed outcome measures (r = 0.05). RESULTS: Greater inhibition (i.e. lower SICI) was associated with lower VA (p = .502, P = 0.008). A greater SICI: ICF ratio, indicating more inhibition relative to facilitation, was associated with lower VA (p = .530, P = 0.004). ICF was not associated with VA (p = .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.
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: 0.91-6.22). 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.

CONCLUSIONS: There does not appear to be a relationship between tight hip flexors and hamstrings injury. Females sustained hamstring injuries, a significant difference (χ² = 5.54, p = 0.016, 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 (χ² = 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.
METHODS

51 participants (23 women) were selected to undergo a pre-intervention test on 14 separate occasions. Participants were divided into two groups: those who would undergo a post-intervention test and those who would not. The post-intervention test was conducted on a subsequent day following the pre-intervention test. Participants were asked to perform a series of tasks, including squats, jumps, and dynamic balance maneuvers, before and after the intervention. The tasks were designed to assess the effects of the intervention on cortico-spinal excitability and inhibition.

RESULTS

Interpretability: Floor effects (>80% scoring 0) were seen in arm displacement in SA and SD, trunk displacement in FL, and reduced LE flexion on landing in hop tasks. Internal consistency: Cronbach’s alpha (α) was calculated for the overall post-intervention 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 α (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 α 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.

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 following a 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 recorded immediately post, 24h (Day 3), 48h (Day 4) and 2 weeks (Day 5) following heading. Results: Baseline CsP of Rectus Femoris was 117.8 ± 4.6 ms, which then increased by 4% to 123.1 ± 4.0 ms (p<0.05), immediately following ball heading and returned to baseline (119.9 ± 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.

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 (uniped) 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 (VUCM) & task-relevant (VORT) variance, and the normalized difference between them (IMA) are reported. Averaged kinematic data were compared at each time-point with paired t-tests. VUCM, VORT & IMA were compared across stance with paired t-tests. RESULTS: VUCM, VORT & IMA were compared across stance with paired t-tests. Results: VUCM, VORT & IMA did not differ (p = 0.17). IMA-UL & VUCM-IL did not differ (p = 0.02). There were no differences in ankle or knee intersegmental angles between IL & UL at any time-point of stance (0.057±0.09 ankle, 0.08±0.08 knee). CONCLUSION: Differences between IL & UL of a uAT subject was detected by UCM, but missed by typical kinematic measures. Greater exploitation of VUCM indicates adaptive preparation of vertical limb length across alternating 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.

C-36 Free Communication/Poster - Neuromuscular Control

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

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

Abbigail L. Fietzer1, Stanislaw Solnik2, Sarine Babikian3, Kornelia Kulig1. 1University of Southern California, Los Angeles, CA. 2Pennsylvania State University, University Park, PA.

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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±1.5 y, height = 1.81±0.1 m, body mass = 89.3±8.9 kg) had their one repetition maximum (1RM) back squat and bench press (153.7±27.9 kg and 117.9±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. Peak force was significantly higher 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.

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 an isokinetic dynamometer followed by an isometric trapezoid investigation. Participants performed 3 isometric maximal voluntary contractions of the leg extensors on an isokinetic dynamometer separated by 3min rest were performed with zero resistance and then 85 to 195 g∙kg

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 (MUFs) across the RT range (i.e., low- and high-threshold motor units). PURPOSE: To examine the effects of short-term unilateral ST on MUFs and antagonist co-activation (ANTCo-A) in the trained (TL) and untrained leg (UL). METHODS: Thirty healthy, males (TG; age = 22 ± 1.9 y) who had not performed ST within the past 6 months were randomly assigned to either a control (CON) or a strength training (ST) protocol. CON: Subjects were tested only. For both the TL and UL, sEMG of the vastus lateralis (VL) and biceps femoris were obtained during an MVC of the knee extensions before (pre) and after (post) ST. The sEMG signals for the VL were decomposed into their constituent motor unit action potential trains and MUF (pulses per second) and RT (%MVC) were calculated. Linear regression was applied to the pooled data to examine the relationship between MUF 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 ANTCo-A 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 = 0.974-0.275) or y-intercept (p = 0.974-0.328) of the linear regression for either leg. ANTCo-A 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 MUFs or ANtCo-A 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.

Abstracts were prepared by the authors and printed as submitted.
neuromuscular fatigue during repetitive electrical stimulation.

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 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 were not on any medications that could affect muscle performance during the experiment. Subjects were 18 to 24 years old at the time of testing. Subjects were excluded if they had a history of lower extremity surgery, or lower extremity injury for 12 months prior to the study.

In both groups, the dominant leg was defined as the leg that exhibited the greater vertical jump height. The dominant leg was determined by measuring each subject’s standing height and comparing the left and right standing leg heights. Left leg height was recorded as the leg that was shorter than the right leg height.

RESULTS: Jump performance was facilitated during 2L jumps rather than 1L jumps, indicating a 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 were not on any medications that could affect muscle performance during the experiment. Subjects were 18 to 24 years old at the time of testing. Subjects were excluded if they had a history of lower extremity surgery, or lower extremity injury for 12 months prior to the study. In both groups, the dominant leg was defined as the leg that exhibited the greater vertical jump height. The dominant leg was determined by measuring each subject’s standing height and comparing the left and right standing leg heights. Left leg height was recorded as the leg that was shorter than the right leg height.

RESULTS: Jump performance was facilitated during 2L jumps rather than 1L jumps, indicating a bilateral deficit during jumping in women.
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.

<table>
<thead>
<tr>
<th>Joint Angle (mean ± SD)</th>
<th>No Tape</th>
<th>25% Tension</th>
<th>50% Tension</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTDPM: Extension (°)</td>
<td>3.9 ± 1.9</td>
<td>3.4 ± 1.4</td>
<td>3.3 ± 1.7</td>
</tr>
<tr>
<td>TTDPM: Flexion (°)</td>
<td>4.7 ± 2.3</td>
<td>4.6 ± 2.0</td>
<td>4.1 ± 1.6</td>
</tr>
<tr>
<td>JPS: Extension (°)</td>
<td>3.6 ± 2.1</td>
<td>3.2 ± 1.9</td>
<td>3.6 ± 1.9</td>
</tr>
<tr>
<td>JPS: Flexion (°)</td>
<td>4.9 ± 5.0</td>
<td>4.4 ± 2.9</td>
<td>4.6 ± 3.9</td>
</tr>
</tbody>
</table>

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 yr) randomly underwent either condition (verbal: “kick, kick, harder, 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. RESULTS: Both conditions significantly increased MVIC (p < 0.05). For KJPS, the angle at which participants identified the direction of movement. 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.

While the barbell squat has been subjected to many biomechanical analyses, it is not known how the kinematics and muscle activation patterns will change as an individual learns 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 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.

| JPS: Flexion (°) | 4.9 ± 5.0 | 4.4 ± 2.9 | 4.6 ± 3.9 |

RESULTS: Muscle activations for verbal and control conditions were compared using a small economy penalty while standing. What prompts a rider's transition between seated and standing positions is unclear as is any implication for muscle mechanics during cycling. PURPOSE: Compare muscle activations for seated and standing cycling positions while 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 a subthreshold intensity with fixed speed (8 mph; 3.58 m/s) and grade (6%) 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 warm-up, 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 seated and standing conditions (p < 0.05). Mean EMG amplitudes (normalized to peak during seated cycling) for RF were 34.3 ± 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.
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.

Resistance training is especially important for populations at risk of sarcopenia and osteopenia such as older adults and 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. 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, 20 Hz, Delays) 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 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.

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 lower body positive pressure treadmill; selecting a preferred speed for each BW support condition (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 (ε = 0.05). When an interaction effect was observed, post hoc analysis was performed using a Fisher’s protected least significant difference multiple comparison test (α = 0.05). RESULTS: Muscle activity (BF, TA, and GA), RPE, PSF, and PS were not influenced by the direction of BW support (P>0.05). RF, BF, and TA were not different between BW support conditions (P>0.05). RF was influenced by the interaction of BW support and PSF (P<0.05). For example, RF during BR at 0% BW support condition was significantly higher than that of BR at 40% (P<0.005), 60% (P<0.005), and 80% (P<0.005) BW support conditions. RF, BF, TA, and GA were not different between directions (P>0.05) but were different between BW support conditions (P<0.05). PSF was influenced by the interaction of BW support and PS (P<0.05). For example, PSF during BR was higher than that of FR, FSF 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.

PURPOSE: We reported that the activity of the infraspinatus 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 infraspinatus and posterior deltoid muscle activities under various loads. The purpose of the present study was to examine changes the activities in the infraspinatus and posterior deltoid, as well as the ratio of the infraspinatus 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 infraspinatus (the upper portion; ISU), and the lower portion; ISU, 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 DP to ISU at 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) to 1 at 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<0.05). 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 infraspinatus 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 infraspinatus to the posterior deltoid, will provide therapist with useful information for design effective exercise programs.
CONCLUSIONS: Four weeks of multi-joint resistance training resulted in decreased EMG for the leg extensors, but not the flexors. The lack of a decrease in leg flexor EMG 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.
Ethan C. Hill, Terry J. Housh, FACSM, Cory M. Smith, Kristen C. Cochrane, Nathaniel D.M. Jenkins, Amelia A. Miramonti, Joel T. Cramer, FACSM, Richard J. Schmidt, Glen O. Johnson, FACSM. University of Nebraska - Lincoln, Lincoln, NE. (Sponsor: Dr. Terry Housh, FACSM)
Email: ethan.hill@unl.edu
(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 ± SD = 23 ± 2 years; resistance training = 15 ± 5 days per month) visited the lab on two occasions (separated by 48 hours) and performed two MVICs before (pretest) and after (posttest) randomly performing two protocols (4+4 on, 4+4 off vs. 4+4 on, alternating 6- and 2-s off) that consisted of 30 intermittent, submaximal (65% of MVIC), isometric muscle actions of the dominant forearm flexors on a calibrated isotonic dynamometer. 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 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
Glyn Howatson, FACSM1, Kevin Thomas1, Martin Barwood1, Karen Keane1, Javier Gonzalez2, Stuart Goodall1.
1University of Bath, Bath, United Kingdom. 2University of Bath, Newcastle-upon-Tyne, United Kingdom. (No relationships reported)

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 ± 7 years) 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 immediately post-elicitated 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.
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 -5.1%), while voluntary activation increased by 8% after the 60% condition. CONCLUSIONS: The results show similar levels of fatigue occur at both 20% 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 Myles J. Polsgrove, Tom E. Parry, Michael Rosengrant. Northeastern Illinois University, Chicago, IL. Email: mjpol@yahoo.com (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. Tenants 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 rpm, 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; 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 (F2, 34= 7.19, p=0.002) and trial (F2, 34= 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 were observed between conditions. Post hoc analysis with Bonferroni adjustment 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).

1518 Board #171 June 2, 8:00 AM - 9:30 AM Effects Of Visual Deprivation On Stability Among Young Adults During Treadmill Walking Fabricio Saucedo, JaeEun Kim, Jose Munoz, George King, FACSM, Feng Yang. University of Texas at El Paso, el paso, TX. (Sponsor: George A. King, FACSM) Email: fsaucedo3@miners.utep.edu (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) 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:

<table>
<thead>
<tr>
<th>Task</th>
<th>Single Task</th>
<th>Dual Task</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean velocity (cm/s) *</td>
<td>183.52</td>
<td>155.99</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean duration (s) *</td>
<td>2.33 (0.04)</td>
<td>2.63 (0.05)</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean Number of steps</td>
<td>3.94 (0.09)</td>
<td>3.97 (0.12)</td>
<td>0.093</td>
</tr>
<tr>
<td>SD velocity (cm/s)</td>
<td>19.88 (1.49)</td>
<td>20.26 (1.84)</td>
<td>0.912</td>
</tr>
<tr>
<td>SD duration (s) *</td>
<td>0.31 (0.02)</td>
<td>0.39 (0.02)</td>
<td>0.004</td>
</tr>
<tr>
<td>CV velocity %</td>
<td>10.75 (0.78)</td>
<td>12.76 (0.98)</td>
<td>0.08</td>
</tr>
<tr>
<td>CV duration %</td>
<td>13.29 (0.79)</td>
<td>14.76 (0.88)</td>
<td>0.227</td>
</tr>
</tbody>
</table>

SD - Standard deviation; CV – Coefficient of variation; P<0.05 significant

Many sports require athletes to compete under conditions that are different from what they are accustomed to. For example, athletes may have to adapt to a new or unfamiliar environment such as a high altitude or a different climate. This can affect their performance and make it more challenging to compete at their best. Additionally, athletes may have to adapt to changes in their training regimen or nutrition. These changes can also affect their performance and make it more difficult to compete at their best.

Conclusion: Athletes need to be prepared for a variety of conditions that they may encounter in competition. By training in different environments and adapting to changes in their training regimen, athletes can better prepare themselves for the challenges they may face in competition.
Day1 Post, Day3, Day7pre, and Day7post. Between Day7pre and Day7post, 16 individuals received paired associative stimulation (PAS) to increase the corticospinal 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 Day1 Post 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 (p=0.04), but not the perturbed event (p=0.67). There was a trend that the error decreased between Day1 Post 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 corticospinal excitability does not regulate motor learning in the retention stage. These findings assist in designing novel rehabilitation interventions for people with CNS dysfunction.

Supported by NIH Grant ROI-HD-062507

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 cortex is not known for young and old individuals. 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 stimulation 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 (Mmax) and plotted against the SO (%AMT) to generate an input-output curve and determine the following parameters: the estimated maximal MEP amplitude (MEPmax), the stimulus intensity required to elicit a response equal to half MEPmax (S50), and the peak slope of the sigmoidal curve.

Results: AMT was similar between the young and old adults (44.9 ± 9 vs 47.4 ± 4 %AMT, respectively) and between men and women (54.4 ± 9 vs 54.8 ± 12 %AMT, respectively). Mmax was less in young women (10.41 ± 1.72 mV) compared with young men (17.28 ± 2.8 mV, p<0.001). When the MEP amplitudes were expressed relative to Mmax, young women and men were similar for the MEPmax (35.3 ± 1 vs 34.8 ± 2.7 mV, p=0.001); S50 was lower in young women compared with young men (110.9 ± 5.9 vs 124.3 ± 5.5 %AMT). Mmax was less in old women compared with old men (6.5 ± 2.4 vs 10.9 ± 3.7 mV, p<0.001). However, when the MEP amplitudes were expressed relative to Mmax, young men and women were similar for the MEPmax (30.7 ± 17 vs 31.7 ± 11.7 mV, p=0.05), peak slope (0.091 ± 0.02 vs 0.084 ± 0.03, p=0.005) and the S50 (113.9 ± 12.3 vs 123.3 ± 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.

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 SLS, running (WALK), and SLS.

METHODS: Fifteen male and 15 female healthy runners volunteered. Participants completed 5 trials running and walking 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 tilt [IPL], contralateral drop [CPD], right rotation [RRP], 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), RRP (p=0.049) and LPR (p=0.014). SLS IPL was greater in males (6.1±2.9°) than females (3.8±3.9°).

In women, LPR was greater in WALK (5.8±4.9°) than RUN (0.5±3.5°) but in men SLS (7.1±3.8°) was greater than RUN (2.1±3.4°). RRP was greater during WALK in men (-10.1±3.8°) than men (-4.8±3.3°); in women, WALK was greater than SLS (-5.0±5.1°). APT was greater in SLS (25.4±10.1°) than RUN (-12.3±2.9°; p=0.001) for both men and women. SLS APT was less than 5.5°. CPD was greater in females (-5.6±0.6°) than males (-3.8±0.6°; p=0.038).

CONCLUSIONS: Differences in trunk/pelvis kinematics are task but not necessarily sex dependent. Comparison of studies with different tasks is cautioned.
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·m²), 10 overweight (Ov: 19.7 ± 6.1 kg·m²) and 11 obese (O: 18.7 ± 2.4 kg·m²); VT (E: 20.9 ± 6.0%, Ov: 17.8 ± 5.5%, O: 16.8 ± 2.7%); HRVTRMSSD: 137 ± 15; HRVTSD1: 134 ± 36; HRVTRMSSD: 101 ± 22; VT: 90 ± 16; HRVTRMSSD: 105 ± 16; HRVTSD1: 138 ± 6; HRVTSD1: 157 ± 17; VT: 140 ± 17%; O: HRVTSD1: 134 ± 14; HRVTSD1: 142 ± 13; VT: 133 ± 15; O: HRVTSD1: 137 ± 15; HRVTSD1: 150 ± 12; VT: 139 ± 33) in eutrophic. There were no significant differences between methods (No relationships reported).

Zumba fitness (Zumba) is a Latin-inspired dance-fitness program that blends Latin music and repetitive step/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 all ages 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 maximum heart rate, 3 days/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⁻¹), blood glucose (mg·dl⁻¹), blood lipids (mg·dl⁻¹), minimal oxygen consumption (VO₂max, ml·kg⁻¹·min⁻¹), 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 (12.3±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). VO₂max increased significantly in AT (30.1±5.1 to 33.3±5.6 ml·kg⁻¹·min⁻¹, p<.05). Systolic blood pressure (p=.013) and diastolic blood pressure (p=.032) decreased significantly in both groups. All subjects showed improvements 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.
measures were performed according to standardized methods. Body composition was measured with bioelectrical impedance analysis (Inbody®720) and VO2max was measured on a treadmill with a modified Balke protocol with MetaMax®8, analyzer (CORTEX Biophysik GmbH, Leipzig, Germany) at baseline and after eight weeks and six months. ANOVA (repeated measures) was used to analyze differences between measurements.

RESULTS: A significant reduction (mean [95% CI]) in bodyweight: -6.8 kg [-7.8, -5.8], BMI: -2.4 kg/m² [-2.7, -2.2] and fat mass: -5.7 kg [-6.4, -5.0] (p<0.001) were found after eight weeks. VO2max increased significantly with 3.9 ml·kg⁻¹·min⁻¹ [4.4, 7.4] and 0.5 L·min⁻¹ [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⁻² [-1.1, -0.2] (p<0.05) and fat mass: -1.9 kg [-3.4, -0.5] (p<0.01) respectively were found. VO2max (ml·kg⁻¹·min⁻¹) increased significantly (p<0.05), but no change was found in L·min⁻¹. 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)
Email: sa12d@my.fsu.edu

(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; aSBP, and AIx@75; aortic systolic blood pressure, aSBP) provide 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 may be the best approach to describing its beneficial effects among obese individuals.

### RESULTS:
- **VO2peak (L/min):**
  - Pre: 1.78 ± 0.39
  - Post: 1.88 ± 0.40
  - % change: 6.3%
- **VO2peak (ml/kg/min):**
  - Pre: 19.0 ± 3.5
  - Post: 20.9 ± 3.4
  - % change: 7.9%
- **AIx@75:**
  - Pre: 18.6 ± 3.8
  - Post: 21.2 ± 4.3
  - % change: 14.6%
- **METS:**
  - Pre: 5.3 ± 1.1
  - Post: 5.6 ± 1.2
  - % change: 8.3%

CONCLUSIONS: Adding CR during AEX improves CRF more than AEX alone and does not compromise other functional adaptations to AEX in obese, older adults.

1530 Board #183 June 2, 9:00 AM - 10:30 AM
Supramaximal Exercise Training Enhances several Health-Related Outcomes in Obese Adults
Email: georgesjabbour1980@hotmail.com

(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) group (n=12; body mass index (BMI)=33.1 kg/m²) and SET group (n=12; BMI=(33.2 kg/m²). 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. Metaabolic, 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±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).

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.

### Abstracts were prepared by the authors and printed as submitted.
The Borg Scale of ratings of perceived exertion (RPE) is widely used to determine subjective exercise difficulty. However, RPE does not indicate emotional state 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 exercise, and 30 minutes after exercise of 3 different intensities. 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.

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. 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] and lowest after REST [1.9 (4.0) μg/dL]. The 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.

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.

Methods: 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 [BF%]), 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 BF% were two components of physical fitness that were correlated with the cognitive function. BF% was correlated with the CASI score (r=−.557, P<0.01) and the LOW VS 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 BF% 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.
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: Twenty-one 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 alarms 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.

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
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 (PIO2=0.12). The participants cycled an ergometer at 30% peak VO2 for 5 min as a warm-up exercise, and then cycled at 50% peak VO2 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 the 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 relative cerebral blood flow, and relative brain power using 3D body imaging (Fit3D) in a sample of college-aged women (N=17), to examine changes in body shape and fat percentage. To examine the acute affective and motivational responses to 3D body imaging (Fit3D) in a sample of college-aged women (N=17), classified as either normal weight (NW; n=10) or overweight/obese (OWOB; n=7). Statistical analysis by ANOVA indicated 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.

PROSPECTIVE MEMORY: 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=17), 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) remember the researcher to send an email to their supervisor to submit a research participation credit 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 rate (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 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 (p=0.295, p=0.23). 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.

The Effect of Anaerobic Exercise on Working Memory

Ashley Connors, John Wygand, FACSM, Robert M. Otto, FACSM, John Petrizzo. Adelphi University, Garden City, NY.

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=0.05) 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.

Affective and Motivational Responses to 3D Body Imaging

Alyssa Abreu, Rachel Nanez, Mark D. Faries, Eric J. Jones. Stephen F. Austin State University, Nacogdoches, TX.

PURPOSE: To examine the acute affective and motivational responses to 3D body imaging (Fit3D) in a sample of college-aged women (N = 12), 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 7.69 ± 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 to 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.
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 effects 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 lower to moderate feelings of guilt (3.18 ± .98), shame (2.67 ± .05), authentic pride (2.68 ± .96), and hubristic pride (2.49 ± .87). Significant differences (p < .05) were found between participants classified as NW or OWOB, respectively, in shame (2.11 ± .76 vs. 3.05 ± 1.07), guilt (2.82 ± .85 vs. 3.43 ± .102), and authentic pride (3.10 ± .78 vs. 2.19 ± .98). Increasing physical activity and self-regulation, eating healthier, and positively reframing the situation were the highest rated coping responses (M = 2.63 ± .25). Differences were found between BMI groups for intention to cope by suppressing appetite (NW = 2.68 ± 1.05, OWOB = 3.56 ± 1.02; t = 2.24, p < .05), supplement use (NW = 1.14 ± .22, OWOB = 1.85 ± 1.28; t = 2.30, p < .05), and a trend for camouflage body (NW = 2.70 ± .51, OWOB = 3.14 ± .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 = .42, p = .01), and suppression of eating (r = .31, p = .07), and supplement use (-.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.

Acute moderate-intensity dynamic exercise (MI) can improve cognitive function (especially executive function (EF)). It is not evident, however, whether acute exercise training programs differencing 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 (10MI), 20 min of MI (20MI), and 40 min of MI (40MI) protocols in a randomized and counterbalanced order. The MI protocol was 60% VO2peak. 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 20MI and 40MI were significantly improved as compared with those before exercise (P < 0.05), while not in 10MI (the EF at 10 min point of post-10MI 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 40MI than 20MI. The mental fatigue immediately after 40MI was significantly decreased as compared with that of 10MI and 20MI (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.

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 was 4-wk period up to 60 min at 30 min/m and a 10.5% grade. The weekly exercise consisted of 2 days of post 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 period. During the last week of exercise, rats were assessed after 60 min after 15% case or high (50% case) 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 < 0.05, 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 vs Sed15: Δ = -0.49 ± 0.20, Ex15 vs Sed50: Δ = -1.17, Ex15 vs Ex50: Δ = -1.14). This finding was supported by means for the 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; Sed 50: M = 43.16 sec; Ex15: M = 55.51 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.

While affective responses to aerobic exercise are fairly well documented, recently have affective responses to high-intensity interval exercise been examined. PURPOSE: To evaluate affective responses before, during, and following 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 ± SD completed randomly ordered 15-min conditions: walking (W; avg RPE = 4.8), 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 (PO), 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 PO with Condition X Time interactions (all P < 0.001) for all measures, reflecting higher affect and HICR and W relative to R. Affective valence (i.e., FS) progressively decreased during HICR: by PO it was less positive than Pre (MpostSE = -0.49 ± 0.20, P = 0.014), then rebounded to P20 to be greater than Pre (0.06 ± 0.13, P < 0.001) and P0 (1.15 ± 0.13, P < 0.001). FS also decreased during D, with P0 FS being less positive than Pre (-0.66 ± 0.11, P < 0.001) and PO (0.27 ± 0.09, P = 0.003). During W FS increased from Pre to P0 (0.55 ± 0.13, P < 0.001), P20. Enjoyment was greater following HICR (92.31 ± 19.55) than both W (88.21 ± 17.61; P = 0.025; d = 0.22) and R conditions (53.03 ± 18.47; P < 0.001; d = 2.07). R resulted in
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 on continuous 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⁻¹; mean value± standard error for variables of interest were: total physical activity: 2,285±231 kcal·wk⁻¹; SPPB 9.4±2.1 out of 12; ACER: 90.3±5.2 (<88=suggestive of dementia onset), 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-6:3 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-6:3 ratio on cognitive function in older adults.

PAST research has identified relationships between daily total water intake (WTO) measured by diet diary and the health benefits of 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 studies of 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 (WTO) 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 (positive 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 vigorous sub-scale of was significantly associated with WTO, (F(3,194)=5.00, R²change=0.05, Beta=0.23, P<0.03). This finding was not apparent in relationships with 24h urine osmolality (F(3,194)=2.58, R²change=0.03, Beta=0.16, P<0.11) or single sample urine osmolality (F(3,194)=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: 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.

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 on continuous 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⁻¹; SPPB 9.4±2.1 out of 12; ACER: 90.3±5.2 (<88=suggestive of dementia onset), 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-6:3 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-6:3 ratio on cognitive function in older adults.
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 deprivally 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
Amanda K. Rounds, Susan E. Lydick, Alison M. Lichy, Jared M. Gollie, Gino S. Panza, Peter Y. Jo, Andrew A. Guccione. George Mason University, Fairfax, VA. (Sponsor: Randall Keyser, FACSM)
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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 (SCI). 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 ability and physical performance. One expectation for rehabilitation is that individuals would continue LT because they could do even 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: 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.

1551 Board #204
June 2, 9:00 AM - 10:30 AM
Cancer Survivors Report Positive Affect during High-Intensity Group Based Exercise
Cheyenne R. Becker, Katie M. Heinrich, Phd., Katelyn E. Gilmore, Tarun B. Carlisle, Kansas State University, Manhattan, KS. (Sponsor: Craig A. Harms Ph.D FACSM, FACSM)

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 ¾, 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±2.1% - 9.9% 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(5,5)=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
Peter J. Ehmann, Ryan L. Olson, Christopher J. Brush, Nicholas J. Maroldi, Brandon L. Alderman. Rutgers, The State University of New Jersey, New Brunswick, NJ.
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(Cardiorespiratory fitness and cardiac autonomic responses are sex-specific 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 (VO2 peak) on a cycle ergometer. 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.

Abstracts were prepared by the authors and printed as submitted.
Additional lifestyle, emotional and psychosocial risk factors of stress should be considered for impacting stress perceptions. Although our analysis revealed no influence of physical activity of varying intensities (sedentary, light, moderate, vigorous) on women's stress perception 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/m²). Time spent 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.

RESULTS: Linear mixed model regression analyses revealed no significant effect of time, menopause 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 worth of exploration. Additional lifestyle, emotional and psychosocial risk factors of stress should be examined.

**Effects of Carbohydrate and Protein Supplementation on Mood, Affect and Discomfort Perception during Endurance Exercise**

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(NO relationships reported)

**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 %) participated in the study with a double-blind counterbalance crossover design. Three types of nutritional treatments were applied for comparing the difference among treatments and time point.

1) An energy-matched amount of CHO in the present study.
2) CHO-electrolyte solution (26mg•L Na+, 8mg•L K+) with 24g whey protein isolate;
3) CHO+CHO solution.

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.

**Conclusions:**

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. INT 11.69±4.3 vs. 13.92±3.7, p < 0.04). There was also a trend toward greater improvement in INT vs. CON on DF1 + DF2 + DF3 (CON 11.29±2.6 vs. 11.57±2.6; INT 12.23±3.4 vs. 14.33±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 (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.

**Effects of Aerobic Exercise Modality on Cognitive Outcomes among Breast Cancer Survivors**

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(NO relationships reported)
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.

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.

Source of Funding and Conflicts of Interest: This work was made possible by funding provided by the National Institute of Neurological Disorders and Stroke (R01 NS075565; to A.P.H.) and the National Science Foundation (GRFP; to A.B.).

PURPOSE: To compare an affect-based exercise prescription (Feeling Scale) to 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 ‘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: The RPE group reported 0 minutes of exercise and 2 members dropped out. In the FS group, all members of the FS group reported completing some exercise while 1 member of the RPE group reported no exercise and 1 member dropped out. At baseline, the FS group showed a higher mean VO2max (14.4 ± 1.8 vs. 13.4 ± 1.7, p < 0.05) compared to the RPE group. 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.

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 (FEV1) 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) –70W (±26.95) achieved on the screening visit. During rest and cycling conditions, participants breathed either DE (PM2.5 = 300µg/m3) 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) vs. 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 increasing levels of diesel exhaust.

RESULTS: There were no significant differences in cognitive function tests at baseline, 20-min, and 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 increasing levels of diesel exhaust.

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 control 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, aged 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: $\text{R} = 3.54\, \mu\text{V} \pm 1.53$ vs $\text{E} = 2.57\, \mu\text{V} \pm 1.55$, p < 0.001; AMP INC: $\text{R} = 5.36\, \mu\text{V} \pm 1.83$ vs $\text{E} = 2.93\, \mu\text{V} \pm 1.93$, p < 0.05; RT CON: R 38.31 ms ± 44.69 vs E 36.22 ms ± 42.07, p < 0.001; and RT INC: R 460.87 ms ± 49.14 vs E 419.47 ms ± 47.58, p < 0.05. 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 µV ± 0.32 vs EX -2.75 µV ± 0.27 p < .001, concurrent with significantly reduced RT: R 425.18 ms ± 8.39 vs EX 391.02 ms ± 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.

C-39 Free Communication/Poster - Physical Activity Interventions in Adults - Part I

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 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 FLTC 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 FLTC, 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.

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Boston, Massachusetts
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 the faculty. PURPOSE: To determine if participation in a year-long 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 required the inclusion of 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 dietician. 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%. SBP, F(3, 45) = 2.703, p = .043 and MAP was significantly lower at 60% than at 100% (Mean difference = 7.08, p = .004). RPP, F(3, 45) = 46.277, p = .005, partial n2 = .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.

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 yr (53.5±14.34). Over a 3-mo intervention, J2W emphasized participation, offered nutrition counseling, community (social/emotional) events, and health coaching. Health coaches were trained using an 18-week educational program. Coaching participation averaged 4.2±2.5 sessions with 0-22 range and was analyzed at three levels (0; 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 > 25% 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.

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

Abstracts were prepared by the authors and printed as submitted.
An acute bout of moderate to vigorous exercise temporarily reduces pain sensitivity in healthy adults, a phenomenon termed exercise-induced hypalgesia (EH). Recently, active gaming (AG), which allows an individual to be physically active during video game play, has been shown to have potential in improving pain sensitivity and compliance. 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 enhances pain tolerance and compliance, compared to passive control.

**METHODS:** Thirteen 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 performance. Prior to each session, participants played four different active games on separate days, including two different boxing games (Boxing1 and Boxing2). On day one, 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, mI/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.
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:** CBVF 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. CBVF was positively correlated 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 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 90th 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**

Dianna Thor, Govindasamy Balasekaran, FACSM, Masato Kawabata, Jason McLaren, Anthony Bert, Jia Bin Fang, Phillis Teng, Nanyang Technological University, Singapore, Singapore.  
Email: dianna.thor@nie.edu.sg

(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 ± 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 (VO2max), 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 ± 23.8 minutes) to post-ECP (34.7 ± 20.6 minutes). Percentage of maximal oxygen consumption at Vpt also increased significantly (p = 0.014) from pre-ECP (70.9 ± 8.4%) to post-ECP (75.6 ± 7.4%). ECP may have induced central training effects, which is supported by the significant increase in time taken to Vpt (p=0.003, 77.0% ± 8.5%) and lactate threshold (56.1% ± 8.5%) post-ECP. A more recently described indicator of central cardiovascular fitness is VO2max. VO2max increased (p<0.05) to post-ECP (75.6 ± 7.4%) compared to pre-ECP (70.9 ± 8.4%).

**CONCLUSIONS:** Results indicated that 30 sessions of ECP increased the time taken to reach Vpt and VO2max 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 VO2max 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**

**Board #227**  
June 2, 9:00 AM - 10:30 AM  
**Pitching Speed and Related Physical Conditioning: A Pilot Prediction Study**

Zhigang Yang1, Weimo Zhu, FACSM. 1Fudan University, Shanghai, China. 2UIUC, Champaign, IL.  
Email: yangzhigang@fudan.edu.cn

(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±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:** Descriptive statistics of PS and the selected variables, as well as their correlations, are summarized below (See the table). M = Means, Num = Number, *p < 0.05. 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.

**Conclusions:** Pitchers’ pitch speed was moderately related to their baseball throw away and somewhat correlated with 30 seconds lung lift and 10 seconds pull elastic band. Therefore, to improve pitching speed, the focus of the training should be improving pitchers’ arm strength, lower body power, and upper body fast strength.

<table>
<thead>
<tr>
<th>ID</th>
<th>Variables</th>
<th>No-SD</th>
<th>SD</th>
<th>Construct</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS</td>
<td>Pitching speed (km/h)</td>
<td>152.3±11.0</td>
<td>5.77</td>
<td>speed</td>
<td></td>
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<tr>
<td>1</td>
<td>30-M sprint (s)</td>
<td>1.77±0.3</td>
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<td>Quickness</td>
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<td>different directions sprint (s)</td>
<td>11.23±0.68</td>
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<td>Quickness</td>
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<td>2</td>
<td>Reaction time (s)</td>
<td>2.08±0.3</td>
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<td>Reaction speed</td>
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<td>3</td>
<td>Baseball throw away (s)</td>
<td>2.08±0.3</td>
<td>0.67</td>
<td>Arm strength</td>
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<td>4</td>
<td>Standing long jump (m)</td>
<td>2.67±0.3</td>
<td>0.67</td>
<td>Lower power</td>
<td>1.14</td>
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<tr>
<td>5</td>
<td>Standing triple jump (m)</td>
<td>8.38±0.3</td>
<td>0.67</td>
<td>Lower power</td>
<td>1.71</td>
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<td>6</td>
<td>10 seconds lung lift (s)</td>
<td>40.27±0.3</td>
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<td>Body fast strength</td>
<td>0.59</td>
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<td>7</td>
<td>Medicine ball side throw (m)</td>
<td>14.99±0.32</td>
<td>0.67</td>
<td>Core power</td>
<td>1.04</td>
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<td>9</td>
<td>10 seconds twist crunches (num)</td>
<td>31.54±0.36</td>
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<td>Core strength</td>
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<td>10</td>
<td>10 seconds pull elastic band (num)</td>
<td>33.74±0.38</td>
<td>0.67</td>
<td>Upper fast strength</td>
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<td>15 1/2 seconds plank (s)</td>
<td>4.26±0.3</td>
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<td>Core stability</td>
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<td>12</td>
<td>10 seconds double jump roge (num)</td>
<td>15.37±0.34</td>
<td>0.67</td>
<td>Coordination</td>
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<td>13</td>
<td>knee side standing (s)</td>
<td>25.01±0.3</td>
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<td>Squatting (s)</td>
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<td>Vertical split (cm)</td>
<td>14.43±0.3</td>
<td>0.67</td>
<td>Core flexibility</td>
<td>0.58</td>
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</table>

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 (WBLLT) or the Balance Error Scoring System (BESS).

**Purpose:** To examine the correlation between Y-Balance Ant, WBLLT, and BESS limb asymmetries. Methods: Sixty-eight physically active adults (male=16; age=20.35±2.02ys; 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 WBLLT 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, WBLLT, 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 WBLLT, BESS-Firm, and BESS-Foam asymmetry. Alpha-level was set a-priori at p<0.05.

**Results:** There was a significant, weak correlation between ANT asymmetry (3.11±3.47%) and WBLLT asymmetry (1.81±1.22cm, r=0.26, r=0.27, p=0.04). There were no significant correlations between ANT asymmetry and BESS-Firm (1.68±1.60, r=0.122, p=0.32) or BESS-Foam (1.47±1.31, r=-0.09, p=0.12) asymmetries. Conclusions: Y-Balance ANT asymmetry was weakly correlated with WBLLT and BESS asymmetries. These findings indicate that WBLLT 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 WBLLT and BESS asymmetries and how these measures may work in concert to predict injury risk.

Abstracts were prepared by the authors and printed as submitted.
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 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 straightforward, in large groups/classroom settings there can be potential sources of measurement error leading to miscounts 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.

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 is often assumed for easy assessment, however, muscles may not be homogeneous.

PURPOSE: To determine if the EI quantified via US panoramic transverse scans possible heterogeneity of the muscle.

METHODS: Purposes continued to use still-images to quantify EI without regard to the size or is often assumed for easy assessment, however, muscles may not be homogeneous. 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 is often assumed for easy assessment, however, muscles may not be homogeneous.

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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.
Comparison of Threshold Determinations between Blood Lactate Samples and Near Infrared Spectroscopy

Karlee S. Edwards¹, Randolp Hutchison², Gibson A.E. Klapthor³, Kristine E. Knowles⁴, Gregory M. Mock², Ardalan Vahidi⁵, Kelly A. Humes⁶, M. S. Murr⁷. ¹Furman University, Greenville, SC, ²Clemson University, Clemson, SC (Sponsor: Anthony Caterisano, FACSM) Email: randolph.hutchison@furman.edu

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 (21.20±2.08 years, 72.81±8.31 kg, 175.44±6.13 cm) completed a maximal step-wise test to volitional exhaustion. Before each test, the subject was braced with the recommended knee angles as measured by a goniometer. A standardized warm-up of 5 min at 40 W preceded each individual’s step-wise test. The step-wise test began at 60 W and increased 20 W 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 R² 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 R² of 0.909. The standard error of estimate is 17.34 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.

Development And Validation Of A Pacer Prediction Equation For VO2peak In 10-15 Year Old Youth

Dawn P. Coe, FACSM¹, Stacy N. Scott¹, Cary M. Springer¹, Jennifer I. Flynn², Michael S. McLanahan², Brittany D. Wiseman¹. ¹University of Tennessee, Knoxville, TN ²University of South Carolina, Columbia, SC. Email: dcce@utk.edu

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 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 PACER equations. 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 the PACER. PURPOSE: To develop and validate a prediction equation to estimate VO2peak from the PACER in 10-15 year-old youth.

**Results:** The relationship between physical maturity and aerobic trainability is not completely understood. In addition, the predictors of aerobic capacity (VO2peak) in youth 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 (VO2max), stroke volume (SVmax), heart rate (HRmax), arteriovenous oxygen difference (a-vO2diffmax). 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 VO2peak median split. Variables were compared between groups and differences in VO2peak between high and low fit groups were compared across Tanner stage. Finally, multivariate regression was used to determine the independent predictors of difference in VO2peak between high and low fit groups, using differences in SVmax and a-vO2diffmax as covariates.

**Results:** No significant differences were identified between Tanner 3, 4, and 5 with respect to VO2peak (2.97 v 3.21 v 3.54 L/min, p=0.18), HRmax (200.0 v 193.0 v 194.5 bpm, p=0.294), or a-vO2diffmax (17.9 v 17.7 v 17.4 mL/dL, p=0.894), while differences across Tanner stage were noted in SVmax (88.1 v 98.8 v 108.8 mL, p=0.006). Compared to low fit, high fit participants had significantly higher a-vO2diffmax (19.9 v 15.7 mL/dL, p<0.001) but no significant differences in SVmax (104.3 v 97.9 mL, p=0.078) or HRmax (196 v 190 bpm, p=0.33). Differences in VO2peak between high and low fit participants did not differ across Tanner stage (r=1.34 v 0.75 v 0.53 L/min, p=0.143). After inclusion in the multivariable model, VO2peak was independently associated with both a-vO2diffmax (r=0.001) and SVmax (r=0.001). The relative importance in the model was higher for a-vO2diffmax than SVmax (r=0.68 v 0.32, respectively).

**Conclusion:** SVmax but not a-vO2diffmax increases with physical maturity. In adolescent female athletes, differences in aerobic fitness are more strongly associated with maximal a-vO2diffmax than VO2peak.
**PURPOSE:** To examine correlations between several markers of cardiovascular (CV) and muscular function among police officers. METHODS: Sixty-five local police officers were recruited (8 female, average age 35.6 ± 9.0 yrs, height 175.8 ± 7.2 cm, body mass index 27.7 ± 3.6 kg/m²). Each officer performed two test sessions: a CV fitness assessment (the time to complete a 1.5 mile run) and a muscular fitness assessment (handgrip strength and pushups). RESULTS: Significant correlations were found between CV fitness assessments and health markers such as waist-hip ratio (r = 0.42), systolic blood pressure (r = 0.38), and lipid markers such as total cholesterol (TC; r = 0.34). Conclusions: Our results provide, for the first time, sex- and age-specific CV fitness 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 CV fitness in the assessment of health and fitness variables in Colombian schoolchildren.

**Funding** COLCIENCIAS (Contract No. 725-2014 Code 12225743978).

**REFERENCES**


**Supplement**

**MEDICINE & SCIENCE IN SPORTS & EXERCISE®

**June 2, 9:00 AM - 10:30 AM**

**Board #238**

**June 2, 9:00 AM - 10:30 AM**

**Board #240**

**June 2, 9:00 AM - 10:30 AM**

**Board #239**

**June 2, 9:00 AM - 10:30 AM**

**Normative Reference Values For Handgrip Strength In Colombian Schoolchildren: The Fuprecol Study**

**Police Officers**

Steven E. Martin, Kelsey McLaughlin, Bethany Noack, Jorge Granados, Dustin Joubert, John Green, FACSM, Stephen F. Crouse, FACSM, Texas A&M University, College Station, TX. (Sponsor: Steve Crouse, FACSM)

Email: semartin@tamu.edu

(No relationships reported)

PURPOSE: To examine correlations between several markers of cardiovascular (CV) and muscular function among police officers. METHODS: Sixty-five local police officers were recruited (8 female, average age 35.6 ± 9.0 yrs, height 175.8 ± 7.2 cm, body mass index 27.7 ± 3.6 kg/m²). Each officer performed two test sessions: a CV fitness assessment (the time to complete a 1.5 mile run) and a muscular fitness assessment (handgrip strength and pushups). RESULTS: Significant correlations were found between CV fitness assessments and health markers such as waist-hip ratio (r = 0.42), systolic blood pressure (r = 0.38), and lipid markers such as total cholesterol (TC; r = 0.34). Conclusions: Our results provide, for the first time, sex- and age-specific CV fitness 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 CV fitness in the assessment of health and fitness variables in Colombian schoolchildren.

**Funding** COLCIENCIAS (Contract No. 725-2014 Code 12225743978).

**REFERENCES**


TRIMPc score (R^2 = 0.00 P = 0.92). However, TRIMPi score correlated with increased VO2max (R = 0.14, P = 0.05). Moreover, there was a significantly greater percent increase in relative VO2max in individuals whose TRIMPi scores were in the top third of the group compared to those in the bottom third (24.70%±9.10 vs 15.11%±7.33, P = 0.0188). CONCLUSIONS: Our data suggests that interval TRIMP scores predict changes in relative VO2max in middle-aged, sedentary individuals undergoing exercise training. In conclusion, interval training may provide a greater stimulus for aerobic adaptation than continuous endurance training.

1588 Board #241
June 2, 9:00 AM - 10:30 AM
Accuracy of Polar Heart Rate Monitors to Predict VO2max
Cassandra Philips, Zachary Ziemba, Bryan Smith. Southern Illinois University Edwardsville, Edwardsville, IL.
Email: cphilip@siue.edu

Currently, there are affordable heart rate monitors on the market that estimate VO2max from resting conditions. Although these heart rate monitors are safer, less expensive, and more accessible than an actual VO2max test, there is limited evidence to show these VO2max estimates are accurate. PURPOSE: The purpose of this study was to compare actual VO2max values (AMax) to predicted VO2max values (PMax) obtained from the V800, M400, and FT60 Polar heart rate monitors. These monitors predict VO2max 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 ± 2.4, age = 21.2 ± 1.2 yrs) and 18 males (BMI = 24.4 ± 3.2, age = 21.4 ± 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 watch. 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), Super (8-12 hrs/wk), and Pro (12+ hrs/wk). After the PMax values were obtained, participants then completed a Modified Bruce Treadmill VO2max test. PMax was defined as the VO2max 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 Caloriometry in Energy Expenditure Estimation
Shih-Ling Chen1, ShuPa LuBi2, Chia-Chih Lin1, Yi-Ting Pan1, Jung-Chang Lin1. 1National Taiwan Normal University, Taipei, Taiwan. 2Sport-supported Cultures International Ltd., Nantou, Taiwan. 3National Dong Hwa University, Hualien, Taiwan. 4Chinese Culture University, Taipei, Taiwan.
Email: falahomerun16@yahoo.com.tw

PURPOSE: To apply innovative Smartphone Sport-supported Fat & Glucose Calculator and Gas Analysis Indirect Caloriometry in endurance exercise and evaluate validity of innovative SSFGC and Gas Analysis Indirect Caloriometry in fat and glucose consumption estimation during cycling endurance exercise. METHODS: Twelve healthy male cyclists (age: 31.8 ± 3.2 yr, height: 171.6 ± 7.9 cm, weight: 71.2 ± 5.0 kg, peak oxygen uptake (VO2peak): 46.2 ± 5.6 mL / min / kg, The VO2max for cycling endurance exercise, subjects were required to comply with SSFGC. All data were analyzed using Winks SDA 7 statistical software (TexasSoft, TX, USA). A significance level of p<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^-1) 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. The grants/conflict of interest: None.

References:

1591 Board #244
June 2, 9:00 AM - 10:30 AM
Determining Validity Of A Self-Paced VO2max Test For Estimating Anaerobic Capacity
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PURPOSE: To determine if VO2-power relationships for 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 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. The grants/conflict of interest: None.

References:

Recent evidence has shown that self-paced VO2max treadmill tests (SPV) can produce similar VO2-power relationships as traditional incremental treadmill tests. The endpoint during the last stage of SPV may be a surrogate for a supramaximal stage. Pairing the SPV on VO2-power relationship and endpoint 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 ± 3 years, VO2max 62.3 ± 9.2 mL·kg^-1·min^-1) completed four supramaximal exercise tests to determine a VO2-power relationship. MAOD was measured during a supramaximal exercise bout. An SPV was completed on an automated treadmill with VO2-power relationship determined from stages 2-4. For both relationships, y-intercept was set at 5.1 mL·kg^-1·min^-1. Accumulated oxygen deficit (AOD) was determined for SPV stage 5 as the sum of each 15 second O2 deficit until estimated O2 demand fell below O2 uptake. Peak power was taken as the highest 15 second average throughout VO2. MAOD was calculated using 15 second averages. Results: Eight subjects produced an endpoint during stage 5 of SPV and were included in the analysis. The supramaximal exercise test 2.24 ± 0.40 min and MAOD averaged 39.2 ± 7.1 mL·kg^-1·min^-1. VO2-power relationship slopes for submaximal stages (0.250 ± 0.0203) and SPV stages (0.259 ± 0.0200) were significantly different (p = 0.043) and significantly correlated (r = 0.828, p = 0.011). However, SPV stage 5 AOD (104.9 ± 114.8 mL·kg^-1·min^-1) and peak power (271 ± 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 endpoint. 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 VO2-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
Guy Leahy1, Todd Crowder2, Jerry L. Mayhew3, William F. Brechue, FACSM4. 1Kirtland Air Force Base, Albuquerque, NM. 2United States Military Academy, West Point, NY. 3Truman State University, Kirksville, MO. 4A. T. Still University, Kirksville, MO. Email: jmayhew@truman.edu (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 RT 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 predicted a 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
Laura J. DuChateau1, Anna M. McCready2, Claudia Espina Bresnahan3, Acadia L. Clohessy1, Michelle E. Judge1, Miran D. McCash1, Johann T. Roberts2, Christopher Villarosa1, Toshihki Kobayashi2, Michael S. Orendurff1. 1Orthocare Biomechanics Laboratory, Mountlake Terrace, WA. 2Hokkaido University of Science, Sapporo, Japan. Email: lauraj.davis@bastyr.edu (No relationships reported)

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 participate in this IRB-approved protocol. Over a 10-day period, each participant completed the BESS and the Y-Balance protocol twice 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 posteriomedial directions on the Y-Balance test using simple linear regression. It was hypothesized that the R² 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: Completed the hypothesis, the data showed significant overestimation of UT (3.5 ± 3.7 kg) but not TR (1.8 ± 5.0 kg). All other equations predicted a 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.

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 McLaughlin1, Bethany Noack1, Jorge Z. Grandanos2, Rick Sterling2, Mark Roltsch2, Stephen F. Crouse, FACSM3. 1Texas A&M University, College Station, TX. 2St. 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 (kcals) 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 systems at different resistances and pedaling 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 VO2 was significant (p<0.0001), with the elliptical machine overestimating EE during a 15
minute session by an average of 10.21 kcal. Measured EE in kcals as derived from open circuit spirometry was significantly predicted by elliptical EE according to the equation:

\[
\text{EE} = 0.95(\text{Elliptical EE}) - 3.161
\]

**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. Nagle1, John Abr2, Kim Beals3, Chris Connaboy4, Dever Dennis Dever5, Alyssa Olenick6, Elizabeth F. Nagle7, FACSM8. 1John Carroll University, Cleveland, OH. 2The University of Kentucky, Lexington, KY. 3The University of Pittsburgh, Pittsburgh, PA. 4Eastern Kentucky University, Richmond, KY. (Sponsor: Elizabeth Nagle, FACSM) Email: jnagle@jcu.edu

(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 establish 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 obtained during the WAnT, and the swimming velocity obtained during the 25yd, 50yd, and 100yd PS. RESULTS: The intersessionICC (TST1-TST2) ICC was 0.871 for Fpeak, and 0.976 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 be considered a valid and reliable test for measuring anaerobic power and

**CONCLUSION:**

The results from three regional cup races were used to rank the participants. **RESULTS:** For the boys, VO2peak (r = -0.845), vVO2peak (r = -0.832), OBLA (r = -0.843), and vOBLA (r = -0.878) all significantly correlated with performance (p < 0.05). For the girls, only VO2peak (r = -0.742), vVO2peak (r = -0.757), and vOBLA (r = -0.709) significantly correlated with performance (p < 0.05). OBLA was not a significant predictor variable for the girls (r = -0.543, p > 0.05). **CONCLUSION:** vOBLA (p = 0.011) and vVO2peak (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?**

Rohan Edmunds, Julian Egan-Shuttler, Cassandra Eddy, Veronica O’Neill, Stephen Ivins. Skidmore College, Saratoga Springs, NY. (Sponsor: Paul Arciero, FACSM) Email: redmonds@skidmore.edu

(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. The results from three regional cup races were used to rank the participants. **RESULTS:** For the boys, VO2peak (r = -0.845), vVO2peak (r = -0.832), OBLA (r = -0.843), and vOBLA (r = -0.878) all significantly correlated with performance (p < 0.05). For the girls, only VO2peak (r = -0.742), vVO2peak (r = -0.757), and vOBLA (r = -0.709) significantly correlated with performance (p < 0.05). OBLA was not a significant predictor variable for the girls (r = -0.543, p > 0.05). **CONCLUSION:** vOBLA (p = 0.011) and vVO2peak (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.

**Results**

Mean time until test termination was 13.5 ± 1.3 minutes. The highest 15-second average VO2 for the overall sample was 57.5 ± 9.2 ml/kg/min, ranging from 40.7 to 54.4 ml/kg/min in the women and 58.2 ± 7.5 ml/kg/min in the men. Although 9 of 11 subjects (7 men, 2 women) ranked above the 95th percentile for VO2max by age and gender based on their highest VO2, only 4 subjects (3 men, 1 woman) achieved a true VO2max according to the designated criteria. The table shows the number of men and women who achieved each physiological criterion.

<table>
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<th>VO2 plateau</th>
<th>HRmax</th>
<th>RER ≥ 1.15</th>
<th>VO2 max</th>
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<tr>
<td>Men (n = 7)</td>
<td>1</td>
<td>4</td>
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<td>Women (n = 4)</td>
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**Conclusion**

In this sample of high-active adult trail runners, the Bruce protocol was not effective in producing VO2max according to suggested physiological criteria. It is recommended that a more aggressive uphill walking or running protocol be used for this athletic population.
v. 621.4 watts, p=0.12) and the stroke at which PP was achieved (6.75 v 7.0, control v. phyo) were not different between groups. At this point, PF (232.0 v. 251.5 lb, AF (154.1 v. 180.9 lb), DS (2.53 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. phyo, 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 VO2 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 (SaO2). Pulse oximetry, used to measure SaO2, may serve as an inexpensive, non-invasive method to predict ResComp.

PURPOSE: The purpose of this study was to explore the validity of using SaO2 as a simple, non-invasive predictor of oxygen consumption (VO2), 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 alinear increase in ventilatory equivalent for O2 corresponded with a decrease in peak end-tidal CO2 (PetCO2), and by detecting an alinear decrease in SaO2 using pulse oximetry. Mixed-design repeated measures ANOVAs were used to analyze differences in the VO2, HR, and RER at ResComp across the three methods, and three GXT protocols.

RESULTS: There were no significant differences in VO2 at ResComp; 3.2 lmol/kg/min ± 0.9 (V-slope), 3.2 lmol/kg/min ± 0.9 (PetCO2), and 3.3 lmol/kg/min ± 0.9 (SaO2); HR at ResComp; 177.1 bpm ± 6.6 (V-slope), 177.1 bpm ± 5.3 (PetCO2), and 180.7 bpm ± 4.8 (SaO2); and RER at ResComp; 1.1 ± 0.1 (V-slope), 1.1 ± 0.1 (PetCO2), and 1.1 ± 0.1(SaO2). There was a significant correlation in VO2 between PetCO2 and SaO2 methods used to determine ResComp (r2 = 0.93, p<0.01). There were no significant differences among ResComp measurement methods and GXT protocols in predicting ResComp HR (r=0.243), VO2 (r=0.199), and RER (r=0.117).

CONCLUSION: Monitoring a drop in SaO2 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. Dalbo1, Jordan L. Fox1, Nattai R. Borges1, Ben J. Dascombe1, Kaelin C. Young1, Aaron T. Scanlan1. 1Central Queensland University, Rockhampton, Australia. 2University of Newcastle, Ouirambah, Australia. 3Edward 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), summed 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 Wada1, Noriyuki Yamamoto2, Yoshimitsu Shimoyama1, Yukinori Shintaku4, Hirofumi Jigami1, Masasi Wada1, Fumihiko Iwahara1, Yu Kashiwagi1,1. Kokushikan University, Tokyo, Japan. 2Japanese Red Cross Hokkaido College of Nursing, Kitami, Japan. 3Nippon Sport Science University, Tokyo, Japan. 4Biwako Seikei Sport College, Ohtsu, 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 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. 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
Jamie K. Schnuch1, Kyle L. Sunderland2, Nicholas P. Gannon2, Matthew R. Kuenen1, Roger A. Vaughan1. 1High Point University, High Point, NC. 2Medical College of Wisconsin, Milwaukee, WI.

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(No relationships reported)

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 PPARα and PPARδ expression (53.3% ± 28.2% and 55.9% ± 15.1%, respectively). Leucine also stimulated markers of mitochondrial biogenesis (PGC-1α, NRF1, and TFAM) leading to increased cytochrome C (61.9% ± 28.6%) and GLUT4 content (129.1% ± 92.9%). Surprisingly, leucine simultaneously increased PPARγ expression (42.0% ± 31.5%) promoting significantly elevated FAS (743.6% ± 304.0%) but not SREBP-1c expression. Conclusions: 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 ± 2 years; BMI = 24 ± 0.9 kg/m²; VO₂peak = 64 ± 3.4 ml/kg/min) received a primed continuous infusion of [L-1³C]leucine and ingested 19 g of intrinsically labeled protein with 60 g carbohydrates at rest and after 1 hour of treadmill running at 70% VO₂peak. Blood samples were drawn every 0.5-1 hour during the infusion protocols to determine amino acid concentrations, leucine enrichments, and intestinal fatty acid binding protein (I-FABP) as an estimate of small intestinal injury. Results: I-FABP increased throughout exercise with values peaking immediately after exercise (156% above baseline) but returning to baseline within 30 minutes 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 splanchic 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 IUJRC Center on Health, Aging, and Disability and the Faculty of Kinesiology and Physical Education Research Grants

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 1, Daniel R. Moore 2, Peter Breithaupt 3, Elizabeth Offord-Cavin 3, Leonidas G. Karagounis 3, Brian W. Timmons 1, 1McMaster University, Hamilton, ON, Canada. 2University of Toronto, Toronto, ON, Canada. 3Nestle Research Centre, Lausanne, Switzerland. (Sponsor: Dr. Stuart Phillips, FACSM)

Purpose: Post-exercise protein ingestion increases whole body protein balance in healthy children early in recovery (i.e., 9h), 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 [13C]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 ± 0.49 ± 10.6 kg; means ± SD) underwent a 5-day adaptation diet (0.95 g protein·kg-1·d-1) before performing an acute bout of exercise (3x20min cycling) with concurrent primed constant infusion of [13C]leucine. After exercise, participants consumed an isonenergetic (140 kcal) carbohydrate beverage containing a variable amount of milk-protein (0g; CONT; 5g; LP; 10g; MP; and 15g, HP) enriched with [13C]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(OX)) and net balance (Leu(NB)).

Results: Total leucine intake (drink + infusion) was: 6.2 ± 0.2 mg·kg⁻¹·h⁻¹ (CONT); 18.4 ± 2.5 mg·kg⁻¹·h⁻¹ (LP; 29.0 ± 4.2 mg·kg⁻¹·h⁻¹ (MP); 40.8 ± 8.8 mg·kg⁻¹·h⁻¹ (HP). Leu(OX) showed a main effect for condition (HP, 24.2 ± 8.2 mg·kg⁻¹·h⁻¹ > MP, 11.6 ± 4.3 mg·kg⁻¹·h⁻¹ > LP, 5.7 ± 1.9 mg·kg⁻¹·h⁻¹) > CONT (3.0 ± 1.7 mg·kg⁻¹·h⁻¹; all P < 0.01), with all conditions differing from zero (all P < 0.001). Linear correlation (r = 0.69, P < 0.001) indicated Leu(OX) became positive at ~10 mg·kg⁻¹·h⁻¹ leucine intake. Bi-phase regression analyses (r = 0.68) revealed Leu(OX) reached a plateau at ~34 mg·kg⁻¹·h⁻¹ leucine intake, which could suggest leucine intakes above this level represent a nutrient overload in our population over the 3h post-exercise period.

Conclusion: During the 3h post-exercise recovery period, Leu(NB) (a surrogate for net protein balance) was negative in the absence of protein ingestion. Consumption of high quality protein increased Leu(NB) 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 ~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 1, Justin T. Parel 1, Michael Mazzullia 1, Sidney Abou Sawan 1, Joseph W. Beals 2, Evan L. Shy 2, Stephen van Vijlet 1, Daniel R. Moore 2, 1University of Illinois at Urbana-Champaign, Urbana, IL. 2University of Toronto, Toronto, ON, Canada. (Sponsor: Jeffrey Woods, FACSM)

Email: naburd@illinois.edu

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 ± 2 years; BMI = 24 ± 0.9 kg/m²; VO₂peak = 64 ± 3.4 ml/kg/min) received a primed continuous infusion of [L-1³C]leucine and ingested 19 g of intrinsically labeled protein with 60 g carbohydrates at rest and after 1 hour of treadmill running at 70% VO₂peak. Blood samples were drawn every 0.5-1 hour during the infusion protocols to determine amino acid concentrations, leucine enrichments, and intestinal fatty acid binding protein (I-FABP) as an estimate of small intestinal injury. Results: I-FABP increased throughout exercise with values peaking immediately after exercise (156% above baseline) but returning to baseline within 30 minutes 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 splanchic 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 IUJRC 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
Yunsuk Koh 1, Kyung-Shin Park 1, 1Baylor University, Waco, TX. 2Texas A&M International University, Laredo, TX.

Email: yunsuk_koh@baylor.edu

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 ≥ 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 VO₂max) 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±0.19 ng/ml) by 22.08% from PRE (1.54±0.16 ng/ml; p = 0.014), which then returned to the baseline value at 1-hr PE (1.45±0.15 ng/ml; p = 0.01). MMP-2 at IPE (43.7±51.56 ng/ml) was significantly higher than PRE (25.68±3.27 ng/ml; p = 0.011) and 1-hr PE (28.04±3.34 ng/ml; p = 0.036), respectively. Additionally, smokers had significantly higher MMP-9 (45.7±8.48 ng/ml; p = 0.037) as compared with non-smokers (31.17±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.
**Effects of Different Intensities of Exercise on Serum Levels of Matrix Metalloproteinases in Obese Men**

Jonathan Jaoude, Stanly Ly, Jin K. Park, Yunusk 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/m²) 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-hoc 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 (31.32±4.82 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.

**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 absorptionimetry) and cross-sectional area (CSA) of the thigh (peripheral quantitative computed tomography) were measured before (BASELINE) and after (POST) a 7-day, near complete starvation caused by Survival, Evasion, Resistance, and Escape School (SEROE) 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-day 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 protein kg⁻¹d⁻¹) diets with additional protein does not enhance LBM recovery from short-term starvation.
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 ± 94 kcal·d⁻¹) also consumed more (P < 0.05) protein (2.1 ± 0.1 g·kg⁻¹·d⁻¹) and carbohydrate (6.6 ± 0.3 g·kg⁻¹·d⁻¹) than those who consumed the least amount of energy (1783 ± 113 kcal·d⁻¹, 1.2 ± 0.1 g protein·kg⁻¹·d⁻¹ and 3.3 ± 0.3 g carbohydrate·kg⁻¹·d⁻¹), 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.
Email: parkkyun@usc.edu

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 (allo 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±0.01 vs. 0.86±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±0.02 vs. 0.88±0.02 vs. 0.92±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, FACSM1, Kyeongtak Song2, Chris Burcal1, Erik Wikstrom, FACSM2. 1University of North Carolina @ Charlotte, Charlotte, NC. 2University of North Carolina @ Chapel Hill, Chapel Hill, NC.
Email: thubbar1@unc.edu

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 = 0.04) and “average time spent performing moderate physical activity” (p = 0.02) 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 = 0.01), and had significantly less days per week where they pursued vigorous activity (p = 0.02) or moderate activity (p = 0.04) one year after their sprain compared to before the injury occurred.

THURSDAY, JUNE 2, 2016

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. Ithurburu1, Mark V. Paterno2, Staci Thomas2, Timothy E. Hewett, FACSM3, Laura C. Schmitt. 1The Ohio State University, Columbus, OH. 2Cincinnati Children’s Hospital Medical Center, Cincinnati, OH. 3Mayo Clinic, Rochester, MN.

Abstracts were prepared by the authors and printed as submitted.

Table I: Mean (±SD) for dependent variables.

<table>
<thead>
<tr>
<th></th>
<th>Before Injury</th>
<th>One Year Post Injury</th>
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<tbody>
<tr>
<td>Time spent walking (per day, in minutes)</td>
<td>89.12 ± 20.2*</td>
<td>52.10 ± 9.9</td>
</tr>
<tr>
<td># days perform moderate activity (per week)</td>
<td>4.3 ± 0.9*</td>
<td>2.1 ± 1.2</td>
</tr>
<tr>
<td>Moderate activity (for a day they are moderately active, in minutes)</td>
<td>62.52 ± 13.2*</td>
<td>32.21 ± 10.2</td>
</tr>
<tr>
<td># days perform vigorous activity (per week)</td>
<td>2.7 ± 0.6*</td>
<td>1.2 ± 0.5</td>
</tr>
<tr>
<td>Vigorous activity (for a day they are moderately active, in minutes)</td>
<td>31.44 ± 9.6*</td>
<td>18.10 ± 6.2</td>
</tr>
</tbody>
</table>

(*Significantly different p < 0.05)

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 NASA Research and Education Foundation.

1614 Board #267 June 2, 8:00 AM - 9:30 AM
Resistive Hamstring Quadriceps Co-contraction Training After Acl Reconstruction
Gulcan Harpat1, Burak Ulusoy2, Hamza Ozer2, Gul Baltaci2. 1Hacettepe University, Ankara, Turkey. 2Gazi University, Ankara, Turkey. 3Private Goven Hospital, Ankara, Turkey. (Sponsor: GUL BALTACI, FACSM)
Email: aktasgulcan@yahoo.com

Co-contraction training (CT) was shown to be an option for quadriceps strengthening after anterior cruciate ligament reconstruction (ACL-R) 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.

Abstracts were prepared by the authors and printed as submitted.
Methods: Fifty two patients (age: 27.5±7.6 years, body mass index: 24.9±3.7 kg/m²) who had ACLR with hamstring tendon autograft were randomly allocated into one of three training groups: 1) CT in open kinetic chain (CKC) 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) = 1.16, 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.

Purpose: The purpose of this study was to investigate the correlation between hip and knee muscles strength and functional outcomes in ACL reconstituted (ACLR) individuals. Methods: Sixty-two ACLR individuals (age 27.6±7.8 yrs, BMI 24.4±4.03 kg/m²) 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 performance was evaluated by One Leg Hop Test (OLHT) and International Knee Documentation Committee (IKDC) Form.

Results: There were no differences between groups in SEBT anterior (p=0.46), posteromedial (p=0.46) 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. There were no differences between groups in SEBT anterior (p=0.46), posteromedial (p=0.46) 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: 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.

<table>
<thead>
<tr>
<th></th>
<th>Concentric QI</th>
<th>Eccentric QI</th>
<th>Eccentric HI</th>
<th>H/Q Ratio</th>
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</thead>
<tbody>
<tr>
<td>IKDC</td>
<td>p=0.008, r=0.36</td>
<td>p=0.03, r=0.3</td>
<td>---</td>
<td>p=0.04, r=0.29</td>
</tr>
<tr>
<td>OLHT</td>
<td>p=0.04, r=0.30</td>
<td>p=0.02, r=0.35</td>
<td>p=0.03, r=0.32</td>
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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/m²) were included. 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 levels. The effect of KB may be further increased when combined with the KT. It may be possible to offer the participants better knee function compared to KT.

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/m², 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, postomedial 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.

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: Fifty two patients (age: 27.5±7.6 years, body mass index: 24.9±3.7 kg/m²) who had ACLR with hamstring tendon autograft were randomly allocated into one of three training groups: 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) = 1.16, 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.
Numerous interventions have been used in attempts to treat delayed 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. 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 divided into two groups. Group 1 (n=14) was treated with 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 eta2 = .009), self-reported functional ability (F(6, 162) = 0.24, p = .815, partial eta2 = .008), elbow range of motion extension (F(6, 162) = 0.96, p = .381, partial eta2 = .034) and flexion (F(6, 162) = 0.65, p = .597, partial eta2 = .024), and upper arm circumference (F(6, 162) = 0.31, p = .287, partial eta2 = .011) when compared to the control group.: CONCLUSIONS: It was concluded that STO is not an effective treatment for DOMS.

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-sprint 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 (r=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.

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/cm2 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) = 9.160 = .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.
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 quadriiceps and hamstring 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. Pain control purposed application of kinesiologic taping to subacromial impingement syndrome patients with subacromial impingement syndrome diagnosis.

RESULTS: 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.
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 LIFUS 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 intercuneiform 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 most time for return to sports was 7.5 ± 2.1 months. All patients presented with valgus hindfoot angle 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 that previously understood. This is the first study to document the extent, pattern and prevalence of associated inter-cuneiform ligamentous 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
Adriana Isacke. Maine Medical Center, Portland, ME. (Sponsor: William Dexter, FACSMD)
Email: isacka@mmc.org

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 effect 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 were the most important elements for clinic success. The majority (90%) of residents believed a dedicated OMT clinic was needed. The residents thought access (35%) resident participation (20%) and OMT were the most important elements for clinic success. There is a need for a dedicated OMT clinic at current practice (18 90% vs. 8 80%)

Tabe 1: OMT Clinic Pre- and Post-Implementation Survey Results

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre-implementation Survey</th>
<th>Post-implementation Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N=20) MD (N=10) DO (N=10)</td>
<td>(N=18) MD (N=9) DO (N=9)</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>There is a need for a dedicated OMT clinic at current practice</td>
<td>18 90%</td>
<td>8 80%</td>
</tr>
<tr>
<td>Currently perform OMT in your practice</td>
<td>9 45%</td>
<td>0 0%</td>
</tr>
<tr>
<td>Instruction provided during residency on OMT helped improve skills</td>
<td>10 50%</td>
<td>6 60%</td>
</tr>
<tr>
<td>Teaching improved your confidence in providing OMT for patients</td>
<td>10 50%</td>
<td>5 50%</td>
</tr>
<tr>
<td>Plan to do OMT after residency</td>
<td>13 65%</td>
<td>5 50%</td>
</tr>
<tr>
<td>Feel confident referring appropriate patients to an OMT clinic</td>
<td>17 85%</td>
<td>8 80%</td>
</tr>
<tr>
<td>Aware there was an OMT clinic taking place September-December 2014</td>
<td>- - - - - -</td>
<td>18 100%</td>
</tr>
<tr>
<td>Easy referral process</td>
<td>- - - - - -</td>
<td>14 78%</td>
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</tbody>
</table>

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
Amanda Gilmore, Brook Fowler, F. Buck Willis, FACSM.
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No relationships reported.

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.

Abstracts were prepared by the authors and printed as submitted.
High Intensity Laser Therapy vs Kinesio Taping in Patients with Subacromial Impingement Syndrome

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** Guven Private Hospitals, Ankara, Turkey

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 (n=16) and 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. Further studies with more focus on exercise compatibility and larger sample size are warranted.

Comparison Of High And Low Volume Eccentric Resistance Training In Patients With Jumper’S Knee

Stephan Geisler, Andreas H. Alt, Thorsten Kreutz. IST-University of applied science, Düsseldorf, Germany.

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(Purpose 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 Sport assessment 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.

Effects of “Throwers Ten” Exercise Program for Injury Prevention in Adolescent Overhead Athletes: A Randomized Controlled Trial

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2 Hacettepe University Health Science Faculty, Ankara, Turkey.
3 Anka Private Hospital, Ankara, Turkey.

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(No relationships reported)
Temperature and skin hydration changes measured pre & post. Absolute changes were considered different between groups (ET); or gradually increasing to 75% maximal voluntary torque (MVT) before holding for 1 s (CT); or gradually increasing to 75% maximal voluntary torque (MVT) before holding for 3 s (CT). Torque & EMG during maximal (MVT & EMGvMT) & explosive (T100 & EMG0-100) contractions, & total Quadriceps volume (QUADvSOL) were measured pre & post. Absolute changes were considered different between groups when: post hoc P-values were < 0.1 & 0.1 effect size (ES) was < 0.5.

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 EMGvMT changes after CT (+0.06 ± 0.03 mV) & ET (+0.04 ± 0.06 mV; P = 0.44; ES = 0.36). EMG increases after CT (+148 ± 135 cm³) were greater than ET (+46 ± 137 cm³; P = 0.074; ES = 0.74). Improvements in T100 were greater after ET (+23 ± 25 Nm) vs CT (+17 ± 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 = 0.25; 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.

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 traditional (TRA) and APS resistance training during a flat bench press. TRA 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 ≤ 0.05. Data are presented as means (SD).

RESULTS: There was a main time 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 (11.5) 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 = 0.01] 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 modes, 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.

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 were 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...
Epinephrine (E) and norepinephrine (NE) basal excretion, and β2-adrenergic (β2) receptor content are altered after overtraining (OT). Recent literature implicates β2 signaling in the maintenance of skeletal muscle mass and phenotype. β2 signaling in skeletal muscle involves the signaling protein extracellular signal-regulated kinase (ERK). To date, no study has investigated the E-β2-ERK signaling axis in OT humans.

**PURPOSE:** To determine if basal sensitivity of epinephrine (E/β2) and norepinephrine (NE/β2) 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=26.6±2.1yrs, ht=179±9.9cm, body mass=78.6±12.9kg) or control group (CON n=8, age=19.8±1.7yrs, ht=179±6.6cm, 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/β2 and NE/β2 (independent variables) were significantly related to changes in pERK (dependent variable) after training. Significance was set at p<0.05. **RESULTS:** When groups were analyzed together, E/β2 and NE/β2 at pre explained 64% of variance in the change of pERK at post (F[2,13]=14.4, p<0.001, adj. R²=0.641). When analyzed separately, OT E/β2 and NE/β2 at pre explained 78% of variance in the change of pERK at post (F[2,5]=13.2, p<0.01, adj. R²=0.778). Both independent variables significantly contributed to the model (E/β2: b=1.05, t=4.89, p<0.001; NE/β2: b=1.07, t=4.99, p<0.001). In CON, E/β2 and NE/β2 at pre did not explain any variance in pERK at post (F[2,5]=0.35, p=0.66, adj. R²=0.01). **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 β2 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 Response to Concurrent Resistance Exercise and High Intensity Interval Training in Overweight/Obese Individuals

Jamie K. Pugh1, Steve H. Faulkner1, Myra A. Nimmo2
1Loughborough University, Leicestershire, United Kingdom. 2University of Birmingham, Birmingham, United Kingdom. Email: j.pugh@lboro.ac.uk

It is recommended that individuals combine a form of resistance and endurance exercise to improve cardiovascular 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 s extensions at 70% 1 RM, or HIIT followed by HIIT (RE + HIIT; 10 x 1 min at 90% HRmax 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+ cells) and activity (MyoD+ cells) were analyzed by immunofluorescence microscopy. Two-way repeated-measure ANOVA was used for statistical analysis.

**RESULTS** The number of mixed muscle fiber satellite cells (Pax7+ 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+ 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+ 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 were 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 Techngym, The Wellness Company and the National Institute for Health Research (NIHR) Diet, Lifestyle & Physical Activity Biomedical Research Unit.
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/m²) 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 observed VE (VEOBS - VE Pred = 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) only 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.

**Effects Of Inspiratory Muscle Training On Inspiratory And Locomotor Muscle Hemodynamics During Exercise In Men**

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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 =135±44 vs. 159±35 cmH2O, p<0.05) but not in the SC group (134±39 vs. 159±35 cmH2O, p>0.05) 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) during 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.

**Dyspnea Intensity, Descriptors, And Negative Symptoms During Exercise In Obese And Nonobese Children**

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**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 VO2max and 50% of VO2max + 20W), and a maximal exercise test. Ratings of perceived breathlessness (RPB), ratings of perceived exertion (RPE), and the 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, compared to only 15 descriptors of dyspnea 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.
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 ± 1.91yrs) 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 (VT), peak tidal flow inspired (PVT), and expired (PVE) time, to inspire (Tt) and expire (TV), total tidal time (Tv), duty cycle (Ti/Tt), and ventilatory capacity (Vc) were assessed repetitively in both conditions via flow-volume loops. Maximum aerobic capacity (VO2peak) and ventilation (VE) 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 PVT (7.00 ± 0.20 vs. 6.03 ± 0.38L·s⁻¹; p<0.05) than cycling. Tt (0.76 ± 0.03 vs. 0.63 ± 0.38s; p<0.05), TV (1.48 ± 0.09 vs. 1.28 ± 0.08s; p<0.05), and Ti/Tt (56.7 ± 1.1 vs. 49.4 ± 0.7%; p<0.05) were greater for swimming than for cycling. In addition, while no difference in PVT (59.8 ± 10.2 vs. 65.0 ± 0.04s; p<0.13), VO2peak (3.61 ± 0.21 vs. 3.60 ± 0.14L·min⁻¹; p<0.05) was lower in the swimming condition, with the level of significance set at 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.

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**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**Board #297 June 2, 9:00 AM - 10:30 AM**

**Ventilatory Strategies Of Competitive Swimmers During Incremental Swimming And Cycling Tests To Exhaustion**

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Stimulation of the Beta, Adrenergic Receptors (βAR) 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 (DMc), and corrected for pulmonary capillary blood volume (Vc/DMc). The improvement in diffusing capacity with exercise could be a direct result of βAR 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, DMc and Vc) with albuterol and the change in DLCO and components with exercise to determine the βAR involvement. METHODS: Healthy participants (N=30) completed a maximal VO2 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, DMc and Vc with albuterol visit and changes in DLCO and components with exercise (DMc < 0.05; Vc < 0.05; VO2peak < 0.05). There was no relationship between changes in DLCO and DMc with exercise, but the change in Vc/Vc under the two conditions was trending towards significance (r=0.35, Vc/Vc=11.5±8.3% and Vc/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 diffusing parameters at peak exercise and following beta-agonist stimulation suggest that at least a portion of this increase is mediated by the βAR. 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 HL08962-05.

**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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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 increases at 2 hours; DI: ~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.

**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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**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**

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**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/day of B-GOS for 3 weeks. Participants were randomized to receive 6 days a week of HIB (30 breaths per minute) 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 (EVBH) 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 EVBH 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 ± 460 mL, vs. day 21; -570 ± 510 mL, P = 0.004). No changes in pulmonary function in the control group were evident. Recent work suggests females have a higher oxygen cost of ventilation than males. There was no significant difference in the change in FVC between the CWL and the control trial (38.5±16 v. 38.5±14∆L/min, P = 0.004). The TNF-α change after EVH was abolished. Baseline CRP was reduced between the CWL and the control groups (P < 0.05). No changes in FENO and CCL17 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.

While there has been extensive research on the effect of altered work of breathing (WOB) on pulmonary and metabolic function in men, its effect on women is still unknown. Recent work suggests that 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/m²) performed a 5km time trial (TT) on a cycle ergometer, and with and without a weighted vest (CWL; 10% of body weight). Both trials were performed during the 1st 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 (VO2), microvascular responses (Near Infrared Spectroscopy; THb: total hemoglobin, HbO: oxyhemoglobin, Hb: deoxyhemoglobin, and power output (PO), were recorded throughout the 5km TT. RESULTS: PO tended to be lower in the CWL v. control (105±5 v. 109± 5 watts, p = 0.13) and 5km time slower (765.2±149 v. 756.2±109 sec, p=0.05). The change in VE was not different between the CWL and the control trial (38.5±16 v. 38.5±14AL/min, p=0.88). There was no significant difference in the change in FVC between the CWL and control trials (-0.13 ± 0.27 v. -0.36 ± 0.20AL) before and after the 5km TT (p >0.05). There was no significant difference in peak VO2 between the CWL and control (34.1 ± 4 v. 32.9 ± 3 ml/kg/min, p=0.05) trials. CWL tended to reduce SO2 (59.8±5.3 v. 51.5±15.0%), THb (57.10 v. 37.14±17.5µM), and HbO (22.4±6.3 v. 21.3±6.6µM), and increase Hb (15.01±4.18 v. 16.38±3.4 µM), control v. CWL, respectively (p<0.05). The change in VAS was higher in the CWL trial (6.0±1.0 v. 4.8±1.1, p<0.05) CONCLUSION: It was demonstrated that CWL, via a weighted vest, tended to reduce microvascular perfusion, lowering SO2, decreasing power output, increasing time to complete 5km, and increasing fatigue compared to the control trial.

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 causes 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- and 800-m running and testing, using a portable autopsimeter. 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 ± 25 vs. 97 ± 27 cmH2O (P = 0.01), ES = 0.65 vs. 108 ± 26 cmH2O (P = 0.01, ES = 0.74) before and after the 400- 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). 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.

The measurement of oesophageal pressure (P0es) 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 POes 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 POes catheter may be adequately compensated via two numerical methods of digital signal compensation.

METHODS: The commercial balloon-catheter used in this report was manufactured by Akrad Laboratories (CooperSurgical, Trumbull, CT). The dynamic response of the commercial POes 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 $P_c$ catheter was “flat” up to only 7 Hz. However, the frequency 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 $P_c$ 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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(No relationships reported)

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) 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 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 (LCTT), while carrying a 25 kg thoracic load. Participants were randomly assigned to either IMT (n=9) or a maintenance group (CON, n=8) and completed 4 additional weeks of training. IMT, consisted of 3 sessions per week whilst simultaneously breathing through the training device at 50% MIP and conducting determined core exercises. CON, comprised of 30 breaths at 50% MIP, 3 times weekly.

Results: Baseline LCTT was 15.93 ± 2.30 and improved to 14.73 ± 2.40 min post 4 sessions per week whilst simultaneously breathing through the training device at 50% range adopted during exercise. FEF25-75% was assessed pre-ingestion and at 1, 5, 10 and 15 min post-ingestion. The post-ingestion value was calculated to provide an index of airway narrowing.

Conclusion: IMT improves MIP and exercise performance with thoracic load carriage and the improvement is enhanced by incorporating a period of IMTF, which provides additional ventilatory gains for a given level of inspiratory muscle effort. 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.

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 VO2max (GET%VO2max) following puberty. Also, trained girls increase absolute GET, but not GET%VO2max. 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 VO2max. Subjects then rested for 15 minutes and performed a constant load exercise bout at 105% VO2max to exhaustion to validate VO2max. GET was determined using the V-Slope method. 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: 29.4 ± 4.5 ml/kg/min; G: 20.5 ± 5.2 ml/kg/min). There were no differences (p>0.05) in GET%VO2max pre- to post-puberty between sexes.

Discussion: These data suggest absolute GET increases with increasing body weight during puberty; however, relative GET and GET%VO2max 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.

**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 on 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.
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±4.2 yrs) or the sham group (n=6, 27.3±9.7 yrs). 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 CO2 (PETCO2) and breathing efficiency for CO2 (VE/VCO2) 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 (FiO2=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. 11.1±20.8% respectively, p=0.055) and mPAP (11.3±16.2 vs. 13.8±23.8% respectively, p=0.057) but sham did not. However, no significant difference in VE, PETCO2 and VE/VCO2 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.
before plateauping (rest=39 ± 2.9; 90 steps min−1=37.0 ± 3.7%). End tidal CO2 (PETCO2) remained constant during exercise (rest=34.8±3.2; 90 steps min−1=35.2±2.5 mmHg). The VE/PETCO2 slope was inversely correlated with fluid loss (R2=0.34).

CONCLUSIONS: ADHF patients after inpatient diuresis showed improved performance in pulmonary function but not lung diffusing capacity. VE/PETCO2 ratio fell before plateauping, and PETCO2 remained constant during exercise. Both values were elevated relative to published norms. VE/PETCO2 slope followed volumetric status after diuresis and may predict boomer compensation. In this continuing study, we seek to determine the usefulness of submaximal exercise as a predictor of clinical outcome.

Passive limb movement (PLM) has been used as a method of activating the mechanoreflex, inducing limb hyperemia which is nitric oxide (NO) dependent. Breathing hypoxic 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% O2) and hypoxic (100% O2) 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% O2) and hypoxic (100% O2) 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, StO2%) 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 responses than females (ΔCO: 1.7±0.7 vs. 0.9±0.6 L/min, p<0.05). Peripherally, PLM increased StO2 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 ASO2%, p<0.05). Hyperoxia had no effect on baseline CO or StO2 (p>0.05) or the response to PLM, and the sex difference persisted (ΔCO: 1.8 ± 1.0 vs 1.1 ± 0.6 L/min, M vs. F) (p<0.05). PLM induced significant changes in StO2, which were not different from normoxia, though the sex specificity persisted (M: 4.5±1.8 vs F: 2.1±2.7 ASO2%, 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 occur in both sexes, the present study suggests that the microvascular mechanoreflex response to PLM may differ. In the current model, prior inhalation of 100% oxygen had no effect on the mechanoreflex in in young healthy males and females.

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 (KATP) 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 KATP channel opening inhibitor (glibenclamide; 100 µM; n = 6), mPTP channel opener (carboxyatractylodiside; 50 µM; n = 5), or a combination of these two (n = 5) prior to HPC treatment followed by a 30 min hypoxia (21% O2, N2, and 5% CO2) and subsequent reoxygenation. The KATP channel opener (diazoxide; 50 µM; n = 7), mPTP channel opening inhibitor (cyclosporin A; 100 µM; 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%), carboxyatractylodiside (7.6 ± 0.9%), and glibenclamide + carboxyatractylodiside (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 combinatorial 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.
self-paced one-mile trail run wearing the Hexoskin and the Cosmed unit. Biometric measures (HR, VR, VE, steps, and EE) were recorded every minute by the Hexoskin and breath-by-breath by the Cosmed unit. 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=0.67, 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.

Millions of athletes participate in the sport of track and field annually. Coaches at all levels are interested in identifying the athletes that 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 various jumping events and to develop prediction results could be used to predict performance in long jump, triple jump, and high jump events in track and field.

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 (VO2max) 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: 12.7±4.23, ST: 10.59±2.55, UT: 18.65±6.03), body mass index (BMI; kg/m²): ET: 23.47±2.04, ST: 23.09±2.07, UT: 23.47±2.04, P=0.011, hemoglobin (HB; g/dl): 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.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 VO2max of ET, ST and UT participants RESULTS. There was a significant difference (P<0.00) for the VO2max (ml.kg-1.min-1) between ET (57.62±5.40), ST (56.73±7.63), and UT (56.73±7.63). All other HR measures were not significantly correlated (HR 1: ICC<0.29, 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.

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, FACSM1, Riley Northrup2, Augustana University, Sioux Falls, SD, 1Ashland University, Ashland, OH. Email: sherry.barkley@augie.edu (No relationships reported)

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 Gupta1, Govindasamy Balasekaran, FACSM1, Vissavureesh Victor Govindaswamy2, Dianna Thor1. 1Physical Education and Sports Science, Human Bioenergetics Laboratory, Nanyang Technological University, Singapore, Singapore. 2College of Arts and Science, Computer Science, Concordia University, Chicago, IL. Email: nidhigupta.ne@gmail.com (No relationships reported)
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 VO2 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 VO2 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 VO2 max, PAT values and training intensity may be used as a predictor of race performance. d-ROMS and baseline VO2 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. Pacing 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 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 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 calculate (% of FT) for the final split. 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 VO2 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 VO2 max, PAT values and training intensity may be used as a predictor of race performance. d-ROMS and baseline VO2 max may help predict potential injury in athletes.

Supported by Quinnipiac University, School of Health Sciences

1669 Board #322 June 2, 8:00 AM - 9:30 AM
Effectiveness of Aqua-titanium Infused Compression Garment in Outdoor Track Event
Peggy Boey1, Govindasamy Balasekaran, FACSMM, Visavasuresh Victor Govindaswamy2, Dianna Thor1, Jolene Lim Ziyuan1. College of Arts and Science, Computer Science, Concordia University, Chicago, IL.

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±1.86yrs, height: 173.01±6.58cm, weight: 67.00±5.21kg, percentage (%) body fat: 13.30±3.20) 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 trials were run twice with maximal effort, followed by a 2000m 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±3.25sec vs. PCG: 31.23±3.71sec, p=0.02) and maximal speed attained in the 50m (ATCG: 7.95±0.68m.s-1 vs. PCG: 7.78±0.59m.s-1, p=0.01). There was no significant difference in distance where maximal speed was attained (ATCG: 35.91±6.51m, PCG: 35.70±5.24m, p=0.89). Wilcoxon signed rank test found no significant difference in performance times for 50m (ATCG: 7.13±0.94sec, PCG: 7.18±0.95sec, p=0.23) and 3000m (ATCG: 13.47±1.98sec, PCG: 13.76±2.06sec, 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 of lower load and greater efficiency of foot 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?
Viviane Merzbach, Itay Basevitch, Justin Roberts, Joseph Biggins, Adrian Scruton, Dan Gordon. Anglia Ruskin University, Cambridge, United Kingdom.
Email: viviane.merzbach@anglia.ac.uk

No (relationships reported)

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 affrent 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 sub-
conscious 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 were approached to participate. Age,
gender and experience of the participants were ascertained using an online survey and
opportunist questionaire surveying at the pre-marathon registration event. Age was
stratified according to those adopted by the marathon organizers: 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).
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 10-15km for all age groups (p<0.05), with this being only
difference for >60yrs group. Large effect size (ES) observed for 18-39yrs at 30-35km
(r= 0.37), 40-49yrs at 30-35km (r= 0.33), 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.

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, VO2max; 52.1 ± 7.5 mL·min-1·kg-1, 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. Differences 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 (48.72 ± 4.08 sec ± 4.09
± 4.19 mL·min-1·kg-1; 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 sec ± 4.17 ± 5.09 mL·min-1·kg-1; 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 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.

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Lower body positive pressure treadmills (LBPT) 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 LBPT 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 LBPT.
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 LBPT. 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 LBPT.
RESULTS: Six articles met inclusion criteria for this review, but only three (Hoffman
2011, Klime 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
(kg) + 10.508 × setting (percent of body weight).
CONCLUSIONS: Changes in stride frequency as a result of 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.

Baden J. Michigan State University, East Lansing, MI. (Sponsor: Curtis Perri, FACSM)
PURPOSE: To determine the effect of LBPT on VO2, as well as the difference
between VO2 and the model-predicted VO2.
RESULTS: Similar VO2 values were observed between LBPT and model-predicted VO2
for all age groups. However, VO2 was significantly different between LBPT and
model-predicted VO2 for all age groups.
CONCLUSIONS: The model developed in this study was able to accurately predict
VO2 during LBPT running.
THURSDAY, JUNE 2, 2016
by ≥ 48 hours and all were completed in ≤ 4 weeks. Participants reported to each session after ≥ 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, 956, 8), p = 0.001], with session 9 (450 ± 27.6s) significantly faster than sessions 1 (491 ± 36.5s), 2 (468 ± 42.6s), 4 (458 ± 42.6s), and 5 (454 ± 33.8s). 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
Jeff S. Lyon, Brock Jensen, Steven Verba, Allan Shook, Jojan Urdia. Slippery Rock University, Slippery Rock, PA. (Sponsor: Patricia Pierce, FACSM)
Email: jelf.myn@gmail.com

It is known that ultra-endurance exercise places extraordinary stress on the cardiovascular system. Still, limited data exist examining cardiorespiratory 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 (men, age 49 ± 1.6y; women, age 43 ± 11.9y) or 163 km (men, age 40.1 ± 7.8y; women, age 38.8 ± 11y) trail race underwent continuous EKG monitoring 1 day before an ultramarathon run (baseline), during, and, after a minimum of 24 hours postrace. 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 ± 6 BPM and ranged from 31-53 BPM. Rare PVCs and/or PACs occurred in 17 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
Lauren Shaver1, Eric E. Hall, FACSM1, Eric K. O’Neal2, Svetlana Nepocatych1. 1Elon University, Elon, NC. 2University of North Alabama, Florence, AL. (Sponsor: Eric E. Hall, FACSM)
Email: lshaver2@elon.edu

PURPOSE: This study examined the effects of ingesting versus mouth rinsing with water during a running time trial. METHODS: Recreational active female runners (n = 23; 26 ± 6 y; 22 ± 3 % body fat) completed two, 15-km time trials on an outdoor course (~20°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. Rare PVCs and/or PACs occurred in 17 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.

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
Jennifer Bossi1, Elizabeth Mullin2, M. Susan Guyer2, Vincent Paolone, FACSM3, FACSM. 1Anderson University, Anderson, SC. 2Springfield College, Springfield, MA. (Sponsor: Vincent Paolone, FACSM)
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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 VO2peak, running economy, lactate threshold, and 10 K running time. METHODS: Subjects (23.5 ± 4.6y; VO2peak 57.03 ± 5.99 mL/kg·min) completed three exercise testing sessions consisting of a Modified McConnell VO2peak test, isotonic 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 VO2peak test to determine lactate threshold. All VO2peak 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%/ and 180%/ and any of the performance variables. No significant correlations existed between the H/Q strength ratio at 60%/ and 180% and stride rate and stride length at any speed. CONCLUSIONS: The VO2peak test 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.

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±3.4 years, VO2peak of 50.53 ± 8.45 ml kg·1·min·1) 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·1 speed and 1% grade and the intensity (speed) was increased 1 km·h·1 every 2 minutes from start to 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 VE/VO2, 2. The breakpoint of the VCO2/VO2 curve, 3. The first constant increase of RQ, 4. The first increase of expiratory fraction of O2. Pearson’s correlation coefficients (r2) was used to compare VO2 at AerT and VO2 at FATmax. RESULTS: FATmax and AerT occurred at 47.4 ± 4.25 % VO2peak and 45.54 ± 0.47 % VO2peak, respectively with fat oxidation at FATmax equal to 0.59±0.26 gmin-1. A high correlation was found between FATmax and AerT (r2=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.
“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. Spearmann’s correlation was then performed to relate mile run time to digit ratio for each hand.

**RESULTS:** Mile run time was 281 ± 37s in males and 305 ± 80s in females. Digit ratio was 0.94 ± 0.03 on the left side and 0.94 ± 0.02 on the right side in males and 0.97 ± 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 statistically significant, the utility of digit ratio measurements likely remains questionable, as the relationship appears inherently weak.

**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 athletes (age 21-46 years old, height 177.60±10cm and mass 80.6±8.63kg) 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 sexes. Pearson’s Correlation r was used to test the correlation between RER and percent slowing.

**Results:** 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 ±1:5 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 (≤ 10%) or marked slowing (≥ 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 test the correlation between RER and percent slowing. **Results:** The mean percent slowing for males and females was 29.1 ± 13.4% and 20.5 ± 16.6%, respectively (p=0.032). Females had a significantly lower RER during steady-state exercise in comparison with males (Female=0.86 ± 0.04, Male=0.89 ± 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 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.
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 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 .

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 the quality of movement during using the Tuck Jump Assessment and 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.

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−1) exercise for 12 days. Sleeping was maintained at 7:00 am - 7:00 am and breakfast consisted of a 7,000 to 14,000 ft ASL) occurred in Colorado where the antecubital vein of individual’s preferred arm in a well hydrated and rested state. (No relationships reported)
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 characteristics while performing the deadlift exercise. Highly resistance-trained men experience similar muscle damage recovery following 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±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±9.5 kg) was 18.6% lower than the free weight barbell group (74.5±12.5 kg, p=0.042) and 15.2% lower than the Smith machine group (72.4±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). **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.

**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

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**C-46 Free Communication/Poster - Skeletal Muscle**

**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, Melissa Richards, Ashley Kloeckner, Taylor Kuhn, Jalana Larson, Kayleigh McClure, Emily Passint, Evan Peterson, Kaila Potting, Megan Williams.

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(No relationships reported)

**RESULTS:** Fifteen women participated, mean age at delivery was 27.2 ± 3.9 years and mean prepregnancy BMI was 25.5 ± 4.8 kg/m². Fifteen women participated, mean age at delivery was 27.2 ± 3.9 years and mean prepregnancy BMI was 25.5 ± 4.8 kg/m². 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 ± t = 2.2, SC = -4.4 ± 3.2, (12) = -2.4 p = 0.02) and mode of delivery (vaginal vs. cesarean section) (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.

**1687 Board #340**

**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**

Kevin D. Camara, Jared W. Coburn, FACSM, Dustin D. Dunnick, Lee E. Brown, FACSM, Andrew J. Galpin, Pablo B. Costa. California State University, Fullerton, Fullerton, CA.

(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.
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 ± 0.07 m, mass = 75.70 ± 11.99 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, μV) 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 used to examine the differences in rmsEMG and ROM between the CABLE and PLATE for each exercise. **RESULTS:** Significantly higher rmsEMG values were observed between the biceps curl on CABLE in the PM (Mdiff = 68.99 ± 25.55, p = .001) and AD (Mdiff = 77.31 ± 24.10, p = .06), along with greater shoulder ROM (Mdiff = 7.51 ± 3.44, p = .036). The chest press produced significantly higher rmsEMG on CABLE in the BB (Mdiff = 120.24 ± 26.59, p < .001), RA (Mdiff = 39.78 ± 17.47, p = .039), and EO (Mdiff = 16.05 ± 5.93, p = .017), and significantly higher rmsEMG on PLATE in the TB (Mdiff = 157.35 ± 31.33, p < .001). CABLE also displayed significantly greater hip ROM (Mdiff = 0.37 ± 0.01, p < .001), knee ROM (Mdiff = 0.107, p < .001), and shoulder ROM (Mdiff = 1.277 ± 0.080, p < .001) for this exercise. The overhead press produced higher rmsEMG on the CABLE in the BB (Mdiff = 177.32 ± 25.82, p < .001) and EO (Mdiff = 11.60 ± 3.82, p = .009) and significantly greater hip ROM (Mdiff = 0.337 ± 0.01, p < .001), knee ROM (Mdiff = 0.107, p < .001), and shoulder ROM (Mdiff = 1.277 ± 0.080, 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 unexplained.

**S364**

**June 2, 9:00 AM - 10:30 AM**

**Comparative Impacts of Plate-Loaded and Cable Resistance Machines on Muscle Activity and Joint Kinematics**

Mark E. Richardson, Nicole K. Rendos, Moataz Eltouhy, Joseph F. Signorile. University of Miami, Coral Gables, FL. (Sponsor: Dr. Arlette Perry, FACSM)

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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 conditions. **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 the biceps curl on CABLE in the BB (Mdiff = 117.32 ± 25.82, p < .001) and EO (Mdiff = 11.60 ± 3.82, p = .009) and significantly greater hip ROM (Mdiff = 0.337 ± 0.01, p < .001), knee ROM (Mdiff = 0.107, p < .001), and shoulder ROM (Mdiff = 1.277 ± 0.080, 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 unexplained.

**1690**

**Activation Of Lower Limb Deep Muscles During Deep Squats On Different Unstable Surfaces**

Chunneci Cao1, Jingmin Liu1, Yu Liu1, Weimo Zhu, FACSM2, 1Department of Physical Education, Tsinghua University, Beijing, China. 2Department of Psychology, Peking University, Beijing, China. 3University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Weimo Zhu, FACSM)

(No relationships reported)

**1691**

**June 2, 2:00 PM - 3:00 PM**

**Activation Of Lower Limb Deep Muscles During Deep Squats On Different Unstable Surfaces**

Chunneci Cao1, Jingmin Liu1, Yu Liu1, Weimo Zhu, FACSM2, 1Department of Physical Education, Tsinghua University, Beijing, China. 2Department of Psychology, Peking University, Beijing, China. 3University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Weimo Zhu, FACSM)

(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 conditions. **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%ROM. 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).

**Table 1. The difference of muscle activation between unstable and stable conditions**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Muscle</th>
<th>Ground</th>
<th>BD</th>
<th>ES</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA</td>
<td>26.48±6.76</td>
<td>21.56±6.17</td>
<td>-0.76</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>RF</td>
<td>25.14±5.80</td>
<td>26.57±10.09</td>
<td>0.18</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>Thickness (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TA</td>
<td>1.25±0.13</td>
<td>1.17±0.09</td>
<td>-0.72</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>RF</td>
<td>2.06±0.45</td>
<td>2.10±0.39</td>
<td>0.09</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>SM</td>
<td>1.90±0.25</td>
<td>2.11±0.26</td>
<td>0.82</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** Compared with the stable condition, deep muscle activation increased to adapt to the unstable condition. Study was supported by Independent scientific research plan of Ministry of Education (2012080823)

**NOTES**

**1692**

**June 2, 9:00 AM - 10:30 AM**

**Effects of AquaTitan Bracelet on Quadriceps Muscles Recovery after Fatiguing Muscular Strength and Endurance Exercise**

Ng Yew Cheo1, Govindasamy Balasekaran, FACSM2, Visvasuresh Victor Govindaswamy1, Dianna Thor1, Badriya Al-Hadahi1, Samuel PC1, Jolene Lim Ziyuan1. 1Physical Education and Sports Science, Human Bioenergetics Laboratory, Nanyang Technological University, Singapore, Singapore. 2College of Arts and Science, Computer Science, Concordia University, Chicago, IL. (Sponsor: Dr. Arlette Perry, FACSM)

(No relationships reported)

**Activation Of Lower Limb Deep Muscles During Deep Squats On Different Unstable Surfaces**

Chunneci Cao1, Jingmin Liu1, Yu Liu1, Weimo Zhu, FACSM2, 1Department of Physical Education, Tsinghua University, Beijing, China. 2Department of Psychology, Peking University, Beijing, China. 3University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Weimo Zhu, FACSM)

(No relationships reported)

**1693**

**June 2, 9:00 AM - 10:30 AM**

**Effect of Two Different Isokinetic Training Protocols on Functional Hamstrings-to-Quadriceps Ratios**

Cassio V. Ruas1, Lee E. Brown, FACSM2, Camila D. Lima1, Andre R. Messquita1, Roney S. Pinto1, 1Federal University of Rio Grande do Sul, Porto Alegre, Brazil. 2California State University, Fullerton, Fullerton, CA. (Sponsor: Dr. Arlette Perry, FACSM)

(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 23.73 ± 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 quadriiceps and eccentric hamstrings (CON/ ECC), eccentric quadriiceps and concentric hamstrings (ECC/CON), and no training (CNTRL). Training began with 1 set of 10 maximal repetitions at 210% concentrically and 60% eccentrically. Intensity of training was increased every week by decreasing the angular velocity for concentric and increasing it for eccentric in 30% increments. Volume of training was increased by adding 1 set each week. All training sessions were separated by at least 48 hours. Concentric quadriiceps 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/CON 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/CON training is more effective at increasing the H:Q functional ratio. This may be due to exclusive eccentric hamstrings strength training with no quadriiceps 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
Melanie Potiaumpai, Maria C. Martins, Joseph F. Signorile.
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(No relationships reported)

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 spine (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 (p=0.299), TRI (p=0.348), Delt (p=0.578), GAS (p=0.633; p=0.018) and VMO (p=0.849, p=0.001) favored 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 findings suggest that HS/ECC training is more effective at increasing the H:Q functional ratio. This may be due to exclusive eccentric hamstrings strength training with no quadriiceps concentric strength training. Eccentric training increases eccentric strength, therefore increasing the functional H:Q ratio.

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
Rodrigo Ferrari, Gabriela Rothe, Luiz Fernando Kruehl. Federal University of Rio Grande do Sul, Porto Alegre, Brazil.
Email: rod.ferrari84@gmail.com
(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 were divided into six groups of similar age and body composition. Each group performed a session of six upper limb exercises (bench press, triceps, unilateral row, and unilateral 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 exercise 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        |
| Repetitions   |               |               |               |               |               |
| Bench press   | 15.56 ± 1.15   | 16.07 ± 1.31   | 10.44 ± 1.57   | 10.06 ± 1.95   | 4.69 ± 0.95    | 4.93 ± 1.03   |
| Row           | 13.81 ± 1.28   | 14.13 ± 1.21   | 9.23 ± 1.29    | 9.33 ± 0.96    | 4.88 ± 0.02    | 4.57 ± 0.82   |
| Skull crusher | 16.73 ± 1.07   | 16.07 ± 1.33   | 11.19 ± 1.06   | 10.63 ± 0.13   | 4.74 ± 1.40    | 5.74 ± 1.17   |
| Arm curl      | 16.63 ± 2.78   | 16.40 ± 1.45   | 9.69 ± 1.64    | 10.21 ± 1.93   | 4.31 ± 0.67    | 4.73 ± 0.88   |

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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(No relationships reported)

PURPOSE: To examine the effectiveness of TENS use on quadriiceps 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 quadriiceps 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 ± 12.6kg) 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% MVE was also assessed.

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 ± 12.6kg) 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% MVE was also assessed.
Performing strength exercises on unstable surfaces (US) in comparison to stable mode was the only significant interaction, showing that men using SVP (10.5 ± 5.0 kg), and FW (6.1 ± 4.9 kg), and [3] LM (8.1 ± 5.3 kg), AM (9.3 ± 5.4 kg), and HM (9.7 ± 6.1 kg) made significantly greater improvement than women (7.5 ± 5.6 kg),

RESULTS: Subjects performed 3 sets of 10RM for supplemental arm and leg exercises during each periodization program of increasing loads and decreasing repetitions. In addition, chest press performance. Training was conducted 3X/week for 12 weeks using a linear progression 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.

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 33rd and 67th percentiles of gender-specific distributions. Participants were randomly assigned to free weight (FW, n = 141), seated horizontal press (SP, n = 164), or supine vertical press (SVP, n = 113) groups and measured for same-side 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: SP (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] SP (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.

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, BFR and PAP 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: 5 subjects were randomly assigned to either the experimental (BFR) or control (C) trial in a cross-over design. Trials were preceded by five minute warm-up of treadmill walking at 80% 1-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=0.05) between sprint times, when comparing each subject’s control and BFR trials (p=0.033). 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.

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 (RENEWU) 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 1RM, perceived exertion of “fairly light” to “somewhat hard”). For RENEX-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 resistance.
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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(No relationships reported)

Physical activity in children consists 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 ± 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 x jump height (cm)) + (25.8 x weight (kg)) x 21,413.1 (Canavan & Vescovi, 2004). Participation in extracurricular sports was determined in a questionnaire. Height, weight and skinfolds (triceps and calf) were also measured. Realized 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 tested to detect differences between gender and eccentric sports participation. RESULTS: Jump height and PP (W) increased with age (PP = 1080 ± 329, 1196 ± 261, 1411 ± 316 W for the 1st, 2nd, and 3rd year respectively, p<0.05). 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<0.001), as well as between sum of skinfolds and relative PP (W/kg) (r = -.54, -.65, -.73, for years 1 to 3 respectively, p<0.001). No significant differences were found in PP between extracurricular sport participants vs. non-participants for the 2nd and 3rd year (1214 ± 296 vs 1165 ± 196 W, p=56; and 1468 ± 348 vs 1297± 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., 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 ± SD: age = 24.8 ± 3.1 years; height = 180.2 ± 4.4 cm; mass = 91.0 ± 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 ± SD: slope = -48.1 ± 47.6 microvolts/sec; Y-intercept = -27.2 ± 20.1 microvolts; r2 = 0.37 ± 0.28). Additionally, 5 of the 12 subjects displayed significant linear relationships for MMG mean frequency across time: (mean ± SD: slope = -0.27 ± 0.42 Hz/sec; Y-intercept = 48.2 ± 20.5 Hz; r2 = 0.18 ± 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. 2d.wk1 the first 4 wk and 3.d.wk1 the last 4 weeks). 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, and after RRT.

RESULTS: RRT1, RRT2, and DT showed similar increases in the TCSA after the HIRT period [16.5% ± (5.6), 15.9% ± (2.7), and 17.1% ± (4.0), (p=0.01, respectively)]. The 1RM and PPw also increased similarly for all three groups [17.2% ± (2.9), 41.1% ± (6.4) and 41.8% ± (6.4) for the first period, and 17.7% ± (3.5), and 55.5% ± (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±4.2%), IRM (23.7±6.8%), and PPw (15.7±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.

Abstracts were prepared by the authors and printed as submitted.
METHODS: Nine healthy males and nine healthy females (age = 21.1 ± 1.4; 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. The time to completion was measured. Position and EMG were sampled at 10 kHz. 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) (120°-150° (M), and load range (L) (120°-150°). EMG was quantified via normalized root mean square (RMS) of the EMG signal within 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.

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: To determine the effect of window in which to collect normalized 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 (window) x 3 (muscle combination) ANOVA. Alpha was set at .05. RESULTS: There was no interaction between window and muscle. There was no main effect of window. There was a main effect of muscle, where normalized MPF slopes of 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 MPF slopes (95% CI for difference: -074 to .012). CONCLUSION: EMG MPF slope data suggests that, during a 50-repetition 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.

It has been suggested that training-related increases in maximal velocity parameters (MPVs) may be mediated through neural mechanisms, however, little evidence exists regarding training induced changes in early-phase muscle activation and MPVs. PURPOSE: To examine the effects of short-term strength training (ST) on MPVs 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 years) 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 years) only participated in the testing sessions. ST sessions consisted of maximal concentric contractions of the knee extensors at 45°/s 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 (Isok500) was performed before (pre), at week 2 (mid), and after week 4 (post) of ST. There was no resistance during Isok500, 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 Isok500. Surface electromyography (EMG) of the vastus lateralis was recorded in order to determine the linear slope of the EMG RMS data from each of the two time periods after the onset of contraction (RER). The contraction producing the highest PV was used for subsequent analysis of all dependent variables (DV’s). 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 DV’s. In the TG there were no changes in any of the DV’s across time in the CG (p > .05). PV (p = .448), RVD (p = .378), and RER (p = .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.

Background: According to the Standard Canadian Society of Exercise Physiology (SCSEP), individuals <45 y 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 each 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], 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 43 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.

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 100 reps. Each 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 43 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.
Effects of Unilateral and Bilateral Plyometric Training on Leg Strength and Rate of Force Development

**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 flexions and extinctions 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±6.8% and 14.6±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±6.5%, U group: 19.9±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±9.1% vs. 13.3±6.2%, p=0.018, respectively). RFD was only increased in the U group (24.4%, p=0.023) but not in the B group (12.576±5.300 vs. 13.052±3.914 Ns, p=0.67).

**CONCLUSIONS:** Unilateral plyometric and strength/power training of the lower limbs may be more effective when exercises are performed with each limb separately, since both unilateral and bilateral maximal strength and RFD are improved.

The Effect of Suspension Exercise on Neuromuscular Control of Trunk Muscle in Healthy Adults

Research indicates that coherence between motor cortex and muscles (corticospinal coherence) could represent the capacity of the functional link between brain and muscle. Greater coherence suggests better neuromuscular control. We will utilize corticospinal 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.

**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:** Corticospinal coherence value of beta band area (13-30 Hz) increased after six weeks of suspension exercise training (0.1191±0.0598 vs. 0.1846±0.0551, p<0.05).

**CONCLUSIONS:** Suspension exercise training could improve neuromuscular control of transversus abdominis/internal oblique muscle.