Thematic Poster - Cardiovascular Responses To Heat Exposure

Friday, June 2, 2017, 9:30 AM - 11:30 AM
Room: 404

Chair: Vienna E. Brunt, University of Colorado-Boulder, Boulder, CO.
(No relationships reported)

2391
Board #1
June 2 June 9:30 AM - 11:30 AM
Impact Of Progressive, Chronic Dehydration On Cardiovascular Responses To Exercise In A Heated Environment
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PURPOSE: To determine the independent effects of chronic hypohydration on cardiovascular (CV) responses during exercise in a heated environment. METHODS: Participants (n=18, 21±1y; mean±SD) followed 3 days of self-determined dehydration (DEH) and then 3 days of hydration (HYD) during a 30-min run at 70% VO2peak in the heat (30°C). RESULTS: Initial plasma volume was decreased in DEH (P<0.05) compared to HYD. Total body temperature was also decreased in DEH (P<0.05) compared to HYD. There were no differences in heart rate, blood pressure, or VO2peak between conditions.

2392
Board #2
June 2 June 9:30 AM - 11:30 AM
The Independent Effect of Heart Rate on Stroke Volume When Skin Temperature is Hot and Cool During Exercise
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(No relationships reported)

There are two hypotheses of how stroke volume (SV) is affected during hyperthermic exercise. The traditional hypothesis is that an increase in cutaneous blood flow (CBF) is thought to lead to a decline in SV. An alternate hypothesis is that a decline in SV is due to an increase in heart rate (HR). However, these two hypotheses have not been tested under the same thermal stress. PURPOSE: To determine the independent effect of HR on SV by using low dose β1-blockade (BB) when skin temperature (Tsk) is high (>38°C) during exercise. 2) To see how the rapid lowering of Tsk reverses the changes in cardiovascular variables. METHODS: Tsk was manipulated by wearing a water perfused suit that covered the whole body, except head, hands, and feet and maintained a perfused water temperature of 30°C to 50°C. Subjects cycled at 60% VO2peak for 30 min in 3 trial conditions: 30°C water with (30-PL), 50°C water with (50-PL), and 50-PL with BB. Tsk was rapidly cooled at 20 min of exercise in all trials by perfusing cold water through the suit (0°C) plus fans. RESULTS: There were no apparent changes in SV when Tsk was maintained in 50-PL. There was no apparent effect of Tsk on FVF responses. CONCLUSION: The increase in HR was responsible for the decrease in SV when Tsk was above 38°C. Rapidly cooling Tsk while Tsk remains elevated decreased CBF and HR.

2393
Board #3
June 2 June 9:30 AM - 11:30 AM
Heart Rate Variability as Potential Indication to the Mechanism of Heat Intolerance
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(No relationships reported)

Objective: To determine whether non-linear HRV measures during heat intolerance (HT) may be used as an indication to the mechanism of heat intolerance. METHODS: HTTs from the IDF Institute of Military Physiology database performed between the years 2012-2015 were analyzed. The non-linear HRV indices D2, SD1/SD2, and APEn have been made for the full HTTs (120 minutes) by a researcher blinded to the HTT results and to the patients’ clinical records. HRV indices were then compared between heat intolerant (HI) and heat tolerant (HT) individuals. RESULTS: Our data included 283 HTTs (215 HT, 76%; and 68 HI, 24%). We found significant differences between HT and HI tests in D2 (HI - 0.0355±0.0261, HT - 0.0096±0.104, P<0.001) and APEn (HI - 1.429±0.079, HT - 1.395±0.11, P<0.027) but not in SD1/SD2 (HI - 0.331±0.067, HT - 0.335±0.007, P<0.72). We found a weak correlation between the HRV indices and the initial and final core temperatures and heart rates. CONCLUSIONS: We found that HT and HI individuals differ in some non-linear HRV measures during an HTT. Although the differences are statistically significant, the values overlap between HT and HI individuals, thus HRV during an HT (using the non-linear methods examined in this study) does not seem to be a valuable tool for heat intolerance diagnosis, but it may serve as a potential indirect indicator to the relative contribution of the ANS to HSV to HT states, and thus to the mechanism associated with HI phenomena.

This work was supported by a grant from the Israeli MOD.

2394
Board #3
June 2 June 9:30 AM - 11:30 AM
Whole-body Heat Stress Sensitizes β1-adrenergic Receptor Mediated Cardiac Systolic Function
Gilbert Moralez1, Ken Kouda1, Michinari Hieda1, Satyam Sarma1, Steven A. Romero2, Matthew N. Cramer1, Amy N. Adams1, Manall F. Jaffery1, Craig G. C randall, FACSM1. 1Institute for Exercise and Environmental Medicine, Presbyterian Hospital and UT Southwestern Medical Center, Dallas, TX. 2Wakeyama Medical University; Wakeyama, Japan. (Sponsor: Craig G. C randall, FACSM)
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Whole-body heat stress improves cardiac systolic function, which is vital towards the maintenance of stroke volume despite reductions in central blood volume and cardiac filling pressure. However, the mechanisms by which cardiac systolic function is enhanced during heat stress are unclear. PURPOSE: To test the hypothesis that whole-body passive heat stress sensitizes β1-adrenergic receptor mediated increases in cardiac systolic function. METHODS: In ten healthy participants (five females: age 23 ± 2 and five males: age 26 ± 3), echocardiographic indices of cardiac systolic function (average peak systolic tissue velocity at the septal and lateral mitral sites - S'avg) were obtained prior to and during intravenous infusion of a low (5 µg/kg/min) and a moderate (15 µg/kg/min) dose of dobutamine (β1-adrenergic receptor agonist) under normothermic (HT) and hyperthermic (HT) increase internal temperature of 1.2 ± 0.1°C conditions. RESULTS: HT increased S'avg at baseline (NT, 9.5 ± 0.5 cm/s vs HT, 14.0 ± 1.0 cm/s, P<0.01). However, the low dose of dobutamine during HT further increased S'avg (A.6.5 ± 1.2 cm/s) compared to S'avg in HT (4.0 ± 0.7 cm/s, P<0.05).
Effect of Exercise Mode on Cardiovascular Drift and Maximal Oxygen Uptake During Heat Stress

Tori M. Stone1, Jonathan E. Wingo, FACSM2, Jason Ng3. The University of Alabama, Tuscaloosa, AL. *California State University, San Bernardino, San Bernardino, CA. (Sponsor: Jonathan E. Wingo, FACSM) Email: tmston3c@crimson.ua.edu

Effect of Exercise Mode on Cardiovascular Drift and Maximal Oxygen Uptake During Heat Stress

Cycling has been reported to result in greater cardiovascular drift (CV drift) compared to running in a temperate environment. It remains unknown whether this holds true in a hot environment. It also remains unknown whether a greater magnitude of CV drift during cycling is associated with a greater decrement in maximal oxygen uptake (VO₂max) compared to running.

PURPOSE: To test the hypothesis that cycling elicits a greater magnitude of CV drift and accompanying greater decrement in VO₂max compared to running. METHODS: Seven men (mean ± SD; age = 25 ± 6 y; body fat = 12.0 ± 2.2%; bike VO₂max = 58.9 ± 4.3 mL/kg/min; treadmill VO₂max = 59.9 ± 4.3 mL/kg/min) completed a graded exercise test on a cycle ergometer and a treadmill (separate days) in ~22 °C to determine VO₂max. Then on separate visits (counterbalanced) they cycled or ran for either 15 or 45 min at 60% mode-specific VO₂max in 35 °C. CV drift was measured between 15 and 45 min during the 45-min trials. The purpose of the separate 15- and 45-min trials was to measure VO₂max over the same time interval that CV drift occurred. RESULTS: The increase in heart rate (HR; ~13% for bike and treadmill, p<0.001) and decrease in stroke volume (SV; ~12% and ~15.5% for bike and treadmill, respectively, p<0.001) between 15 and 45 min were not different between exercise modes (p=0.91 and 0.53 for mode × time interaction for HR and SV, respectively). VO₂max decreased 15% from 15 to 45 min (p<0.002), but the reduction was not different between exercise modes (p=0.54 for mode × time interaction). CONCLUSION: Contrary to our hypothesis and to previous findings in a temperate environment, the magnitude of CV drift during prolonged exercise in the heat was not different between cycling and treadmill running. The rise in HR and concomitant decrease in SV associated with CV drift in the heat—regardless of the exercise mode—corresponded to a proportional decrease in VO₂max.

Blood Pressure and Cardiovascular Responses to Emergency Calls in Volunteer Firefighters and Emergency Medical Technicians

Meaghan E. Corbin1, Cassandra C. Derella1, Kelly C. McLaughlin1, Allyson K. Getty1, Lauren N. Chavis1, Tia R. Wisdo1, Christian K. Roberts, FACSM2, Deborah L. Fearheil1. *URSUS College, Collegeville, PA. Occidental College, Los Angeles, CA. (Sponsor: Christian K Roberts, FACSM) Email: meccorbin@ursinus.edu

Blood Pressure and Cardiovascular Responses to Emergency Calls in Volunteer Firefighters and Emergency Medical Technicians

Hypertension and obesity are both primary risk factors for cardiovascular (CV) disease. Among the firefighter (FF) population cardiac events remain the leading cause of line-of-duty deaths. Work related stress can cause a surge in heart rate and blood pressure (BP) and studies have noted that FF and Emergency Medical Technicians (EMTs) have increased heart rate and BP throughout their shift. Thus, understanding the risk factors associated with work related stress in FF and EMTs, including BP surges and CV disease risk are important factors in continual need of study. PURPOSE: To examine the relationship between BP responses to emergency calls and CV health. METHODS: Eight FF and EMTs (7M/1F; 2EMTs/6FFs; 32.8±9.3 yrs) were asymptomatic brachial BP cuffs during a 12-hour work shift to observe BP responses to emergency calls. Additionally, plasma glucose levels, total cholesterol levels and triglyceride (TG) levels, and central BP through radial artery tonometry was obtained to emergency calls. In addition, a preliminary sub-analysis was completed between 4 lean and 4 obese (BMI 30-kg/m²) groups. RESULTS: Average 12-h BP was 118.8±7.4/74.0±6.7 mmHg. With emergency calls, the brachial BP surge was 20.7±14.9 / 10.0±6.7 mmHg compared to the measured brachial BP immediately before alarms. When compared to the mean 12-h BP, the BP surge was larger (22.9±11.7 / 13.6±6.6 mmHg). We found no relationship between central BP surge and CV health measures in the group and no relationship between core BP and BP surge. In the sub-analysis, the average brachial BP for lean group (BMI 22.9±4.7 kg/m²) was 118.4±24.3 / 71.4±31.9 mmHg, and the average brachial BP for the obese group (BMI 37.2±6.3 kg/m²) was 136.3±5.1 / 84.9±4.4 mmHg. Central BP in the lean population was 103.6±6.6 / 72.9±5.8 mmHg, while in the obese population it was 118.5±9.0 / 85.0±11.8 mmHg. We found a relationship between diastolic BP surge and glucose levels in both groups, as well as a correlation between diastolic BP surge and TG in lean group (p<0.05). CONCLUSION: This pilot data suggests that both systolic and diastolic BP surge during emergency calls. The data also preliminarily indicates that obese emergency workers exhibit higher brachial and central BP. Further research is needed to determine whether obese firefighters are at risk of CV events during emergency calls.

Blood Pressure and Cardiovascular Responses to Emergency Calls in Volunteer Firefighters and Emergency Medical Technicians

Eight FF and EMTs (7M/1F; 2EMTs/6FFs; 32.8±9.3 yrs) wore a blood pressure cuff during a 12-hour work shift. Although the time spent on vigorous activities was short, its intensity varied. HR and BP comparisons in the 3 evaluations are shown on Table. CONCLUSION: Our data show a significant increase in resting HR after 12-hour on-duty shift work. Although the time spent on vigorous activities was short, its intensity might represent an acute elevated risk for fatal and non-fatal cardiovascular event in susceptible firefighters.
METHODS: We evaluated 30 male military FF, aged 40±3.2 yrs, BMI = 26.3±3.1 career firefighters (FF), in association with the CRF.

PURPOSE: The present study was conducted to examine the behavioral cognitive and neurophysiological effects of acute exposure to simulated moderate and high altitudes at rest and during exercise in an effort to delineate whether there is a level of simulated altitude beyond which executive cognitive functions are impaired and neurophysiological effects of acute exposure to simulated moderate and high altitudes.

RESULTS: For the Flanker task, both MA and HA slowed reaction time (p<0.04), while exercise improved reaction time (p<0.01). Similarly, for the Stroop task, HA (though not MA) slowed reaction time (p=0.02), while exercise improved reaction time (p=0.04). Accuracy was preserved under all conditions. These effects were partially explained by alterations in associated event-related potential amplitudes and latencies, such as slower N200 latencies with altitude (p=0.04) but faster latencies with exercise (p<0.01), as well as reduced P300 amplitude and slower latency with altitude (p<0.01), and reduced amplitude but faster latency with exercise (p=0.03).

Conclusions: Acute exposure to simulated altitudes slows behavioral cognitive reaction time on executive function tasks while preserving task accuracy. An acute bout of moderate intensity cycling exercise improves reaction times so that they are comparable to those achieved without exercise or simulated altitude exposure, at least in instances where exercise does not exacerbate the peripheral oxygen saturation drops seen with simulated altitude.

PNN50% in SUP and ORT, at control (Eva1), before (Eva2) and after a routine work (Eva3)

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<th>SUP</th>
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<tr>
<td>Eva1</td>
<td>11.4 (0.0 - 54.0)</td>
<td>2.6 (0.0 - 31.5)</td>
<td>&lt;0.01</td>
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<tr>
<td>Eva2</td>
<td>7.8 (0.0 - 53.6)</td>
<td>1.0 (0.0 - 25.2)</td>
<td>&lt;0.01</td>
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<td>Eva3</td>
<td>11.4 (0.0 - 61.4)</td>
<td>0.35 (0.0 - 60.3)</td>
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<td>p/F</td>
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Theories currently used to understand exercise behavior focus on cognitive constructs but overlook the potential role of affect. However, recent studies have yielded evidence of an association between exercise-induced affect and exercise behavior, focusing on single assessments of affect during and post-exercise or pre-post changes. We extend this line of research by (a) tracking the affective response with multiple assessments during exercise and calculating individual slopes of change and (b) setting exercise intensity at the ventilatory threshold (VT), where interindividual variability in affective responses is expected to be maximized, according to the dual-mode theory. Purpose: To assess the relations between slope of affective valence (AV; i.e., pleasure-versus-displeasure) and the mean AV during exercise at the VT with exercise behavior.

Methods: Volunteers (N=93; 62.4% female; VO2peak: 31.7±8.13 mL kg^(-1) min^(-1); BMI: 25.05±4.86 kg m^(-2); age: 25.27±9.11 years) completed a maximal exercise test to determine the VT. One week later, participants completed a 5 min warm up followed by 10 min of exercise at the watts corresponding to the VT. During exercise, AV was assessed every 2 min using the Feeling Scale (FS; Hardy & RJ Ejes). Leisure-time moderate- and vigorous-intensity exercise behavior were assessed one week earlier using the International Physical Activity Questionnaire (Craig et al., 2003). Results: As anticipated, considerable heterogeneity in the slope of AV during exercise was evident; 62% of participants reported declines whereas 23.9% reported increases.

Abstracts were prepared by the authors and printed as submitted.
reported improvements. The slope of AV was related to moderate (r = -.22, p ≤ .03) but not vigorous exercise behavior (r = .04, p = .72). Mean AV during exercise was also related to moderate (r = -.28, p ≤ .006) but not vigorous exercise behavior (r = -.08, p = .74). Conclusions: AV during exercise is associated with moderate, but not vigorous, exercise behavior. Future investigators should determine if changes in AV during exercise correspond to changes in exercise behavior in longitudinal studies.

2403  Board #3  June 2 9:30 AM - 11:30 AM Does A Mentally Demanding Cognitive Task Influence Motor Reaction Time? Bart Roelands1, Jeroen Van Cutsem2, Samuele Marcora2, Romain Meeussen, FACSM3. 1Vrije Universiteit Brussel, Brussels, Belgium. 2University of Kent, Kent, United Kingdom. (Sponsor: Romain Meeussen, FACSM) Email: bart.roelands@vub.ac.be

PURPOSE. Recent research has reported mental fatigue not only impairs endurance, but also sport-specific technical performance. Therefore we sought to examine the effect of a mentally fatiguing task on a motor-reaction time (M-RRT) task.

METHODS. A M-RRT task was developed with Fitlight hardware and software in order to evaluate the effect of mental fatigue on stimultype (simple vs. response inhibition) and visual-field position (central vs. peripheral). Eleven untrained healthy subjects (age: 25 ± 4y; 6 female, 5 male) performed two experimental trials in a randomized crossover order. Participants first completed a baseline M-RRT task (-6min, 90sec), followed by a Flanker task. Next they performed either a 90min mentally fatiguing task (Stroop task; MF) or watched a 90min documentary (CON). Immediately thereafter again the Flanker task and the M-RRT task were completed. Accuracy (ACC) and reaction time (RT) were followed up in all tasks but the documentary. In addition multiple physiological and psychological measures were assessed during the protocol.

RESULTS. ACC on both the Stroop task (p = 0.021) and the Flanker task (p ≤ .03; p = 0.048) dropped over time in MF. Participants got faster over time on the Stroop task in MF (p ≤ .004). RT on the Flanker task did not change over time in both MF and CON. Subjectively, higher (p ≤ .001) mental fatigue was perceived in MF compared to CON. Concerning the M-RRT-performance, no effects were observed for the simple stimuli. For the response inhibition-stimuli, only in MF participants became significantly slower in time (—7.5%; p ≤ .007).

CONCLUSION. Mental fatigue negatively affects sport-specific response inhibition—RT. Therefore, besides endurance capacity, also sport-specific cognitive performance appears to be impaired by mental fatigue. The impairment in RT was independent from the visual-field position of the stimulus and was not perceived by the participants.

2404  Board #4  June 2 9:30 AM - 11:30 AM Regulating Pleasure During Exercise: Impact on Exercise Adherence Nicole B. Doolen, Walter R. Bixby, FACSM, Elon University, Elon, NC.

PURPOSE: To compare the impacts of an affect-based exercise prescription (Feeling Scale) versus an intensity-based exercise prescription (Rating of Perceived Exertion) on changes in exercise adherence. METHODS: Participants were assigned to an FS prescription (n = 26) or a RPE prescription (n = 24) for a 6-week intervention consisting of at least 30 minutes of cardiovascular exercise on at least 3 days per week. The FS prescription required participants to maintain a perceived FS value of at least 4 (somewhat hard) throughout each exercise bout. Exercise logs were used to assess exercise participation and minutes of exercise per week at 1, 3, and 6 months post-intervention. RESULTS: For the 26 participants in the FS group who began the intervention, 77% completed the 6 weeks, 62% reported exercise at 1 month, 46% reported exercise at 3 months, and 31% reported exercise at 6 months. For the 24 participants in the RPE group who began the intervention, 67% completed the 6 weeks, 38% reported exercise at 1 month, 21% reported exercise at 3 months, and 25% reported exercise at 6 months. For minutes of exercise per week, a 2 (group) x 3 (time)ANOVA with repeated measures on the time factor revealed a significant main effect for time, F(2, 48) = 3.20, p = .049. Minutes of exercise for the FS and RPE groups varied at 1, 3, and 6 months: FS = 96.2, 61.4, & 57.3; RPE = 89.1, 37.7, & 94.5.

CONCLUSION: Drop-out rate was lower for the FS group across all time points. Three months post-intervention, more participants in the FS group reported exercise and they did more minutes of exercise per week. At 6 months, this trend in adherence for the FS group had disappeared. A more robust intervention may have improved 6 month adherence.
CONCLUSIONS: In univariate analyses, sex and contact level were associated with emotion dysregulation in high school athletes. Concussion history and incident concussion were not associated with emotion dysregulation in high school athletes. Concussion history and sex, contact level and concussion history in high school athletes.

METHODS: Postseason concussion history and emotion dysregulation measures were collected at one high school during 2013-2014 and 2014-2015 and at three high schools during 2015-2016. Sports were categorized into no-contact (cross country, swimming, tennis, track), low-contact (baseball, basketball, diving, softball, volleyball), and high-contact sports (field hockey, football, lacrosse, soccer, wrestling). Concussion history and incident concussion were analyzed as dichotomous variables (any vs. none). One-way analysis of variance was used for all analyses. Preseason emotion dysregulation scores and sport were used as covariates for all analyses.

RESULTS: Postseason data were collected from 717 athletes (n=392 males, 325 females; age=15.7 ±2.2 years) who averaged 5.7 ± 3.5 years of sport participation. Females reported significantly lower anger scores compared to males (B = -10.489, p<0.008, 95% CI: -18.219, -2.759). Low contact sport reported significantly lower anxiousness compared to higher contact sports (B = -10.487, p=0.0079, 95% CI: -18.218, -2.756). No other significant postseason behavior dysregulation differences were found between sex (p=0.020), contact levels (p=0.020), concussion history (p=0.111), or incident concussion (p=0.206).

CONCLUSIONS: In univariate analyses, sex and contact level were associated with emotion dysregulation in high school athletes. Concussion history and incident concussion were not associated with postseason emotion dysregulation in high school athletes. Longitudinal studies over several years may be needed to determine these relationships.
**2412 Board #3 June 2 9:30 AM - 11:30 AM**

**Cardioprotection in Breast Cancer Survivors: Sports Activity Vs Exercise As Prescription Model**

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(No relationships reported)

**PURPOSE:** Cardiotoxicity is the second leading cause of long-term morbidity and mortality among cancer survivors. Regular exercise program and sport are normally proposed to maintain myocardial performance. No data is available about actual myocardial benefits when different levels of physical exercise are allowed. The study aims to report clinical and cardiac outcomes, by the 2D Speckle tracking (ST) analysis, in order to detect the eventual differences between the sports activity and exercise model to protect patients survived to breast cancer. METHODS: From a cohort of 55 previous cancer patients, a group of 23 subjects trained in competitive sports activity Dragon Boat Athletes (DBA) for at least 5 yrs were selected. They were evaluated by echo exam including LV Longitudinal Strain (SI) assessment (XStrain - Essaoe) and matched with a group of 23 previous cancer patients following the Exercise as prescription therapy program. They were compared with two groups of healthy subjects: 20 athletes (HA) from different kinds of non competitive sports, and 20 volunteers submitted to the exercise as prescription program. RESULTS: All data were compared by T-student test. Despite not significant differences of the EF values, the SI resulted to be different among the groups. Significantly higher in healthy subjects volunteers submitted to the exercise as prescription program. RESULTS: All data were compared with two groups of healthy subjects: Healthy Athletes and Healthy volunteers submitted to the exercise as prescription model.

**CONCLUSIONS:** An iKT approach, involving survivors and their families, can help inform exercise programming issues and the need for program modification to optimize survivor satisfaction and adherence.

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applicable and helpful to the knowledge users. **PURPOSE:** To identify barriers, facilitators and preferences towards exercise of cancer survivors after participation in the ACE pilot study. **METHODS:** A longitudinal descriptive design using mixed methods research methodology was used to better understand the participant exercise experience. Following study completion, a post-study satisfaction questionnaire was administered and a focus group session was held. Quantitative data were analyzed descriptively and qualitative data used to interpret, clarify and further describe quantitative results. **RESULTS:** 82% of participants indicated a preference for a combination of unsupervised and supervised exercise, 77% preferring to exercise with other cancer survivors, and 67% for exercise programming to occur in a community facility. 76% perceived little to no difficulty in continuing to exercise independently. A major theme emerging was the lack of counselling from healthcare providers on exercise during the cancer treatment period. Oncologist referral to the ACE pilot was minimal, with 93% of survivors indicating they self-referred to the program. Specifically, participants identified a lack of (1) communication on the value of exercise for recovery and (2) provision of information on the availability of cancer-specific exercise programming. **CONCLUSIONS:** An iKT approach, involving survivors and their families, can help inform exercise programming issues and the need for program modification to optimize survivor satisfaction and adherence.

**2413 Board #4 June 2 9:30 AM - 11:30 AM**

**Effect of an Argentine Tango Intervention on Gait Variability in Cancer Survivors**

Ajit M.W. Chaudhari, FACSM, Scott M. Monfort, Marie T. Lamantia, Maryam B. Lustberg, Lise C. Worthen-Chaudhari, The Ohio State University, Columbus, OH.

(No relationships reported)

**BACKGROUND:** Advances in cancer diagnoses and treatment have contributed to improved outcomes for many cancers. The increasing number of cancer survivors and increased risk of falling in cancer survivors support the need for interventions to mitigate functional impairments in this population. Argentine tango has demonstrated efficacy as a dance-based intervention in improving function in the elderly as well as patients with Parkinson’s disease; however, the efficacy of this intervention in cancer survivors has yet to be elucidated.

**PURPOSE:** To investigate the efficacy of an Argentine tango intervention on a measure of fall risk (i.e., stride-to-stride gait variability) in a group of cancer survivors.

**METHODS:** Seven cancer survivors (2m:5f; 63.9 ± 10.2y; 1.74 ± 0.11m; 79.7 ± 12.1kg) participated in a 10-week Argentine tango intervention, which consisted of one hour of instructed class held twice a week. Gait assessments were conducted before starting the intervention – baseline, at a five week midpoint, and at the conclusion of the 10-week intervention. Gait analysis consisted of survivors walking on a treadmill while bilateral lower extremity kinematics were recorded (MTP Series 2 system, Motra Innovation). During all testing timepoints, survivors walked at the 25% self-selected speeds that were identified at the baseline timepoint. Mean, standard deviation (SD), and coefficient of variation (CV) of stride-to-stride fluctuations in speed, stride length, stride time, and step width were calculated. Linear mixed models for repeated measures with survivors as a random effect, and testing timepoint as the fixed effect, were used to estimate changes for each gait parameter.

**RESULTS:** The CV of stride-to-stride fluctuations in speed decreased post-intervention (pre: CV = 3.0%, post: 2.2%, p = 0.003). Additionally, the SD of stride-to-stride speed decreased post-intervention (pre: σ = 0.026 m/sec, post: 0.019 m/sec, p = 0.004). No other gait parameters differed significantly between study timepoints (p>0.05).

**CONCLUSION:** Argentine tango was found to improve stride-to-stride variability in gait speed. This study supports the efficacy of dance-based exercise interventions to improve gait variability and potentially decrease falls risk in cancer survivors.

**Exercise Maintenance After a Randomized Resistance Training Intervention in Breast Cancer Survivors Undergoing Adjuvant Therapy**

Martina E. Schmid1, Joachim Wiskemann2, Cornelia M. Ulrich1, Andreas Schneeweiss3, Karin Steinendorf2, 4German Cancer Research Center (DKFZ) and National Center for Tumor Diseases (NCT), Heidelberg, Germany. 5University Hospital Heidelberg and National Center for Tumor Diseases (NCT), Heidelberg, Germany. 6Huntsman Cancer Institute and University of Utah, Salt Lake City, UT. (Sponsor: Juergen Scharhag, FACSM)

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(No relationships reported)

Exercise is highly recommended for breast cancer patients and survivors and may be increased by supervised interventions. Yet, still little is known about factors influencing the longterm physical activity behavior after the end of an Intervention. **PURPOSE:** To investigate the course and determinants of physical activity of breast cancer patients during and up to 12 months after a supervised resistance exercise intervention concomitant to adjuvant cancer treatment. **METHODS:** Physical activity was assessed in 227 breast cancer survivors before, during, and 3, 6 and 12 months after they participated in two randomized controlled trials investigating 12-week supervised resistance exercise vs. a relaxation control group concomitant to adjuvant chemotherapy (BEAT-Study, NCT0106820) or radiotherapy (BEST-Study, NCT01468766). To identify determinants of physical activity multiple ordinal logistic regression analyses were performed. **RESULTS:** During adjuvant therapy the intervention group exercised a median 1.8 h per week (interquartile range: 1.4–2.5), while 68% of controls did not engage in any exercise. Yet, irrespective of the intervention 32% of patients did not engage in any exercise at 12-month follow-up. Of the patients who cycled for transportation pre-diagnosis about half stopped cycling in the long run in both groups. In contrast, walking was maintained over time. Low levels of exercise at 12 months were determined by low pre-diagnosis levels of exercise (p<0.001), lower education (p=0.0032), being postmenopausal (p=0.028), and having breast problems (p=0.0099) or depressive symptoms (p=0.059). At 12-month follow-up survivors who exercised was more common in the exercise group compared to the control Group. **CONCLUSIONS:** Breast cancer patients markedly decreased the exercise level and cycling for transportation after diagnosis and treatment. Yet, our resistance training intervention effectively counterbalanced this decline and boosted strength.
exercise in the months following the intervention. However, in the longer term many
survivors were insufficiently active. Our results that identified subgroups especially
vulnerable to physical inactivity may help to develop better individually tailored
strategies to improve the physical activity behavior in breast cancer survivors in the
long run.

Sleep problems frequently affect breast cancer patients during and after treatment
and reduce their quality of life. However, coping and treatment strategies are mostly
unknown or understudied. Only few studies have investigated the effect of exercise on
sleep quality, particularly during the course of radiotherapy. PURPOSE: To assess
within a large randomized controlled trial whether a 12-week exercise program starting
with the radiotherapy influences sleep trajectories.METHODS: Sleep problems were
assessed via self-report in 160 breast cancer patients before, during, and 3.6 and 12
months after they participated in a trial investigating 12-week resistance exercise
versus a relaxation control group concomitant to adjuvant radiotherapy (BEST-Study,
NCT01568766). In addition, 25 age-matched women without cancer were exercising and
followed the same study protocol for comparison purposes. RESULTS: Ordinal
logistic regression analyses revealed significant exercise intervention effects regarding
the changes in sleep problems (scale: 0-100) from baseline to the end of radiotherapy
(mean between-group difference (MD): -10.2, p=0.03) and to the end of intervention
(MD= -10.9, p=0.01), with sleep problems decreasing in the exercise group and
increasing in the control group. At 12 months, differences were still observed but
were statistically non-significant (MD= -5.9, p=0.3). Further adjustment for potential
confounders did not change the results. The course of sleep problems in exercising
women during the exercise phase was similar in breast cancer patients and in healthy
exercisers, yet, patients experienced significantly higher levels of sleep problems at all
times. CONCLUSIONS: Our large randomized exercise intervention trial confirmed
results from earlier but mostly small studies that radiotherapy aggravates sleep
problems in breast cancer patients and that exercise represents an effective treatment
option. Given the strong link between quality of life and sleep problems, our findings
that a 12-week resistance training for breast cancer patients undergoing radiotherapy
reduces sleep problems is of high importance for many cancer patients.

Cancer-related fatigue is the most commonly reported side effect in cancer patients.
This debilitating fatigue is often accompanied by reductions in overall physical activity
and physical function. Whereas fatigue in cancer survivors seems partially dependent
on neuromuscular factors, these relationships have not been established in Hodgkin’s
lymphoma survivors (HLS). PURPOSE: To assess self-perceived fatigue and muscle quality in Hodgkin’s
lymphoma survivors. METHODS: A total of 12 HLS, age 32.16 ± 8.06, and 36 control healthy subjects
(CON) matched by age, gender and level of physical activity were enrolled in the
study. Fatigue was measured using MF1-20. Muscle thickness of knee extenders (MT)
was measured using B-mode ultrasound. Muscle quality was assessed by echo intensity
(EIF) of rectus femoris and specific torque (ST) of the knee extensors. The ST was
calculated as follows: isokinetic peak torque (PT)/ MT. Isokinetic PT was measured
by two sets of four maximal isokinetic knee extension at 60°/s’. Independent samples
T-tests were used to compare physical characteristics, muscle function and fatigue
between HLS and CON.

RESULTS: No significant differences (p > 0.05) in any physical characteristics
were observed. There was no difference in PT (HLS: 384.58 ± 55.91 vs. CON: 199.14 ± 60.57; N= 0.552),
MT (HLS: 27.35 ± 8.70 vs. CON: 28.55 ± 7.58 mm; p = 0.439), EIF (HLS: 63.18 ± 11.12 vs. CON: 65.36 ± 11.76; p
= 0.575), and ST (HLS: 6.89 ± 1.59 vs. CON: 7.05 ± 1.46 Nm/mm; p = 0.737). However, there was a significant difference between HLS and CON for self-perceived
fatigue (HLS: 14.00 ± 3.91 vs. CON: 10.80 ± 3.36; p = 0.009; ES = 0.8778).

CONCLUSION: A higher level of self-perceived fatigue was observed in HLS when
compared to CON. However, no differences in muscle quality were observed when
HLS are matched by age, gender and physical activity level with CON. It appears that
as HLS are further out from the completion of their major treatments, their muscle
characteristics and function are preserved if they maintain certain level of physical
activity. This study provides insight on the potential similarities between HLS and
CON, with same physical activities level, regarding muscle characteristics, function,
and performance, which should be considered when prescribing exercise training to
this population.

Purpose: To determine the extent to which 12
body composition and fitness are just as important as technique development for
dancers. Supplementation protocols may be a simple way to optimize body composition,
performance, and aesthetics without dramatically changing classical training. To date,
no studies have investigated the impact of supplemental protein on body composition
and performance in dancers. PURPOSE: To determine the extent to which 12
Inadequate Caloric Intake Amid Inadequate Caloric Intake In Collegiate Female Gymnasts

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Collegiate, women’s gymnastics is a sport that requires explosive muscular contractions, muscular endurance, and demands twice-daily workout schedules. What is lesser known is if day-to-day variations in eating exist, and if so, would they tend to result in balanced energy requirements, or a deficit. PURPOSE: To determine if daily variations in energy intake and nutrient insufficiency occurs during a competition week for female gymnasts. METHODS: Female, NCAA gymnasts (n=14; 20 ±1.2 y; BMI =23.4 ±2.5 kg·m⁻²) provided 7-day food and physical activity recalls during a week for female gymnasts.

RESULTS: There were no significant differences between groups at baseline. PLA consumed significantly lower protein (0.9 g/kg/day) than PRO every week of the study (2.4 g/kg/day; p<0.001). Body weight, fat and lean mass did not change between groups or over time. Lean mass index (LMI; absolute value of fat change plus muscle change) was significantly higher in PRO (99.6 ± 19) compared to PLA (83.8 ± 3.1; p=0.048) at week 12. PLA significantly increased peak power during the Wingate anaerobic power test from baseline to week 12 absolute (746.4 ± 92.9 W, 855.6 ± 51.6 W; p<0.005). Although not significant, PLA completed the study in negative nitrogen balance whereas PRO was in positive nitrogen balance. Differences detected in aesthetic presentation from baseline to week 12 were significantly lower in PLA (1.9 ± 0.5; 1.0-5.0 scale) compared to PRO (2.6 ± 0.8; p=0.048).

CONCLUSIONS: Protein supplementation for 12 weeks significantly improved LMI as well as aesthetic presentation during dance performance. Additionally, protein supplementation provides a simple way to improve the diet and LMI in a group of dance athletes that require nutritional attention. This study was supported by a Dymatize Nutrition Sports Institute grant.

Recent studies suggests that a substantial proportion of elite athletes with SCI (spinal cord injury) have insufficient 25(OH)D status which may be associated with decreased muscle strength. PURPOSE: This study: 1) examined the effects of a 16-wk Vitamin D supplementation protocol on 25(OH)D levels in male and female wheelchair athletes with SCI (n=26); 2) compared the wheelchair athletes’ 25(OH)D levels to the general population (n=63); 3) examined the effects of 16-wk Vitamin D supplementation protocol on 25(OH)D status and wheelchair sprint performance time in male and female wheelchair athletes with SCI (n=26).

METHODS: Thirty-four male and female wheelchair athletes with SCI were recruited from the Canadian Wheelchair Sports Association from outdoor and indoor sports participating. Serum 25(OH)D concentrations, lifestyle and dietary factors were assessed during the Winter and Spring. Participants were assigned to a 16-wk sliding scale vitamin D3 (cholecalciferol) (KleanAthlete Brand) supplementation protocol based on initial 25(OH)D levels. Participants with insufficient status (<30ng/mL) received 50,000 IU/wk for 8 wks, and participants with insufficient status (20-30 ng/mL) received 35,000 IU/wk for 4 weeks followed by a maintenance dosage of 15,000 IU/wk. Participants with sufficient status (>30ng/mL) received the maintenance dosage of 15,000 IU/wk. Performance measurements were assessed using a 20 meter wheelchair sprint, and handgrip strength. A paired t-test was used to assess differences in 25(OH)D status and performance before and after supplementation, respectively.

RESULTS: 25 (OH) D concentrations increased significantly after supplementation (P<.001; 26.5 ± 9.7 ng·mL⁻¹; 44.5 ± 9.5 ng·mL⁻¹; mean ± SD) for Winter and Spring, respectively. 26% of athletes had sufficient 25(OH)D concentrations prior to supplementation, and 94% had sufficient concentrations post supplementation. 60% of participants improved handgrip strength post-supplementation. However, no change in wheelchair sprint performance time was observed.

Conclusion: The 16-week sliding supplementation protocol used in the current study is effective for achieving sufficient Vitamin D concentrations during the winter months in elite athletes with SCI. Furthermore, handgrip strength improved in 60% of participants post supplementation.
Optimal nutrition enhances athletic performance. Eating adequate amounts of energy and meeting recommendations for macronutrients are essential and a priority for athletes. PURPOSE: To evaluate the dietary intakes of macronutrients of Masters Athletes. METHODS: This cross-sectional study included 25 Masters Athletes (14 females, 11 males), 39.4±10.1 years of age. Body composition was determined by dual-energy X-ray absorptiometry (DXA). Participants completed a self-administered Block Food Frequency Questionnaire (FFQ) used to assess dietary patterns over the previous year. The FFQs were analyzed by a third party source; however, statistical analyses were conducted by the researchers. For the purposes of this study, athletes were classified as either lean or non-lean based on percent body fat. Female athletes with < 24.4% and male athletes with < 17.4% body fat were considered lean.

RESULTS: Average carbohydrate intake was 44.7±6.6% and 47.7±7.6% of total energy intake for lean and non-lean athletes, respectively. Average protein intake was 15.3±2.8% and 15.0±2.0% of total energy intake for lean non-lean athletes, respectively. Average fat intake was 38.1±7.4% and 36.5±4.9% of total energy intake for lean and non-lean athletes, respectively. There were no significant differences between groups in percent of carbohydrate, fat and protein consumed to total energy intake diet. CONCLUSION: Macronutrient recommended intakes for carbohydrates and proteins are being met for Masters Athletes, which helps to ensure optimal overall health.

Supported by ONR N00014-11-1-0929.

Athletes in weight category sports practice various methods of acute weight loss, with recent research and long standing "grey literature" demonstrating the popularity of "water loading" (the consumption of large volumes of fluid for several days, prior to withholding intake) as a means to increase body water losses following fluid restriction. No research has examined this technique or its risk of causing hyponatraemia. PURPOSE: To determine the effectiveness and safety of water loading and assess potential mechanisms. METHODS: Male combat sport athletes (n=21, 77.5±8.1kg 177±5.6 cm, 26±4 years) were separated into a control (CON, n=10) and water loading (WL, n=11) group. Subjects were fed a standardised isoenergetic diet based on fat free mass (assessed via DXA scan) controlling for macronutrient, sodium and fibre content for 6 days. Day 1-3 fluid intake was 40ml/kg CON and 100ml/kg WL. Day 4 fluid intake was 15ml/kg CON and WL. Day 5 no fluid was consumed until midday with both groups following the same rehydration protocol until day 6. Urine sodium, specific gravity (USG) and volume were recorded alongside training sweat losses and sleep quality/duration (measured via actigraphy) throughout. Renal hormones (vasopressin, renin, and aldosterone), blood urea and electrolytes (%ES) and body mass (BM) were measured each morning (lasted) and evening following 30 min supine rest. Physical performance was assessed pre- and post intervention. Two way repeated measures ANOVAs were used to assess differences between groups. RESULTS: Following fluid restriction, significant differences with large effect sizes were found in fluid input/output ratio (39.11%, p < 0.01, ES=1.2) and BM loss (0.6%BM, p=0.02, ES=0.82). No differences in sleep or performance

FRIDAY, JUNE 2, 2017
measures existed. Time had a significant effect on USG, all USFs and renal hormones (p < 0.05). An interaction effect existed between time and intervention on blood sodium, potassium, chloride, urea, creatinine, USG and vasopressin (p < 0.05) but not on other hormones or electrolytes. No mean USFs differed from reference range or approached critical values. CONCLUSION: Water loading appears to be a safe and effective method of acute BM loss under the conditions utilised in this study. Changes in vasopressin may in part underlie the mechanism facilitating this technique.

E-14 Thematic Poster - Rehab and Recovery in Skeletal Muscle and Connective Tissue
Friday, June 2, 2017, 9:30 AM - 11:30 AM
Room: 101

2427 Chair: Matthew C. Kostek, FACSM. Duquesne University, Pittsburgh, PA.
(No relationships reported)

2428 Board #1 June 2 9:30 AM - 11:30 AM
Knee Morphology After Secondary Ipsilateral ACL Injury Compared to Those That Have Not Reinjured
Lindsey K. Lepley1, Jessica E. Digiacomo1, John A. Redman2, Riann M. Palmieri-Smith2, 1University of Connecticut, Storrs, CT; 2University of Michigan, Ann Arbor, MI.
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(No relationships reported)

Modifiable and non-modifiable risk factors have been identified for primary anterior cruciate ligament (ACL) injury however less research is available examining risk factors for a second ACL rupture. Identifying whether bony morphological factors are different (or more exaggerated) among those that experience a secondary ACL injury is critical to understanding if non-modifiable risk factors are associated with re-injury. PURPOSE: To identify if bony morphology is different among those that experience a secondary ACL re-injury as compared to ACL individuals that do not. METHODS: ACL participants were tracked after return-to-play following primary reconstruction, and if bone morphological risk factors. ACLx2 participants were matched to individuals (sex, age, height, graft, gender and activity level) that had undergone reconstruction but did not experience re-injury (ACLx1, n=14, 8F/6M, 18.7±4.0yrs). 10 healthy controls were also enrolled (5m/5f, 20.8±3.9yrs) for the purposes of comparing our ACL data against healthy knees. Lateral and medial posterior tibial slopes (LPTS, MPTS), notch shape index (NSI), and medial tibial plateau depth of concavity (MDC) were compared between all ACL participants (combined ACLx1 and ACLx2 groups) and controls using independent t-tests and across groups (ACLx1, ACLx2, controls) using one-way ANOVAs. RESULTS: All ACL reconstructed patients had a steeper LPTS than controls (6.2±2.7deg vs. 3.9±3.7deg, d=0.87, 95% CI 0.11-1.60, P<0.023), however no difference in LPTS was found between ACLx1 and ACLx2 (6.8±3.2deg vs. 6.3±2.4deg, P=0.05). No differences in MPTS, NSI and MDC were found between all ACL participants (combined ACLx1 and ACLx2) groups and controls using independent t-tests and across groups (ACLx1, ACLx2, controls) using one-way ANOVAs. RESULTS: All ACL reconstructed patients had a steeper LPTS than controls (6.2±2.7deg vs. 3.9±3.7deg, d=0.87, 95% CI 0.11-1.60, P=0.023), however no difference in LPTS was found between ACLx1 and ACLx2 (6.8±3.2deg vs. 6.3±2.4deg, P=0.05). No differences in MPTS, NSI and MDC were found between all ACL participants (combined ACLx1 and ACLx2) groups and controls using independent t-tests and across groups (ACLx1, ACLx2, controls) using one-way ANOVAs. CONCLUSION: Compared to healthy individuals, a steeper LPTS is a common bony abnormality among all ACL injured participants. Individuals that go onto experience a secondary ipsilateral ACL injury, do not have more exaggerated bony morphology than those that do not, suggesting that differences in modifiable risk factors at return-to-play may contribute to re-injury.

2429 Board #2 June 2 9:30 AM - 11:30 AM
Focused Shockwave Therapy & Low Level Laser Therapy In Patella Tendinopathy Among German Soccer Players
Karsten Knobloch. SportPraxis Prof. Dr. Karsten Knobloch, Hannover, Germany.
Email: kknobi@yahoo.com
(No relationships reported)

PURPOSE: To assess the feasibility and efficacy of combined focused extracorporeal shockwave therapy (ESWT) & low level laser therapy (LLLT) in addition to conventional eccentric training in patella tendinopathy among elite professional soccer players with patella tendinopathy. METHODS: 34 German Bundesliga soccer players suffering from patella tendinopathy > 4 weeks underwent both, conventional and Power Doppler ultrasound determining the size of the lesion diameter as well as the amplit damage location of neovascularisation by PowerDoppler ultrasound in my practice. The multimodal tendon treatment consisted of three sessions of: • Focused extracorporeal shockwave therapy (Storz Ultra device, 0.15-0.3mJ/mm², 1000-2000 impulses per session) • Low Level Laser Therapy (LLLT, Irradia 940nm 12-fold laser device) • Eccentric training on a 25° decline (daily 6x15 repetitions per leg according to Alfredson’s scheme) RESULTS: Pain at exercise (on a visual analgouge scale 0-10) was reduced from 6.2±2.5 to 2±1.5 during 1±1 week after intervention. Morning stiffness was reduced at six weeks by 56% and 87% after 12 weeks. The degree of neovascularisation in PowerDoppler ultrasound was reduced from Öhberg degree 3+ to 0-1+ after 12 weeks as was the tendon diameter by 38% in grey scale ultrasound. VISA-P scores improved by 32% at six weeks and 51% at 12 weeks. Players were able to return to sport at mean 18±12 days after initiation of the weekly therapy. CONCLUSIONS: Combined focused shockwave & low level laser tendon therapy accompanied by daily eccentric training are able to improve patella tendon function with a sustained effect in soccer athletes with an early return to game play.

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

2430 Board #3 June 2 9:30 AM - 11:30 AM
Progenitor Cells From Cartilage: Grade Specific Differences In Stem Cells Markers Expression
Marija Mazor1, Annabelle Cesaro1, Mazen Al2, Thomas M. Best, FACSM3, Enric Palleja2,3, Haimi Toumi1. 1Service de Rhumatologie, Centre Hospitalier Régional d’Orléans, La Source, France, Orleans, France. 2-Service chirurgie orthopédique et traumatologique Centre Hospitalier Régional d’Orléans, La Source, France, Orleans, France. 3Department of Orthopedics, Division of Sports Medicine, Miami, FL. (Sponsor: Thomas best, FACSM)
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(No relationships reported)

BACKGROUND: Recent research confirmed the presence of Mesenchymal stem cell (MSC) - like progenitors (MPC) in both normal and osteoarthritic cartilage. However, there is only limited information concerning how MPC markers develop with osteoarthritis progression. The purpose of this study is to determine the prevalence of MPC markers in different OA grades.

MATERIALS AND METHODS: Human osteoarthritic tibial plateau were obtained from ten patients undergoing total knee replacement. Each sample had been classified into a mild or severe group according to OARSI scoring. Tissue was taken from each specimen and mRNA expression levels of CD105, CD166, Notch 1, S0x9, Acan and Coll II A1 were measured at day 0 and day 14 (2 weeks in vitro). Furthermore, MSC markers: Nucleostemin, CD90, CD73, CD166, CD105 and Notch 1 were studied by immunofluorescence. RESULTS: mRNA levels of MSC markers did not differ between mild and severe OA at day 0. At day 14, protein analysis showed that proliferated cells from both sources express all 6 MSC markers. Only cells from mild OA resulted in a significant increase of mRNA CD105 and CD166 after in vitro expansion. Moreover, cells from the mild OA showed significantly higher levels of CD105, S0x9 and Acan than those from severe OA.

CONCLUSION: Results confirmed the presence of MSC markers in mild and severe OA tissue on both mRNA and protein levels. We found potential differences between cells obtained from mild compared to severe which suggests that mild OA derived cells may have a greater MSC potential.

2431 Board #4 June 2 9:30 AM - 11:30 AM
Relaxin Influences Knee Laxity Changes Across the Menstrual Cycle
Travis Anderson, Zachary Kincaid, Laurie Wideman, FACSM, Sandra J. Shultz, FACSM. University of North Carolina at Greensboro, Greensboro, NC. (Sponsor: Dr. Sandra J. Shultz, FACSM)
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(No relationships reported)

Greater knee laxity is associated with an increased risk for anterior-cruciate ligament (ACL) injury, particularly in women. Research suggests that the hormone relaxin may influence the structural integrity of the ACL, rendering a weaker and more lax ligament. PURPOSE: To assess the impact of relaxin on knee laxity once progesterone and testosterone (potential endocrine antagonists) are accounted for. METHODS: College-aged females (166.0±5.7cm, 65.8±18.5kg, 20.8±2.9yrs) provided blood samples for the first 6 days of menses and first 10 days of luteal phase of one menstrual cycle. Knee laxity was recorded as anterior knee laxity (AKL; mm), genu recurvatum (GR; °), and general joint laxity (GJL; score, 0-9), and dependent variables were calculated as mean (X), cyclic (A (max – min), coefficient of variation (CV), and standard deviation (SD). Progesterone (P, ng/ml), testosterone (T; ng/dl), and relaxin (R; pg/ml) were analyzed via ELISA assays. The sum of the 6 greatest hormone concentrations during menses (M) and luteal phase (L) and the change in exposure from M to L (M/LA) were calculated. Only subjects with captured R and P peak were included in analysis (n=18). M and MLA for each hormone were entered into backward stepwise (in: p<0.05; out: p>0.20) multiple linear regression models to predict each laxity measure. RESULTS: R and P were significantly different between M and L (p<0.001, R<sub>ML</sub>=22.2±2.9 vs. R<sub>ML</sub>=147.0±96.3; p<0.001, P<sub>ML</sub>=5.8±1.8 vs. P<sub>ML</sub>=89.7±36.6), whereas T was less variable (p>0.07, T<sub>ML</sub>=203.8±63.0 vs. T<sub>ML</sub>=222.7±82.6). All laxity
showed variation across the menstrual cycle (range [min-max]: AKL=−5.9-7.6; GR=−2.6-5.6; GIL=−8.2-2.1). Significant models were observed for GR (p<0.014; R²=0.418; GR=3.501+1.024GR; GIL=[−39.372,39.072]; GIL=[−404.137,−253.115]; GIL=[−469.137,−440.137]; and GIL=[−317.137,−353.137]; R²=0.507). Models for AKL, GR, and GIL approached significance (all p<0.075).

CONCLUSION: Once controlling for P and T, R was a significant predictor of knee laxity mean and cyclic changes. These findings would suggest that R, combined with other hormones, may affect the structural integrity of the ligament and impact injury risk. Further study is needed to explore potential mechanisms for this association.

**2432 Board #5**

**June 29, 9:30 AM - 11:30 AM**

**The Human Piriformis Muscle: Sensory, Postural, Or Just A Pain**
Matthew C. Kostek, FACSM, Rachel Sweetnich, Tim Dusch.
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(No relationships reported)

**Piriformis syndrome is a form of low back pain that is debilitating and difficult to treat. Physical therapy is often effective but in some cases the Piriformis muscle is disconnected or removed entirely through surgery. The short term consequences of this procedure are negligible but the long term consequences have not been studied. Furthermore, because of its size and anatomical location, it is not thought to be a primary mover of the body. The purpose and necessity of the muscle is an area of speculation. We hypothesized that it is a sensory and postural muscle, which could explain why short term consequences of its removal are minimal.**

**PURPOSE:** To determine the density of muscle spindles and fiber type composition of the human Piriformis muscle.

**METHODS:** Six human cadavers (males = 3; females = 3) had their right and left Piriformis muscles removed for histological analysis. Whole muscles were paraffin embedded, sectioned, H&E stained or stained with myosin heavy chain antibodies. Microscopy analysis examined spindle density and fiber type composition.

**RESULTS:** The average spindle density per muscle was 3.4±1 and was not significantly different between male and female (p=0.23). Fiber type composition was 84.8% slow twitch and was not different between male and female (p=0.23).

**CONCLUSIONS:** The human Piriformis muscle does not appear to be a sensory muscle due to the low concentration of muscle spindles but is very likely a postural muscle. The results of this characterization may better inform treatments including the surgical removal and long term rehabilitation.

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**2433 Board #6**

**June 29, 9:30 AM - 11:30 AM**

**The Effects Of Cryo-compression Therapy On Recovery From An Acute Bout Of Resistance Exercise**
William H. DuPont, Vincent H. Hardesty, Emily C. Barnhart, Brek J. Meuris, William J. Kraemer, FACSM. The Ohio State University, Columbus, OH. (Sponsor: William J. Kraemer, FACSM)

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(No relationships reported)

**Compression and cold therapy used separately have consistently shown to reduce these determents. However, the effects of combining compression and cold therapy (cryo-compression) as a single recovery modality has yet to fully examined. PURPOSE:** To examine the effects of Aquilo Cryo-compression Pans (Aquilo Sports, Louisville, KY) on recovery from a lower body resistance exercise bout typically used by recreationally active individuals. METHODS: Sixteen healthy adult men were matched and then randomly assigned to either Control (CON) or the Aquilo Cryo-compression Pans (ACPs) groups. Participants performed a typical lower body workout consisting of barbell back squats, stiff legged deadlifts, and Nordic hamstring curls. and then received 20 minutes of either cryo-compression using the Aquilo Cryo-compression Pans (ACPs) or nothing (CON) post exercise. Pain, soreness, mood, sleep quality, power, and reaction time, and muscle fatigue/damage biomarkers were measured at specific time points. RESULTS: The mean value comparisons show that after exercise ACC had significantly (p ≤ 0.05): lower levels of soreness 24hrs (ACC: 44.3, CON: 52.5) and 48hrs (ACC: 36.6, CON: 41.3); pain 60min (ACC: 3.0, CON: 4.1), 24hrs (ACC: 3.4, CON: 4.0) and 48hrs (ACC: 2.6, CON: 3.4); reduced muscle fatigue (reduced CK levels) 24hrs (ACC: 577 UI, CON: 966 UI) and 48hrs (ACC: 399 UI, CON: 613 UI); better sleep quality 24hrs (ACC: 58.0, CON: 52.5) and 48hrs (ACC: 56.75, CON: 47.6); better power output (reduced decrement) 24hrs (ACC: 5031.0; CON: 4087.2) and 48hrs (ACC: 5056.4, CON: 4879.8); and experienced a better overall mood 24hrs (ACC: 0.55, CON: 0.9) and 48hrs (ACC: 0.28, CON: 0.68).

**CONCLUSION:** Compression and cold therapy has developed a practical, portable recovery device that synergistically combines compression and cold therapy which effectively helps reduce muscle fatigue, soreness, pain, and poor sleep quality that may result from an acute bout of exercise. Funding, in part, was provided by Aquilo Sports, Inc.

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**2434 Board #7**

**June 29, 9:30 AM - 11:30 AM**

**Performance-related And Molecular Effects Of External Pneumatic Compression Treatment As An Adjuvant To Heavy, Voluminous Resistance Exercise**
Cody Haun. Auburn University, Auburn, AL.

*Email: cth0023@auburn.edu*

(No relationships reported)

Cody T. Haun1, Matthew A. Romero1, Shelby C. Osburn1, Gillia L. Langston1, Brooks Mobley1, Richard G. Anderson1, Michael D. Goodlett1, David D. Pascoe1, Michael D. Roberts2, Jeffrey S. Martin2
1School of Kinesiology, Auburn University, Auburn, AL, 2Department of Cell Biology and Physiology, Edward Via College of Osteopathic Medicine - Auburn Campus, Auburn, AL; Athletics Department, Auburn University, Auburn, AL.

**PURPOSE:** We sought to determine the effects of external pneumatic compression (EPC) when used concurrently with resistance training on functional and molecular measures related to recovery. METHODS: Twenty (N=20) resistance-trained male participants (aged 21±1.24 years) were randomized to sham or EPC intervention groups. The protocol consisted of 3 consecutive days of voluminous back squat exercise followed by EPC/sham treatment (Days2-4) and 3 consecutive days of recovery (Days5-7) with EPC/sham only on Days5-6. On Day 1 (PRE), and Days3-7, venipuncture, flexibility and pressure-to-pain threshold (PPT) measures were performed. Vastus lateralis muscle was biopsied at PRE, 1-h post-EPC/sham treatment on Day2 (POST1) and 24-h post-EPC/sham treatment on Day7 (POST2). Isokinetic peak torque was assessed at PRE and POST2. RESULTS: The PPT was significantly lower on Days3-6 with sham, indicating greater muscle soreness, though this was largely abolished in the EPC group. A significant decrease in flexibility with sham was observed on Day5 (+16.2±4.6% knee joint angle; P<0.01) whereas there was no change with EPC (+2.8±3.8%; P>0.01). Vastus lateralis poly-ubiquitinated proteins significantly increased at the POST2 time point relative to PRE with sham (+66.6±24.6%; P<0.025) and were significantly greater (P<0.025) than those observed with EPC at the same time point (+18.6±8.5%). 4-hydroxynonenal values were significantly lower at POST2 relative to PRE with EPC (-16.2±5.6%; P<0.025) and were significantly lower (P<0.025) than those observed with sham at the same time point (+11.8±5.9%).

**Conclusion:** EPC mitigated tissue damage and flexibility in the PPT that occurred with sham. Moreover, EPC appeared to reduce select skeletal muscle oxidative stress and proteolysis measures during recovery from heavy resistance exercise.

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**2435 Board #8**

**June 29, 9:30 AM - 11:30 AM**

**Fascicle Lengthening During Eccentric Exercise Determines The Magnitude Of Muscle Damage**
Dr Kirsty Hicks1, Gladys Onambale-Pearson2, Keith Winwood3, Christopher Morse3, Northumbria University, Newcastle, United Kingdom, 2Manchester Metropolitan University, Crewe, United Kingdom. (Sponsor: Glyn Howatson, FACSM)

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(No relationships reported)

The characteristics of the muscle-tendon interaction during eccentric contractions suggests that tendon properties and the magnitude of fascicle lengthening contribute to the extent and the variability of exercise-induced muscle damage (EIMD). The mechanical processes which predispose the severity of EIMD remains unclear. **PURPOSE:** To determine whether 1) patella tendon stiffness, at rest and during eccentric contractions, 2) the magnitude of vastus lateralis (VL) fascicle lengthening during eccentric contractions, and/or 3) eccentric torque, are determinants of EIMD. **METHODS:** Combining dynamometry, electromyography and ultrasoundography, patellar tendon properties and VL architectural properties were measured pre and during the first of 6 sets of 12 maximal voluntary eccentric knee extensions (range of motion 20 - 90°, 0° = full extension). The eccentric phase of the contraction was performed at an isokinetic angular velocity of 30°s⁻¹ and the concentric phase was performed passively at an angular velocity of 60°s⁻¹. Maximal isometric torque loss and creatine kinase (CK) activity were measured pre-damage (-8 h), 48, 96 and 168 h post-damage as markers of EIMD. **RESULTS:** Compared to pre-damage, a significant reduction in maximal isometric torque (264 ± 35 Nm, 221.0 ± 48.4 Nm, p = 0.004) and a significant increase in CK (136 ± 114, 796 ± 723 UL, p = 0.014) was reported 48 and 96 hrs post EIMD respectively. Relative changes in CK correlated with the relative change in fascicle length during eccentric contractions (r = 0.53, p = 0.02) and eccentric torque (r = 0.50, p = 0.02). Additionally, the relative change in CK tended to correlate with estimated patellar tendon lengthening during eccentric contractions (r = -0.41, p = 0.10). However, relative change in CK did not correlate with resting measures of patella tendon properties or VL properties. Similarly, torque loss did not correlate with patellar tendon or VL properties at rest or during eccentric contractions.

**CONCLUSION:** The extent of fascicle lengthening during eccentric contractions is related to the magnitude of the CK response. Furthermore, at rest, patellar tendon properties are not determinants of indices of EIMD. During eccentric contractions of the VL, the patella tendon might play a modulatory role during exercise, to the susceptibility of EIMD.
Minor correlations between measurements for lower-extremity muscle strength and balance in individuals, regardless of the age, have been revealed. Similarly, maximal strength and balance have been individually investigated between an athletic population and a non-athletic population. However, comparisons between lower extremity strength (specifically ankle strength and hip strength) and balance between an athletic versus a non-athletic population have not been established. PURPOSE: The purpose of this pilot study was to find correlations in hip strength and balance versus ankle strength and balance in an athletic (NCAA athletes) and non-athletic population. METHODS: Twelve NCAA Division-I athletes (age: 20.42 ± 1.51 years, height: 179.27 ± 11.2 cm, mass: 79.07 ± 14.89 kg, gender: 6F, 6M) and twelve healthy college students (age: 22.58 ± 2.47 years, height: 171.65 ± 8.00 cm, mass: 72.72 ± 14.21 kg, gender: 6M, 6F) participated. Following informed consent, balance on the dominant leg was measured using a BOSU ball in timed trials with eyes open and eyes closed. Using a Biodex System 4 Isokinetic DYNAMOMETER, the isokinetic muscular strength and directional torque of eight muscle groups in the sagittal and frontal planes were measured. Lastly, multivariate regression models were performed (α=0.05). Eyes open and eyes closed analyses were performed separately. RESULTS: Athletes had a higher ability to balance (athletes: 61.61 ± 42.67s vs non-athletes: 26.48 ± 27.19s) (p=0.030) in the eyes open trial and presented a correlation for ankle dorsiflexion (R=0.674) (p=0.008) when regressed with eyes open and ankle eversion (R=0.833) (p=0.002) with eyes closed. Meanwhile, non-athletes demonstrated a correlation for hip extension when regressed with eyes closed (R=0.705) (p=0.005). CONCLUSIONS: This study revealed a stronger correlation for ankle strength and balance in an athletic population while a stronger correlation between hip strength and balance was observed for a non-athletic population. Hence coaches, clinicians, or physical therapists can use these findings to tailor exercise protocols specific to individual cases and potentially increase balance to prevent injuries and falls.

Strength and balance deficits are important factors contributing to falls risk in the community-dwelling older women. PURPOSE: To investigate upper and lower limb strength and static and dynamic balance in community-dwelling older women. METHODS: Forty-three active female volunteers, aged 60 to 89, were divided into three groups: G1 (under 65 years, n=16); G2 (65 to 74 years, n=14); and G3 (75 years and above, n=13). Their upper limb strength - hand grip (HG), lower limb strength - 30 seconds chair stand (STS), dynamic balance - timed up-and-go test (TUGT) and static balance - bipedal anterior-posterior sway with eyes open and closed (APO and APC, respectively), and bipedal medial-lateral sway with eyes open and closed (MLO and MLC, respectively) were assessed. RESULTS: Polynomial Trend analysis showed that most variables decreased significantly and linearly across the 3 age categories (HG: F=4.92, p=0.032; STS: F=5.82, p=0.021; TUGT: F=7.92, p=0.008; APC: F=6.27, p=0.016; MLO: F=5.63, p=0.033; MLC: F=4.59, p=0.038), but HG and MLC also had a quadratic component (F=11.31, p=0.002 and F=4.30, p=0.045, respectively). Specifically, HG held up well into the mid-seventies, then dropped markedly; while MLC declined immediately after women turned 65. GH and STS were significantly inter-correlated (r=0.39, p=0.01), and both were significantly correlated with dynamic balance function - TUGT (r=0.40 p=0.008) and both were significantly correlated with any static balance measures. In addition, significant correlations were only observed between open and closed eyes balance conditions in the same postural sway direction (APO and APC: r=0.55 p<0.001; MLO and MLC: r=0.55 p<0.001) not between different postural sway directions.
CONCLUSIONS: These findings have important implications for therapeutic exercise interventions designed to maintain and improve strength and balance in community-dwelling older women.

Among older adults, falls are the leading cause of injuries and are responsible for significant disability, hospitalization, loss of independence, and reduced quality of life. Previous research showed that physical exercise (PE) is effective in preventing falls and has the potential to reduce serious fall-related injuries, emergency department visits, hospitalizations, nursing home placements, and functional decline. In most clinical trials the effect of PE was assessed by means of tests which assess a single “balance system”, while balance control is very complex and involves many different underlying systems. The BESTest Scale consists of 36 items, grouped into 6 systems: biomechanical constraints, stability limits/verticality, anticipatory postural adjustments, postural responses, sensory orientation, and gait stability.

PURPOSE: To investigate the effects of a short (4 weeks), intensive (75 min sessions 3 times per week) PE program which included strength, coordination, gait, multiaxial training, and single- and dual-task balance exercises on the balance of elderly subjects at risk of falls.

METHODS: Thirty sedentary subjects aged 70+ years at risk of falls (Berg’s Balance Scale < 52) were recruited and randomly allocated to a Multi-Component Exercise group (MCE) or a Control group (CON). Main outcome was change in BESTest Scale (BT) total score.

RESULTS: At baseline, the two groups were similar with respect to age, gender distribution, anthropometric measures and risk of falls (BESTest Scale Score 53.7±14.8 in CON and 55.0±10.8 in MCE, n.s.). At the end of the study, BT total score was 55.5±16.7 in CON group (n.s. vs. baseline) and 72.7±8.8 in MCE group (p=0.001 vs. baseline). The change of BT total score was 1.8 (95% CI: 1.9-5.5) in the CON group and 17.7 (13.4-22.1) in the MCE group (p<0.001 between groups). Also, the MCE group significantly increased the scores of all the six balance subsystems of the BT. Eventually, the change of Berg’s Scale score was 0.9 (-2.0-2.1) in CON and 6.0 (4.4-7.6) in MCE (p<0.001). At the end of the study MCE subjects could not be considered at risk for falling any more.

CONCLUSIONS: A 4 weeks, intensive, multi-component training program significantly improved balance in elderly subjects at risk of falls. The improvement affected the many systems involved in balance control.

CONCLUSIONS: Falls present a serious challenge not only among older adults, but for young adults, especially those whose working condition exposes them to a high fall hazard. Treadmill-based perturbation training, as a task-specific training, has emerged as a new paradigm used to prevent falls. However, the training program contained up to 30 perturbation trials in previous studies. It is unclear if a reduced number of perturbation trials could still induce positive effect in preventing falls. PURPOSE: To investigate the effect of a treadmill-based perturbation training paradigm consisting of 8 slip perturbations on reducing slip-related falls in young adults. METHODS: Thirteen healthy young adults (24 ± 4.34 years) were randomly assigned into either training (n = 6) or control (n = 7) groups. The training group underwent 8 unexpected slip trials on a special treadmill during 4 weeks while the control group received a “mock” training in which they walked on the same treadmill. After the training, both groups were subjected to an unexpected slip induced by releasing a movable platform when walking overground (OG). Subjects wore a safety harness equipped with a load cell. Body kinematics were captured and used to calculate dynamic gait stability on the OG slip. The load cell force was used to determine the OG slip outcome (fall vs. no-fall). A Chi-square test and independent t-test were used to respectively compare the fall incidents and dynamic stability between groups. RESULTS: Responding to the OG slip, 4 out of 7 (57.1%) subjects in the control group while 1 out of 6 (16.7%, p = 0.18) in the training group fell. The training group displayed a lower instability than the control at recovery foot touchdown (-0.56 ± 0.12 vs. -0.69 ± 0.07, p < 0.05)

CONCLUSIONS: This study suggests that treadmill-based perturbation training with less perturbation trials could lower the risk of falls among young adults when exposed to a real-life like OG slip. Given that treadmill-based slip training is easy to use, portable, controllable, and reproducible, this training could provide a relatively novel modality to reduce falls among both young and older adults. Further studies based on a large sample size are needed to symmetrically evaluate the effectiveness of this type of training. Supported by the PiMSA Student Graduate Grant.

PURPOSE: Falling poses a significant potential health risk for older adults. Fall risk questionnaires have been identified as a quick and easy way to screen for the potential for falling compared to objective balance testing. However, the relationship between these questionnaires and formal balance assessments is not fully understood. Therefore, the purpose of this study was to elucidate the relationship between validated fall risk questionnaires and selected measures of balance using computerized dynamic posturography (CDP) in older adults of varying functional abilities. METHODS: Ten male (n=4) and female (n=6) elderly (72.7 ± 6.1 yrs) subjects completed testing and were included in the final analyses. All subjects passed the Mini-Mental Status Exam (MMSE) with a score > 24 prior to participating. Each subject completed two fall risk questionnaires (in random order): the Falls Efficacy Scale (FES) and the Activities-Specific Balance Confidence Scale (ABCS), as well as CDP testing for fall risk assessment: the Berg’s Scale (DCL) for forward (F) and backward (B) directions were calculated using the Pearson correlation coefficient using pairwise deletion for missing variables. Alpha levels were set at 0.05.

RESULTS: Scores on the FES and ABCS were significantly correlated (r=-0.826, p=0.003) with one another. FES was significantly correlated with SOT (r=0.28, p=0.046) and FMXE (r=-0.684, p=0.042) but not with any backward measures. The ABCS was not significantly correlated with any CDP measures. No injuries occurred during the study. CONCLUSION: Although the ABCS and FES are similar tools and are highly correlated with one another this data suggests that they are possibly capturing unique dimensions of balance confidence and capability in older adults. It is surprising that the ABCS, which includes a more robust mix of physical activities, was not significantly correlated with either SOT or FMXE while the FES was. More investigation into the relationship of these questionnaires with objective balance measurements is warranted.
non-slipping foot lift-off (p=0.002) and touch-down (p=0.005). CONCLUSION: RST increased recovery rate by reducing slip severity and maintaining slipping heel positions more proximal to the sacrum. This cost-effective method for RST may improve its potential for adoption as a slip-and-fall prevention intervention.

E-16 Clinical Case Slide - Foot and Ankle III

Friday, June 2, 2017, 9:30 AM - 11:10 AM
Room: 103

2445 Chair: Patrick Leary, FACSM. Lake Erie College of Osteopathic Medicine, Erie, PA.
(No relationships reported)

2446 Discussant: Stephen M. Simons, FACSM. South Bend Notre Dame Sports Medicine Fellowship, South Bend, IN.
(No relationships reported)

2447 Discussant: Leonardo P. Oliveira. University of Chicago, Chicago, IL.
(No relationships reported)

2448 June 2 9:30 AM - 9:50 AM
Medial Foot Pain in a Youth Soccer Player
Christine Bender1, Heather Gillespie, FACSM1, Abby Markham2. Maine Medical Center, South Portland, ME. ‘Maine Medical Center, Falmouth, ME. (Sponsor: Heather Gillespie, FACSM)
(No relationships reported)

HISTORY: A 13 yo male presents with right foot pain. Started 3 yrs ago with a forced inversion injury during soccer game when he collided with another player. He recalls swelling and bruising at that time. He went to the ER and had x-rays done which were “inconclusive” as his mother recalls. Pain never completely went away and worsened several weeks ago. He has been doing a lot of hiking recently, very uneven surfaces and he reports pain with these activities. He has used an ankle brace and tried arch supports with no significant improvement.

PHYSICAL EXAMINATION: Inspection of feet and ankles reveals pes planus R>L supports with no significant improvement.

TREATMENTS AND OUTCOMES: 1. Orthopedic referral was made at 4 months post-injury and she decided to proceed with a left lateral sesamoidectomy with immobilization within a boot for another 1-2 months 2. Repeat radiographs at 3 and 4 months post-injury showed continued non-union of the lateral sesamoid bone. 4. Orthopedic referral was made at 4 months post-injury and she decided to proceed with a left lateral sesamoidectomy with immobilization within a boot for 4 weeks. 5. At 4 months post-operatively, she was able to run with no pain and good range of motion of her left first MTP joint.

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2450 June 2 10:10 AM - 10:30 AM
A Rare Cause of Foot Pain in an Adolescent Male Multisport Athlete
John Franco, Edward Laskowski, FACSM, Cara Prideaux. Mayo Clinic, Rochester, MN. (Sponsor: Edward Laskowski, FACSM)
Email: franco.john@mayo.edu
(No relationships reported)

HISTORY: A 13 year old male football, basketball, and baseball athlete presented to sports medicine clinic with a 3 month history of non-traumatic exertional right lateral foot pain. He reported 8/10 pain with strenuous activities, such as running and jumping. He had no pain with walking. He reported aching discomfort in the morning upon waking. He denied numbness, tingling, or abnormal sensation.

PHYSICAL EXAMINATION: There was no significant deformity. He was able to walk with a non-antalgic gait. There was tenderness to palpation over the lateral base of the 5th metatarsal. Range of motion of the foot and ankle was normal. There was normal strength upon manual muscle testing, but resisted ankle eversion reproduced pain. No focal soft tissue swelling.

DIFFERENTIAL DIAGNOSIS: 1. Metaphyseal-Diaphyseal (Jones) Fracture 2. Fifth Metatarsal Stress Fracture 3. Traction Apophysitis (Iselin’s Disease) 4. Insertional Peroneal Tendinopathy 5. Avulsion Fracture

TESTS AND RESULTS: X-ray Right Foot: No evidence of acute or prior fracture or abnormal periosteal reaction. There is an accessory navicular noted.

FINAL WORKING DIAGNOSIS: Pes planovalgus with Accessory navicular syndrome

2449 June 2 9:50 AM - 10:10 AM
Foot Injury in a Recreational Runner
Ashkan Alkhamisi, Glenn G. Shi. Mayo Clinic, Jacksonville, FL. (Sponsor: George G.A. Pujalte, MD, FACSM)
Email: ashkan.alkhamisi@mayo.edu
(No relationships reported)

Foot Injury in a Recreational Runner
Ashkan Alkhamisi, MD, Glenn G. Shi, MD, and George G.A. Pujalte, MD, FACSM

HISTORY: A 37-year-old, healthy, young female presented with 5 weeks of left foot pain. She denied any major trauma or precipitating event, but did recall doing holiday shopping for 10 hours straight a few days prior to experiencing symptoms. Patient stated that she used to wear heels all the time at work as a school-teacher. She reported numbness and tenderness over the plantar aspect of the first metatarsophalangeal joint. She wore a metatarsal pad and took ibuprofen with no relief of symptoms. The pain was exacerbated with weightbearing.

PHYSICAL EXAMINATION: Left foot: No tenderness to palpation of the hindfoot or midfoot. Pain was elicited with passive dorsiflexion and plantarflexion of first metatarsophalangeal (MTP) joint. Tenderness to palpation along the lateral aspect of the first MTP joint, with no erythema or swelling. Sensation was intact.


2451 June 2 10:30 AM - 10:50 AM
A Rare Cause of Left-Handedness
Franko J, Laskowski Ed, Prideaux C. Mayo Clinic, Rochester, MN. (Sponsor: Edward Laskowski, FACSM)
Email: franco.john@mayo.edu
(No relationships reported)
Well-corticated bone fragment proximal and perpendicularly-oriented to the base of the 5th metatarsal, representing an accessory osicle (os vesalianum) versus ununited fracture. No evidence of acute fracture and normal-appearing apophysis.

- Right foot MRI: Ossceous body at base of the 5th metatarsal with irregular margins, hyperintense T2 fibrous union, and internal edema of the ossicle and adjacent proximal metatarsal, favored to represent a symptomatic os vesalianum. No increased apophyseal distraction.

**FINAL WORKING DIAGNOSIS:**
Symptomatic Accessory Os Vesaliunum

**TREATMENT AND OUTCOMES:**
1. Immobilize in a walker boot for 6-8 weeks.
2. Physical therapy after immobilization, with emphasis on peroneal muscle strengthening and range of motion.
3. If complete resolution of symptoms, may gradually return to sport as tolerated. If symptoms persist, consider surgical excision.

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**Clinical Case Slide - Hip and Pelvis II**

**Friday, June 2, 2017, 9:30 AM - 11:30 AM**

**Chair:** James Patrick MacDonald, FACSM. *Nationwide Children's Hospital, Bexley, OH.*

**Discussant:** Joshua T. Goldman. *University of California, Los Angeles, Los Angeles, CA.*

**Clinical Case Slide - Hip and Pelvis II**

- **June 2 10:50 AM - 11:10 AM**
  - **Not Your Ordinary Ankle Sprain**
    - Juraj Zahatnansky, Robert Baker, FACSM, Mark Sysytsma.
    - *Western Michigan University Homer Stryker M.D. School of Medicine, Kalamazoo, MI.* (Sponsor: Robert Baker, FACSM)
    - Email: juraj.zahatnansky@med.wmich.edu
    - (No relationships reported)

**HISTORY:** This is a case of an otherwise healthy 19-year-old running back who sustained a left ankle eversion type injury during a football game when an opponent landed on his lower leg forcing it into external rotation. He did not finish playing due to the inability to bear weight.

**PHYSICAL EXAMINATION:** During initial evaluation, limited to a significant amount of pain, he had tenderness over the deltoid, anterior talofibular, and calcaneofibular ligaments. During reevaluation two days later he was also complaining of some tenderness around the lateral aspect of his left knee. His exam showed mild edema at the level of his ankle, tenderness over ligaments as noted before, along with pain on external rotation of his foot, compression along his syndesmosis, and palpation over his tibiofibular joint with increased posterior translation of his proximal fibula compared to the contralateral side. His left knee exam revealed pain in the area of his fibular head with varus stress, but was otherwise unremarkable.

**DIFFERENTIAL DIAGNOSIS:**
- Ankle fracture
- Syndesmosis injury
- Proximal tibiofibular joint injury

**TREATMENT AND OUTCOMES:**
- Stress radiographs of left ankle at the stadium:
  - no acute fracture and no obvious opening of his syndesmosis or medial joint space
  - Repeat weight bearing radiographs of left ankle:
  - ossification of his syndesmosis likely indicative of previous injury, as well as decreased overlap between distal tibia and fibula
  - no clear evidence of medial ankle joint space widening
  - MRI of left calf and ankle:
  - no ligamentous tear of the proximal tibiofibular joint, but changes consistent with chronic avulsion injury of the syndesmotic membrane from the distal portion of the tibia and probable injuries to his anterior inferior tibiofibular ligament and anterior tibiofibular ligaments

**FINAL WORKING DIAGNOSIS:**
Syndesmosis injury with proximal tibiofibular joint instability

**TREATMENT AND OUTCOMES:**
1. Non-weightbearing for the initial 10 days post injury.
2. Open reduction and internal fixation of distal syndesmosis using a single tightrope fixation, along with stabilization of the proximal tibiofibular joint using the same technique.
3. Non-weightbearing for the following 6 weeks.
4. Gradual return to physical activity.
HISTORY: 25 yo woman developed R hip pain while running her 1st marathon. She first noticed R hip pain during training runs approximately 2 wks before the event. Her pain was present at the beginning of her runs, subsided during, and then ached afterwards. During the marathon, she first noticed hip pain around mile 20-21, but this didn’t affect her stride until mile 24 when she began to feel cramping and her stride changed. In the last mile, which was downhill, she knew something was wrong and about 100 m from the finish line she felt a “pop” in her R hip. She was unable to weight bear and was piggy-backed over her finish line about 3h:20min after the start.

PMH: History of severe GERD in 2013, currently on ranitidine 75mg daily. Avid Nordic skier and mountain biker. Suffered a mountain bike crash 1 yr prior to the race and was unable to exercise for 6 mo due to severe concussion symptoms. Started running 5 mo before the race and ramped up to the marathon distance. Reports normal menstrual cycles. Non-vegan vegetarian for 15 yrs. No iron supplementation due to GERD.

PHYSICAL EXAM: Brought to medical tent in a wheelchair, unable to bear weight on her R leg. She had no tenderness to palpation of her hip musculature. Her R leg appeared to be slightly shorter and externally rotated compared to her L leg. She had exercising pain with internal rotation of her hip.

DIFFERENTIAL DIAGNOSIS:
1. Hip fracture
2. Stress fracture/reacttion
3. SI joint dysfunction
4. Gluteal muscle strain

TEST AND RESULTS:
Hip radiographs: R transverse fibular femoral neck fx
Hip CT: R transverse fibular femoral neck fx, no pathologic fx
Pending: DEXA scan, diet and activity analysis for energy deficit

FINAL WORKING DIAGNOSIS:
R transverse fibular femoral neck fx

TREATMENT AND OUTCOMES:
1. R femoral neck fx- CRIF
2. Weight bear as tolerated with crutches prn
3. PT started 2 wks post-operatively
4. No “pounding” activities for 6 wks
5. Stationary bike for exercise as tolerated
6. Nutrition counseling

History: 47 yo female presented to this clinic with more than 2 years of right anterior thigh pain. She had previously been an ultramarathon runner and cyclist but had to stop these activities secondary to pain. Her pain started the day after running a marathon in September 2014. She completed that marathon with symptoms of mild calf tightness and anterolateral thigh “giving out” during the last mile. The following day she developed right posterolateral buttock pain with radiation to anterior and mid-thigh with ambulation. She had an extensive workup prior to presentation at the sports medicine clinic and was being treated under the working diagnosis of radiculopathy. She had MRIs of her right knee, right hip, and lumbar spine. She had tried physical therapy, chiropractic care, lumbar epidural injection and watchful waiting. None of these alleviated her symptoms. At initial presentation to this clinic, she complained of right anterior thigh cramping that starts with 15 minutes of running and stops within an hour after rest. The pain is severe and rated 7/10 with activity. The pain does not radiate and is located in the anterior thigh. She denies lower back pain, numbness or tingling. She has no pain with squatting and minimal periodical pain with prolonged walking.

Exam: On exam, the patient had a normal gait, a small right knee effusion and tenderness to palpation over the distal myotendinous junction of rectus femoris and vastus lateralis. Hip ROM was full and non-painful, with negative FADIR and Stinchfield tests. Knee exam with no ligamentous laxity or point tenderness. She had bilateral weakness of hip abductors. Differential Diagnosis: 1) Hip labral tear 2) Femoral Acetabular Impingement 3) Iliac artery endofibrosis 4) Inflammatory Myositis 5) Meniscal Tear of Knee Tests and Results: Diagnostic US of knee and hip - patellofemoral arthropathy - small knee effusion - CAM type femoral deformity - anterior acetabular calcification without labral tear Diagnostic Knee and Hip Injection without benefit Arterial Dopplers - abnormal ABI on R, normal on L - Complete external iliac artery occlusion on right and ~50% stenosis of left common iliac artery - Final Diagnosis: Complete right external iliac endofibrosis Outcome/Treatment: - Right external thromboendarterectomy - Partial running on AlterG at 2 months - Full running at 3 months

HPI
17yr old ballerina presents with bilateral hip pain, left > right that has become progressively worse over the last year. Groin pain and some posterior hip pain. She states that when standing in arabesque she has the most discomfort but also with standing in 3rd and 5th position .

PE
Normal, non-antalgic gait.

Right Hip: Negative log roll. Negative straight leg raise and Stinchfield testing. Flexion to 150°, internal rotation 30°, external rotation 50°, abduction of 50°. Negative impingement. Minimal discomfort with extension and external rotation.

Left Hip: Negative log roll. Negative straight leg raise and Stinchfield testing. Flexion to 140° but painful from 110-140°. Internal rotation to 20°, external rotation to 50° and abduction to 50°. She has positive impingement testing. She also has a positive FABER and scissor test. Significant pain with extension and external rotation.

DIFF DS
Labral tear
FAI
Psoas tendinitis/bursitis
Dysplasia

Email: ronan.cahill@swedish.org

ACSM May 30 – June 3, 2017
Denver, Colorado
Final Working Dx
Posterior bony impingement with secondary anterior instability
Osteochondroma (unlikely)

Treatments
Continue PT
Modify dance, except for performances.
Surgical planning in progress - open posterior femoral osteochondroplasty, possible arthroscopy

2460 June 2 10:50 AM - 11:10 AM
Right Hip Pain in a 36 year old Ironman Athlete
Alan J. Boucher, MD, Joel Shaw, MD, Joe Simko, PT.
OhioHealth Grant Medical Center, Columbus, OH.
(No relationships reported)

HISTORY: A 36 year old female long distance runner who was training for an Ironman that presented with a 1 week history of right hip pain. Onset of pain when standing up quickly from sitting position. Pain is reported laterally and worsening with activity. She said it is progressing for the last 2 nights. Now she is unable to weight bear on her right leg.

PHYSICAL EXAMINATION: Her hips were with no obvious deformity or effusion to inspection bilaterally. She exhibited normal ROM with severe pain with internal rotation. Strength 5/5 in hip bilaterally. Tenderness of the anterior aspect of the right hip. Pain elicited with resisted hip flexion.

TEST AND RESULTS: X-ray right hip revealed a large separated bony piece at the area of the anterior inferior iliac spine (AIIS) consistent with an avulsion, initially presumed as a chronic injury. Based on the severity and concern for stress fracture of the femoral neck she was placed on crutches with no weight bearing. MRI was ordered presumed as a chronic injury. Based on the severity and concern for stress fracture of the femoral neck she was placed on crutches with no weight bearing. MRI was ordered.

TREATMENT:
- Crutches until pain free
- Ice and electrical stimulation
- Vitamin D3 supplementation
- Physical therapy started 3 weeks post injury
- Progressed through a gradual return to activity

2461 June 2 11:10 AM - 11:30 AM
Pelvic Injury in a 60 Year Old Rollerblander
Andrew Barclay. LECOM Sports Medicine, Erie, PA. (Sponsor: Patrick F. Leary, FACSM)
(No relationships reported)

Clinical Case Abstract
Pelvic injury - Rollerblanding
Andrew D. Barclay, LECOM Sports Medicine, Erie, PA
Email: andrew.barclay@nv.touro.edu
(Sponsor: Patrick F. Leary, FACSM)
HISTORY: A 60 year old female presented on a Friday afternoon with right groin pain for one week. Onset of pain after a fall while rollerblading. She was unable to bear weight on her right leg after the injury and during the evaluation. After examination, she was sent for radiographs of the pelvis and bilateral hips.

PHYSICAL EXAMINATION: Examination in the office of the right pelvis and hip revealed inability to flex the hip in supine position due to pain. Special testing revealed a negative log roll and FABER test, but positive

FADIR test. Gait posture was antalgic and the patient was unable to fully bear weight on right leg.

DIFFERENTIAL DIAGNOSIS:
- Hip/pelvic fracture
- Hip dislocation
- Hip osteoarthritis
- Bone contusion

TEST AND RESULTS:
- X-ray Pelvis and Bilateral Hilps:
  - nondisplaced fractures right superior and inferior pubic rami
  - mild osteoporosis
- Pelvic CT:
  - minimally displaced comminuted fracture right inferior pubic ramus
  - nondisplaced fracture proximal right superior pubic ramus adjacent to the acetabulum

Dexa Scan:
- T-score of -2.1

Labs:
- Vit D pending

FINAL/WORKING DIAGNOSIS:
- Pelvic ring fracture
- Osteoporosis

TREATMENT AND OUTCOMES:
- Crutches until pain free
- Ice and electrical stimulation
- Vitamin D3 supplementation
- Physical therapy started 3 weeks post injury
- Progressed through a gradual return to activity

2462 June 2 9:30 AM
Knee Injury- Ballet
Lindsay Ramey, Daniel Blatz.
(No relationships reported)

Abstracts were prepared by the authors and printed as submitted.
Final Working Diagnosis: Osgood-Schlatter disease

Test and Results:
Knee US: Focal hypoechoegenicity & fiber disruption in the right medial proximal patellar tendon
Right knee MRI: Increased signal on T2 & STIR confirming partial tear of the proximal patellar tendon

Diagnosis:
Right proximal patellar tendon tear

Treatment and Outcomes:
Initial treatment included knee immobilization, activity restriction, topical nitroglycerin & PT for 3 months without improvement. The patient pursued an US-guided platelet-rich plasma (PRP) injection without tenotomy at an outside facility. He had partial improvement but dance remained restricted. Subsequent US at 6 months showed persistent tear. US-guided tenotomy and PRP injection were repeated, followed by activity restriction, PT and return to activity protocol. He noted limited relief at 4 weeks and pursued a third PRP injection at an outside facility. He developed worsening, diffuse anterior knee pain. US showed new thickening and heterogeneity throughout the right patellar tendon.

MRI confirmed hypertrophic changes. Given prolonged course, he underwent open patellar tendon debridement & repair. Intra-operatively, the tendon was noted to be significantly thickened with abnormal color & texture. Post-operative follow-up is ongoing.

Knee Injury-jumping

HISTORY: 40 year-old female who injured her right knee jumping onto a dock. She had sudden, severe pain, 9 out of 10 in intensity. She could not bear weight or bend it initially. She had swelling the next day. She described locking and occasional “giving out”. Within days, she could walk with minimal discomfort but could not exercise or lift weights. Symptoms slowly improved over the past 8 weeks as she presented for further evaluation.

Physical Examination:
Healthy-appearing male in no acute distress. No fever, chills, or knee drainage was present. Due to the symptoms, he returned to clinic for further evaluation.

Tests and Results:
Right knee limited ultrasound - moderate effusion within joint capsule. US showed intrasubstance tearing and a 10x5mm peritendinous cyst.

Diagnosis:
Right proximal patellar tendon tear

Treatment and Outcomes:
1. Modified rest for another 4 weeks (12 weeks from injury) 2. Physical therapy 3. Gradual return to jumps, squats, lunges, and weight lifting

HISTORY: A 60 year old male runner with a history of right common peroneal nerve entrapment status post-surgical decompression presented for evaluation of right lateral knee pain that had been present for 1 year. He described dull, lateral, aching knee pain, worsened by impact activity (e.g., running). He denied mechanical symptoms or effusion. Knee MRI demonstrated popliteus tendinopathy with partial-thickness intrasubstance tearing and a 10x5mm peritendinous cyst.

Ultrasound (US)-guidance was used to drain and fenestrate the cyst, and fenestrate and inject the popliteus tendon with leukocyte rich platelet rich plasma (PRP). The procedure was performed without complication. The patient used crutches for 5 days post-procedure, but on day 6 he walked 6 blocks without crutches. That evening, he developed pain and swelling with erythema in the suprapatellar region. No fever, chills, or knee drainage was present. Due to the symptoms, he returned to clinic for evaluation.

Physical Examination: Healthy appearing male in no acute distress. Mildly antalgic gait pattern. Grade 2 right knee effusion with erythema around the suprolateral aspect of the knee. Well-healed injection site without erythema. Mild tenderness to palpation over the popliteus tendon insertion. Normal ligamentous and meniscal tests.

Final Working Diagnosis: Fracture of Osgood-Schlatter disease

Test and Results: X-rays revealed hypertrophic changes of right tibial tubercle with mild associated soft tissue swelling. MRI revealed irregularity of tibial tubercle suggesting sequela of Osgood-Schlatter disease. There were surrounding inflammatory changes and edema with small amount of fluid in deep and superficial infrapatellar bursae. No internal derangement.

Treatment and Outcomes: 1. Modified rest for another 4 weeks (12 weeks from injury) 2. Physical therapy 3. Gradual return to jumps, squats, lunges, and weight lifting


FINAL WORKING DIAGNOSIS: Acute right knee pseudogout flair in a patient with no history of pseudogout, status post popliteus tendon PRP injection with peritendinous cyst aspiration and facetectomy.

TREATMENT AND OUTCOMES: The patient was successfully treated with crutches, ice, compression, elevation, and NSAIDs.

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2468 June 2 10:30 AM - 10:50 AM Knee Pain - Soccer
Kenneth Y. Choi, Marissa S. Vásquez, Michael K. Fong. Kaiser Permanente Los Angeles Medical Center, Los Angeles, CA. (Sponsor: Aaron Rubin, FACSM) (No relationships reported)

HISTORY: 18 y/o male soccer player sustained a twisting injury with direct contact of his left knee during a game. He had no immediate or delayed swelling, but continued to have persistent posterior knee pain for two months before he pursued medical care. No instability or locking. Due to the severity of the pain, he had not played at all since the injury.

PHYSICAL EXAMINATION: Examination in the office revealed a trace effusion and tenderness to palpation over the proximal posteromedial tibia. Otherwise, the patient had full range of motion, no ligamentous laxity, and no meniscal signs.

DIFFERENTIAL DIAGNOSIS:
1. Fracture/stress reaction
2. Contusion
3. Capsular sprain
4. MCL sprain
5. Medial meniscus tear
6. Maligancy

TEST AND RESULTS:
1. MRI Left Knee Without Contrast
   a. 7 mm x 6 mm x 7 mm intracortical lesion with periostitis and peristential reaction
   b. Bone marrow edema in the proximal tibia with medial aspect surrounding the intracortical lesion
   c. Clinical correlation required to differentiate whether bone marrow edema is from recent trauma or intracortical lesion
2. CT Left Knee Without Contrast
   a. 4 mm x 3 mm x 4 mm intracortical extracapsular osteoid osteoma in the proximal medial tibial metaphyseal cortex

FINAL WORKING DIAGNOSIS: Osteoid osteoma of the proximal tibia

TREATMENT AND OUTCOMES:
1. Initially treated with rest and non-steroidal anti-inflammatory medication as needed
2. Had continued pain for three months after diagnosis, and was referred to orthopedic oncologist
3. CT-guided radiofrequency ablation performed successfully

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2469 June 2 10:50 AM - 11:10 AM Utility of Dynamic Sonographic Evaluation of Left Knee Pain & Locking in a Softball Catcher
Allison N. Schroeder, Kentaro Onishi. University of Pittsburgh Medical Center (UPMC), Pittsburgh, PA. (Sponsor: Tom Best, FACSM) Email: asshroel1@alumni.nd.edu (No relationships reported)

HISTORY: An 18-year-old softball catcher presenting with a 3 year history of left progressive postero-lateral knee discomfort with associated knee locking when squatting or deep knee flexion. Onset was 3 years ago when she was in a squat position during a softball game. She had been avoiding aggravating activities and initially sought medical care 3 months ago, presenting to an orthopedic specialist’s clinic. Following a negative MRI, she was referred to our clinic for diagnostic ultrasound of the knee. She reported reliable way to reproduce locking, but, when locking does occur, she must manually unlock herself. Previous treatment included 8 weeks of physical therapy without benefit.

PHYSICAL EXAMINATION: No discoloration or swelling of the left knee. Non-articular gait. Valgus alignment with dynamic valgus on single leg squat. Posterior lateral joint line tenderness. No other focal tenderness. Full and symmetric bilateral knee active range of motion without pain, except in terminal flexion. Negative McMurray’s, cruciate and collateral ligament testing and dial test. 9/9 Beighton criteria.

DIFFERENTIAL DIAGNOSIS:
1. Meniscocapsular separation
2. Lateral meniscus injury
3. Proximal tibial tibial osteoarthritis
4. Popliteus muscle/tendon injury
5. Anterolateral complex sprain
6. PFL injury

TEST AND RESULTS: MRI: Slight irregularity of posterior superior meniscocapsular fascicle deemed secondary to volume-averaging artifact. Otherwise, no discrete pathology was noted. Ultrasound: No discrete lesion of entirety of lateral meniscus on static development of a separation (3.1mm) between posterior capsule tissue and posterior outermost fiber of left lateral meniscus when knee is in near full flexion.

FINAL WORKING DIAGNOSIS: Left posterolateral meniscocapsular separation

TREATMENT AND OUTCOMES: Management options (expectant management, injection options to mitigate pain, and a surgery) were discussed. Patient elected surgical fixation of lateral meniscus. Arthroscopic fixation of lateral meniscus with 2 vertical mattress sutures using a FastFX device was performed. After 4 weeks of bracing to allow proper surgical healing, she was able to start using an elliptical at 6 weeks and jogging at 9 weeks. She remains void of pre-surgical pain and locking at 16 weeks post-operatively.

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E-24 Basic Science World Congress/Poster - Neurobiological Effects of Exercise
Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2481 Board #1 June 2 9:30 AM - 11:00 AM FMRI Assessed Neural Activation in Blood Flow Restricted Handgrip Exercise
Aaron W. Johnson, Tiffany D. deVries, Brock Kirwan, J W. Myrer. Brigham Young University, Provo, UT. (Sponsor: Pat Vehrs, FACSM) (No relationships reported)

PURPOSE: Blood-flow-restricted (BFR) exercise is reported to improve strength and elicit muscle hypertrophy, although little is known about its neural effects. The purpose of this study was to investigate brain neural responses to BFR exercise and control conditions during handgrip exercise.

METHODS: Twenty-five subjects completed dynamic handgrip exercises during BFR and control conditions on two different days separated by 72 hours. fMRI scans were acquired during both exercise conditions. The exercise protocol consisted of five 30-second sets of squeezing a non-metallic handgrip exerciser (a reported 13.6 kg resistance), doing as many repetitions as possible, with 20-second rest intervals between sets.

RESULTS: There was a significant main effect of exercise condition in the neural activity in the premotor dorsal (F = 5.71, p = 0.022), prefrontal ventral (F = 8.21, p = 0.007), and right ventral striatum (F = 7.36, p = 0.01) areas. When considering anatomical regions of interest, we found no significant differences between exercise conditions in the bilateral primary sensory cortex (p = 0.32), primary motor cortex (p = 0.33), supplementary motor area (p = 0.66), cerebellum (p = 0.70), insular cortex (p = 0.45), anterior cingulate cortex (p = 0.24), or thalamus (p = 0.66). Significant linear trends (p = 0.001) over the five exercise sets were found in the bilateral anterior......
presence of locomotor muscle fatigue. mediated long-interval inhibition (LII) during cycling exercise in the absence and paired TMS-cervicomedullary stimulation (CMS, TMS-CMS) were used during NFC fentanyl (FENT) impairing feedback from group III/IV leg muscle afferents. Single pattern changes with fatigue development.

PURPOSE: To investigate the influence of group III/IV muscle afferents on GABA-mediated inhibition and Corticospinal Excitability. Supported by NIH grant 1R15AG047553 - 01A1

PURPOSE: To test the effects of fatigue phases (early vs late) on force steadiness, muscle activity, RPE, and hemodynamic responses of each neural channel. Physiological measures of joint force and electromyography measuring muscle activity changes with fatigue of these large muscles. METHODS: We measured neurogenic effects of static muscle contraction on large muscle afferents. Subjects participated in two 8-hr simulated workdays: 1) sitting continuously (SIT), and 2) alternating sitting and standing every 30 min (SS). Beat-to-beat peak systolic, mean systolic and diastolic CBF were recorded bilaterally for 1 min via insonation of the middle cerebral artery using transcranial Doppler ultrasonography before (morning), between (midday) and following (afternoon) two 4-hr work periods. Results: Mean (SD) age was 42 ± 12 (years), blood pressure (BP) was 132 (9)/83 (8) mmHg, and BMI was 32 (5) kg/m2. Repeated measures ANOVA revealed a significant effect of time for peak systolic (P < 0.05), resulting in a 7 ± 5% decrease in MEP/CMEP in SIT but not SS (P > 0.14). The only change from midday to afternoon was an increase in mean systolic CBF (P = 0.048) in SIT. No significant effects were observed by condition or for the condition x time interaction (P > 0.20) (Figure). Conclusions: In individuals with elevated BP and BMI, CBF differed across an 8-hr workday but not across sitting and alternating posture conditions. However, significant midday declines were observed only during prolonged sitting. Future studies should study trajectories and factors that influence CBF during the workday.

CONCLUSION: These findings suggest that the absence of fatigue, group III/IV muscle afferents may facilitate the excitability of motor cortical cells by limiting the activation of GABA intraarticular inhibitory interneurons.

CONCLUSION: The presence of locomotor muscle fatigue. mediated long-interval inhibition (LII) during cycling exercise in the absence and paired TMS-cervicomedullary stimulation (CMS, TMS-CMS) were used during NFC fentanyl (FENT) impairing feedback from group III/IV leg muscle afferents. Single pattern changes with fatigue development.

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CONCLUSION: The presence of locomotor muscle fatigue. mediated long-interval inhibition (LII) during cycling exercise in the absence and paired TMS-cervicomedullary stimulation (CMS, TMS-CMS) were used during NFC fentanyl (FENT) impairing feedback from group III/IV leg muscle afferents. Single pattern changes with fatigue development.
anaerobic test were monitored using both devices for 15-minute post-test, with values noted at 0-, 60-, 90-, 120-, 300-, 600- and 900-second time points. Means and standard deviations were generated for all variables. Repeated measures ANOVA was used to determine differences between time points for Cox, end-tidal carbon dioxide (PETCO2), heart rate (HR) and respiratory rate (RR). Significance was set at p < 0.05.

RESULTS: Baseline Cox was 66.96 ± 5.79%. Throughout recovery, Cox did not differ from baseline until 600s post-test, where it significantly increased to 68.73 ± 7.22%. At exercise cessation, PETCO2 was 25.84 ± 4.58mmHg before a sudden influx at 60s, achieving 33.37 ± 4.18mmHg; which was followed by a gradual decline through the 900s time point. As expected, both HR and RR peaked at exercise cessation and gradually declined through recovery.

CONCLUSION: Cox following anaerobic exercise did not deviate from baseline until a sudden rise approximately 600s post-test. This differs from previously outlined responses to aerobic exercise, which have found drastic reductions and consequential influxes following maximal exercise. PETCO2 and RR readings indicate that RCT was not achieved despite a rise in CO2 levels, which may have prevented the drastic changes in oxygenation that are observed with aerobic exercise.

Cerebral blood flow and oxygenation are important variables to consider for concussion diagnosis and treatment. As a result, monitoring these variables throughout progressive aerobic exercise has emerged as a potential concussion management tool, as well as an indication to sport, such as cycling. However, such a mechanism may not be specific to the sport or workplace to which the individual is returning. Understanding how a healthy brain responds to various types of exercise has the potential to create more individualized methods of concussion management.

PURPOSE: To identify the differences in cerebral oxygenation recovery following bouts of maximal resistance and aerobic exercise.

METHODS: Twenty-eight physically active, healthy participants aged 18-35 were recruited, each partaking in two sessions. At the first session anthropometric measures were collected, followed 30 minutes later with the aerobic test (Cox from baseline until 600s post-test, where it significantly increased to 68.73 ± 7.22%). During the second session participants completed a maximal leg press resistance training protocol, followed 30 minutes later by a maximal aerobic protocol. Participants were connected to a cerebral oximeter and metabolic cart for monitoring. As such, cerebral oxygenation and ventilatory gas exchange variables were documented throughout the duration of exercise and for 15-minutes of passive recovery post-test.

RESULTS: Maximal aerobic exercise resulted in a progressive increase in cerebral oxygenation following cessation of exercise until peaking at 70.61 ± 7.41%, 300-seconds post-test. This represents a significant rise from a baseline value of 66.00 ± 5.48%. The rise in oxygenation following aerobic exercise differed from resistance exercise from 90-seconds onwards, as resistance exercise did not result in a significant change from its 66.89 ± 5.62% baseline value.

CONCLUSION: While maximal aerobic exercise resulted in significant increases in cerebral oxygenation from baseline levels throughout recovery, maximal resistance exercise did not elicit the same response. This indicates that aerobic exercise results in a metabolic strain on the brain which differs from the strain experienced as a result of resistance exercise. As such, expecting equivalent outcomes and utility as concussion management tools from both exercise methods may be misguided and requires additional research.

Cerebral autoregulation is the ability of the brain to maintain constant cerebral perfusion despite oscillations in systemic blood pressure. Exercise training improves cerebral vasomotor function; however, the impact of habitual exercise on cerebral autoregulatory function is unknown. PURPOSE: To determine whether habitual aerobic exercise affects cerebral autoregulation in habitually exercising and sedentary young adults. We hypothesized that young adults who habitually exercise would show enhanced measures of cerebral autoregulation compared to sedentary controls. METHODS: We evaluated 20 habitual exercisers (EX: age = 28 ± 1 y; women = 6; VO2max = 47 ± 1 ml/kg/min, BMI= 24.2 ± 3.0 kg/m2) and 21 sedentary controls (SED; age = 46 ± 20 y, women= 12, VO2max = 27 ± 6 ml/kg/min, BMI= 24.9 ± 2.0 kg/m2). Mean arterial pressure (MAP) and middle cerebral artery velocity (MCAv) were continuously recorded during rest. Pulsatility index (PI) was calculated by subtracting diastolic MCAv from systolic MCAv and dividing the result by the mean MCAv. RESULTS: Habitual exercisers had a lower MCAv compared to sedentary controls (EX: 5.7 ± 3.5 cm/s vs. SED: 68.5 ± 4.0 cm/s; p<0.05), and MAP was similar between the two groups (EX: 88 ± 2 mmHg vs. SED: 89 ± 2 mmHg; p=0.69). Habitual exercisers tended to have a lower PI (EX: 0.75 ± 0.03 vs. SED: 0.83 ± 0.04; p=0.09), and VO2max was inversely associated with PI (r= -0.34; p=0.05) when evaluating all subjects. CONCLUSIONS: Habitual exercisers tended to have a lower PI, although the results did not reach statistical significance. The inverse association between VO2max and PI suggests that individuals with a higher fitness may have a lower risk of developing cerebrovascular-related pathology. Supported by NIH grant HL118154.
51 ± 6 degr. vs. CON: 46 ± 8 degr.; p=0.64). CONCLUSIONS: Our results indicate that low frequency cerebral autoregulatory function is not different between habitually exercising and sedentary young adults, as the higher coherence was, 57.5% accompanied with a difference in phase or gain. Future studies may further examine if mode of exercise might influence cerebral autoregulation. Supported by NIH grant HL118154.

2490 Board #10 June 2 9:30 AM - 11:00 AM
Association Between Habitual Physical Activity and Mechanical Pain Sensitivity in Healthy Adults
Katrina Maluf, Jaime Zinn, Luisa Davila-Pablo, Paige Kettenburg, San Diego State University, San Diego, CA.
Email: kmaluf@mail.sdsu.edu

No relationships reported

Routine engagement in physical activity is recommended for the prevention and management of chronic musculoskeletal pain. Previous studies have compared pain sensitivity between active and sedentary groups categorized based on self-reported levels of physical activity. However, the extent to which pain sensitivity varies with individual differences in objectively assessed habitual physical activity is not known. PURPOSE: To quantify associations between mechanical pain sensitivity and physical activity outcomes measured by accelerometry. METHODS: Healthy young (21.5 ± 2.2 years) adults wore an accelerometer (ActiGraph Model wGT3X-BT) on the waist while performing their usual activities for 7 consecutive days. Published calibration equations were used to classify each 1-min epoch of activity count data as sedentary (0–100 counts/min), light (LPA), moderate- to vigorous-intensity physical activity (MVPA), and moderate-to- vigorous intensity physical activity (MVPA). The amount of time spent in each category was expressed as a percentage of total daily wear time, and was averaged across days with at least 10 hours of valid activity data. Mechanical pain sensitivity was quantified by applying a 1-cm² algometer probe to the ventral forearm at 50 kPa/sec. Pressure pain threshold (PPTth) was recorded as the pressure at which the stimulus first became painful, and pressure pain tolerance (PPTtol) was recorded as the pressure above which the painful sensation could no longer be tolerated. Associations between physical activity and pain sensitivity outcomes were assessed with Pearson’s correlation. RESULTS: On average, 74(±SD 6)% of total daily wear time was spent engaged in SB, LPA and MVPA comprised 23(19)% and 4(2)% of daily wear time, respectively. PPTth ranged from 34 to 287 kPa, and PPTtol ranged from 536 to 1576 kPa. PPTtol was not associated with physical activity outcomes. PPTtol was negatively associated with SB (r = 0.70) and positively associated with LPA (r = 0.56) but not MVPA. CONCLUSION: Healthy young adults who engage in less sedentary behavior and more light intensity physical activity have greater tolerance of mechanical pain. Future work should determine whether this relationship reflects activity-related adaptations in pain processing, or the effects of pain tolerance on willingness to engage in physical activities.

2491 Board #11 June 2 9:30 AM - 11:00 AM
Effect of Exercise Training on Cerebral Microcirculation in Men with and without Type 1 Diabetes
Antti-Pekka E. Rissanen1, Heikki O. Tikkanen2, Anne S. Koponen3, Jyrki M. Aho2, Juha E. Peltonen1. 1University of Helsinki, Helsinki, Finland. 2University of Eastern Finland, Kuopio, Finland. 3Foundation for Sports and Exercise Medicine, Helsinki, Finland.
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No relationships reported

PURPOSE: Effects of regular exercise on cerebral microcirculation in diabetes are not known. Aerobic exercise training may improve cerebral blood flow (CBF) regulation and reduce the risk of dementia. Cerebral autoregulation (CA) is the unique function of the brain which maintains CBF during changes in blood pressure. PURPOSE: To determine 1) the effects of aerobic exercise training and improvement of cardiorespiratory fitness on dynamic CA (dCA) and 2) the reproducibility of dCA metrics in patients with mild cognitive impairment (MCI). METHODS: Seventy MCI patients were randomized to 12 months of aerobic exercise training or stretching. Before and after intervention, beat-by-beat CBF velocity and blood pressure were simultaneously measured by transcranial Doppler (TCD) and finger plethysmography during a seated resting condition and a repeated sit-stand maneuver. Transfer function analysis was used to estimate dCA gain, phase, and coherence. Cardiorespiratory fitness was assessed by maximal oxygen uptake (VO2max) that is measured on treadmill using a modified Astrand-Saltin protocol. RESULTS: Clean TCD signals were available from 54 patients at baseline, of which 29 patients completed exercise training (n=14) or stretching (n=15) program. After exercise training, dCA gain, phase, and coherence measured during rest and sit-stand maneuvers were not different from stretching group. Likewise, those dCA metrics measured from the patients who did not improved VO2max was not different from the other patients who did not make improvement. The comparison of dCA metrics measured before and after 12 months showed significant intra-class correlations of dCA gain at very low frequency (rest: R²=0.33, P=0.001; sit-stand: R²=0.40, P=0.029). CONCLUSIONS: Although dCA metrics were reproducible over 1 year (particularly the gain at very low frequency during rest), neither aerobic exercise training nor the improvement of cardiorespiratory fitness altered dCA metrics in MCI patients. Supported by the NIH (R01AG033106 and K99HL133449) and the American Heart Association (14POST201400103).

2492 Board #12 June 2 9:30 AM - 11:00 AM
Aerobic Exercise Training and Dynamic Cerebral Autoregulation in Patients with Mild Cognitive Impairment
Takashi Tarumi1, Chang-Yang Xing2, Marcel Turner1, Justin Repshas1, Rong Zhang1. 1UT Southwestern Medical Center, Dallas, TX. 2Texas Health Presbyterian Hospital Dallas, Dallas, TX.
Email: takat@gmail.com

No relationships reported

Aerobic exercise training may improve cerebral blood flow (CBF) regulation and reduce the risk of dementia. Cerebral autoregulation (CA) is the unique function of the brain which maintains CBF during changes in blood pressure. PURPOSE: To determine 1) the effects of aerobic exercise training and improvement of cardiorespiratory fitness on dynamic CA (dCA) and 2) the reproducibility of dCA metrics in patients with mild cognitive impairment (MCI). METHODS: Seventy MCI patients were randomized to 12 months of aerobic exercise training or stretching. Before and after intervention, beat-by-beat CBF velocity and blood pressure were simultaneously measured by transcranial Doppler (TCD) and finger plethysmography during a seated resting condition and a repeated sit-stand maneuver. Transfer function analysis was used to estimate dCA gain, phase, and coherence. Cardiorespiratory fitness was assessed by maximal oxygen uptake (VO2max) that is measured on treadmill using a modified Astrand-Saltin protocol. RESULTS: Clean TCD signals were available from 54 patients at baseline, of which 29 patients completed exercise training (n=14) or stretching (n=15) program. After exercise training, dCA gain, phase, and coherence measured during rest and sit-stand maneuvers were not different from stretching group. Likewise, those dCA metrics measured from the patients who did not improved VO2max was not different from the other patients who did not make improvement. The comparison of dCA metrics measured before and after 12 months showed significant intra-class correlations of dCA gain at very low frequency (rest: R²=0.33, P=0.001; sit-stand: R²=0.40, P=0.029). CONCLUSIONS: Although dCA metrics were reproducible over 1 year (particularly the gain at very low frequency during rest), neither aerobic exercise training nor the improvement of cardiorespiratory fitness altered dCA metrics in MCI patients. Supported by the NIH (R01AG033106 and K99HL133449) and the American Heart Association (14POST201400103).

2493 Board #13 June 2 9:30 AM - 11:00 AM
Effects of Aerobic and Resistance Exercise on Cognitive Function
Takaki Komiyama1, Kenji Ando2, Mizuki Sudo2, Ryuji Takigawa2, Kazunori Okawara2, Yoshinari Uehara1, Hiroaki Tanaka1, Yasuki Higaki3, Soichi Ando2, Fukoku university, Fukuoka, Japan. 1The University of Electro-Communications, Tokyo, Japan. 2Meiji Yasuda Life Foundation of Health and Welfare, Tokyo, Japan.

No relationships reported

There is a substantial body of evidence to show that acute exercise improves cognitive function. The improvements seem to be observed irrespective of exercise mode (i.e., aerobic and resistance). However, it is unclear how aerobic and resistance exercise improves cognitive function. PURPOSE: To clarify the effects of acute aerobic and resistance exercise on cognitive function. METHODS: Sixteen subjects completed cognitive tasks before and after acute aerobic or resistance exercise in a randomized counterbalanced design. In aerobic condition, they cycled an ergometer at the intensity corresponding to 40% peak oxygen uptake. In resistance condition, they performed resistance exercise using elastic bands. Exercise duration of each condition was 30 min. Cognitive task was a Go/NoGo task, which required executive function. Plasma catecholamine, insulin-like growth hormone factor 1 (IGF-1), serum brain-derived neurotrophic factor serata (BDNF), and blood lactate concentration were measured before and after exercise. RESULTS: Compared with rest, reaction time on the Go/NoGo task tended to decreased after exercise (aerobic: 651 ± 143 vs. 586 ± 175 ms, resistance: 644 ± 212 vs. 604 ± 160 ms, p = 0.06). Neither exercise nor condition altered the accuracy on the cognitive task. Both aerobic and resistance exercise increased noradrenaline (aerobic: 38 ± 9 vs. 51 ± 21 ng/mL, p=0.05, resistance: 18.8 ± 21.4 vs. 66.9 ± 30.3 pg/mL, p<0.01), noradrenaline (aerobic: 341 ± 97 vs. 476 ± 142 pg/mL, p=0.05, resistance: 41.8 ± 25.3 vs. 72 ± 36 pg/mL, p<0.01). There is no significant difference in adrenaline (aerobic: 38.8 ± 14.4 vs. 71.5 ± 21.5 pg/mL, resistance: 43.3 ± 17.2 vs. 28 ± 8 pg/mL, p=0.13). Considering the results of noradrenaline and adrenaline, it can be concluded that acute exercise improved cognitive function.
progressively declined with the progression of dementia, implicating that AD and its progression might be the result of an intertwined decline of both neural and vascular functions, likely related to the NO availability.

Conclusions: Acute aerobic and resistance exercise improves cognitive function, probably due to increased central neuroplastic activity. After resistance exercise, increases in IGF-1 and blood lactate concentrations might contribute to the improvement.

Purpose: Physical activity during adulthood is discussed as a major preventive factor against loss of cognitive function in old age. The present study aims at analyzing the effects of lifelong physical activity (PA) on cognitive function and brain metabolism.

Methods: Data were obtained from 50 cognitively unimpaired elderly participants (72±5yrs, 27±). Lifetime PA was assessed by a validated questionnaire investigating five epochs across the lifespan (age in years: 14±21, 22–34, 35–50, 51–65, 66–80). Data were analyzed as average energy consumption (MET-h/wk) per epoch. Participants individual lifespan activity profile was defined as the behavior they engaged in for at least 60% of their lifetime (≥5 epochs). Referring to current activity guidelines (7.5 MET-h/wk: < 75% vigorous or 150’ moderate PA-min/h) and based on the individual activity profiles, subjects were stratified in 3 groups of lifetime activity behavior (MET-h/wk: <7.5 / 7.5-15 / >15).

Cognitive assessment included testing of executive function (stropp interference test), verbal and non-verbal declarative memory and crystallized intelligence (MWT-B). Brain metabolism was recorded from a transversal slice just above the corpus callousum via magnetic resonance spectroscopic imaging (MRSI), and analyzed as the ratio of N-Acetylaspartate to choline (NAA/Cho).

Results: Compared to individuals reporting less than the recommended minimum of 7.5 MET-h/wk (460ms), ANCOVA revealed significantly (p<0.05) higher NAA/Cho values and shorter mean response times for strop word test among those performing the recommended minimum (<50ms) and those performing ≥2 times the minimum (<60ms). Stroop interference scores were solely higher in participants performing ≥2 times the minimum recommendation. Correlation analysis showed significant associations of overall and vigorous mean lifetime PA with stroop performance (r=0.408; r=0.410; p=0.05) and NAA/Cho (r=0.303; r=0.310; p<0.05).

Conclusions: The findings suggest that lifelong adherence to the minimum recommended amount of health enhancing PA results in positive effects on executive function and neuronal metabolism in old age. Exceeding minimum guideline recommendations in terms of intensity and duration might lead to additional benefits.

Purpose: To compare the effect of volume-matched high-intensity interval training (HIIT) and moderate-intensity continuous training (CONT) on ischaemic muscle pain tolerance and high-intensity exercise tolerance. Methods: Twenty healthy adults were randomly assigned to either 6 weeks of HIIT (6×5 min at halfway between lactate threshold and maximal power output) or CONT (6×5 min at 50%-55% of maximal power output). Results: HIIT resulted in similar improvements in all markers of aerobic fitness (P>0.05). Compared with pre-training, HIIT increased TTE at the same absolute and relative intensity) and the post-training 50%Δ (same relative intensity). The post-training TTE trials were completed at the pre-training 50%Δ (same relative intensity). Results: HIIT and CONT resulted in similar improvements in all markers of aerobic fitness (P>0.05).

Purpose: To compare the effect of high- but not moderate-intensity interval training increases pain tolerance: results from a randomised study.

Purpose: To examine the effect of HMB supplementation on the cognitive function of aged mice. Memory at the University of Illinois at Urbana Champaign. Supported by Abbott Nutrition through the Center for Nutrition, Learning, and Memory at the University of Illinois at Urbana Champaign.
Acute exercise (AEX) is a promising intervention for improving learning and memory. The memory enhancing effects of AEX may be mediated by increased expression of neurotrophins, elevated catecholamine signaling, and modifications to postynaptic glutamate receptors. Given the known memory enhancing effects of AEX in humans, it is important to explore how AEX and related noradrenergic signaling impact behavior, which are commonly used to study the influence of exercise on brain plasticity and behavior. PURPOSE: To determine the effects of one acute bout of exercise on hippocampal Bdnf expression, AMPA receptor phosphorylation, and behavior in mice. METHODS: C57BL/6J mice were randomly assigned to 3 groups: control (CON; n=12); moderate-intensity AEX (MOD; n=12); and high-intensity AEX (HI; n=12). CON mice were placed on the stationary treadmill (TM) for 30 min and MOD and HI mice ran for 30 min at 12 m/min and 15-17 m/min, respectively. Mice were sacrificed immediately after AEX, mRNA from the hippocampus, including total Bdnf (exon IX), Bdnf exon IV (Bdnf IV), and glutamate receptor subunits were quantified with qPCR. Total and phosphorylated GluR1 (Ser845 and Ser831) protein were quantified with immunoblotting. Utilizing the same CON (n=15) and HI (n=15) TM protocol, object location memory following AEX was examined. Anxiety-like behavior was assessed in the open field task (OFT) in a subset of mice that were separated into 4 groups: CON (n=8); AEX- Saline (n=8); and AEX- DSP-4 (n=9). DSP-4 was used to lesion the central noradrenergic system. RESULTS: We observed higher Bdnf IV mRNA in hippocampus of HI compared to CON mice (p=0.03). There was no effect of AEX on total Bdnf or any other mRNA or protein targets. There were no effects of AEX on memory performance in the object location task, though HI mice explored the testing arena significantly less (distance) during the initial phase of the task compared to CON (p=0.0003). In the OFT, mice exposed to AEX traveled significantly less total distance (p=0.0001) and spent more time grooming (p=0.0001) than CON mice. There was no effect of DSP-4 on behavior. CONCLUSION: AEX increases Bdnf IV mRNA expression in an intensity-dependent manner; however, high-intensity AEX also induces behaviors suggestive of an anxious phenotype in C57BL/6J mice.
brain MVD in LZR/UCMS group. CONCLUSION: Taken together, these results suggested that OZR is more susceptible to UCMS associated brain vascular structural alteration than LZR is. Importantly, exercise treatment appears to prevent UCMS associated brain rarefaction in OZR.

2502 Board #22
June 2 9:30 AM - 11:00 AM
Effects of Voluntary Wheel Running exercise on the Circadian Alterations of Neuroendocrine Induced by Chronic Unpredictable Mild Stress in Rats
Yan Zhao, Yu Fu. Cheng Du Sport University, Cheng Du, China. (No relationships reported)

PURPOSE: To investigate the effect of voluntary wheel running exercise on the circadian rhythmic alterations of plasma hormone and peptide induced by the Chronic Unpredictable Mild Stress (CUMS).

METHODS: Ninety male SD rats were divided into three groups: CUMS group, EC group (Exercise plus CUMS), and Control group. The CUMS procedure consists of a variable sequence of 12 stressors. Rats were randomly exposed to two stressors every day for 3 weeks. Rats in EC group were trained in a voluntary wheel running program for a total of 8 weeks, plus CUMS procedure during the last three weeks. Blood samples were collected at each of six time points (ZT1 and 5, 9, 13, 17, 21). Plasma concentrations of corticosterone (CORT), melatonin (MT) and vasointestinal peptide (VIP) were detected by ELISA kits. Data were analyzed by one-way ANOVA, and the circadian rhythms by single cosinor method.

RESULTS: Rats in Con group showed robust circadian rhythms in plasma CORT, MT and VIP. Rats in CUMS group showed an obvious disorder in circadian rhythm of plasma CORT, including phase advance and decrease in amplitude, and markedly blunted circadian rhythm. There also showed a markedly blunted circadian rhythm and decreased levels of plasma melatonin in CUMS rats compared to Con rats. VIP still has 24-hour rhythm, but the amplitude was significantly lower than that of the Con group, peak phase also delayed for 6 hours, expression was significantly higher than that of the Con group. 8-week voluntary wheel running exercise can significantly inhibit the disturbance of MT, CORT and VIP circadian rhythm, and also the abnormal expression of these hormones secretion.

CONCLUSION: CUMS induce these peptides and hormones desynchronized from SCN and voluntary wheel running exercise can rescue the disturbed circadian rhythms of these synchronizers. Supported by the Sports Medicine key laboratory of General Administration of Sport of China/Sports Medicine key laboratory of Sichuan province Foundation.

2503 Board #23
June 2 9:30 AM - 11:00 AM
Long-term Treadmill Exercise Reduces Obesity-induced Tau Hyperphosphorylation In Rat Brain
Guoliang Fang1, Ye Tian2, Jixiu Zhao1, Zihong He1, Liang Li1, Xingya Yang1, Pengfei Li1, Tao Yu1, Yuemeng Wen1. 1China Institute of Sport Science, Beijing, China. 2China Anti-Doping Agency, Beijing, China. (No relationships reported)

PURPOSE: To investigate the effects of aerobic exercise on tau phosphorylation and PI3K/Akt pathway in the hippocampus of obese rats, and provide some theoretical basis for physical activity improving obesity-related neurological disorders.

METHODS: Male Sprague-Dawley rats aged 3 weeks were randomly assigned to either a high-fat or a normal diet protocol for 12 weeks. Animals submitted to the high-fat diet were divided into two groups: sedentary group (HF-Sed) and exercise group (HF-Ex). The rats fed the normal diet were also divided into sedentary group (ND-Sed) and exercise group (ND-Ex). The rats in the HF-Ex and ND-Ex groups were underwent a treadmill training for 8 weeks. Then the hippocampus were isolated at 48h after last exercise. The protein and phosphorylation levels of tau, GSK3β, PI3K and Akt were analyzed by Western blot.

RESULTS: After 8 weeks of treadmill exercise, compared with ND-Sed group, the phosphorylation levels of tau were increased significantly in the HF-Sed group. While the phosphorylation levels of tau were decreased remarkably in the HF-Ex group compared with HF-Sed group. Furthermore, compared with ND-Sed group, the activity of GSK3β was increased in the HF-Sed group by reducing Ser9 phosphorylation and increasing Tyr216 phosphorylation. But in the HF-Ex group, the activity of GSK3β was decreased significantly compared with HF-Sed group by increasing Ser9 phosphorylation and reducing Tyr216 phosphorylation. Moreover, compared with ND-Sed group, in the HF-Sed group the PI3K/Akt pathway was inhibited by reducing the protein levels of PI3K p110 and p85 subunits and the phosphorylation levels of Akt Thr308 and Ser473. While compared with HF-Sed group, the protein levels of PI3K p110 and p85 subunits and the phosphorylation levels of Akt Thr308 and Ser473 were increased remarkably in the HF-Ex group, and the activity of PI3K/Akt pathway was enhanced.

CONCLUSIONS: Obesity induces tau hyperphosphorylation in the rats hippocampus. While long-term aerobic exercise can reduce tau hyperphosphorylation by increasing PI3K/Akt pathway activity and inhibiting GSK3β activity. It has a positive effect on delaying neurofibrillary tangle formation and improving obesity-related neurological disorders.

2504 Board #24
June 2 9:30 AM - 11:00 AM
Role Of Neuronal Fractalkine In Reducing Diet-induced Hypothalamic Inflammation
Robby Zachariah Tom, Yuanqing Gao, Sonja C. Schriver, Dominik Lutter, Chun-Xia Yi, Matthias Tschöp, Susanna M. Hofmann. Helmholtz Zentrum, Munich, Germany. Email: robby.tom@helmholtz-muenchen.de (No relationships reported)

PURPOSE: Persistent exposure to an energy dense diet leads to hypothalamic inflammation and is considered an early and a determining factor for the development of obesity metabolic disorders. Hypothalamic pro-inflammatory signals activate the glial cells resulting in various inflammatory mediators resulting in neuronal dysfunction further promoting obesity and systemic metabolic disease. It has been reported from our lab that moderate intensity treadmill training could revert the diet-induced microglial activation in the hypothalamus. Several lines of evidence suggest that chemokines are involved in the regulation of neurodegenerative and neuroneurodegenerative diseases. Fractalkine (CX3CL1) is a chemokine that is secreted from neurons, which then binds to its receptor CX3CR1 on the microglia. This ligand-receptor interaction confers a resting - ramified phenotype to microglia thereby reducing hypothalamic inflammation. AIM:The aim of the present study is to investigate the role of exercise induced fractalkine in reducing high-fat diet (HFD) induced hypothalamic inflammation.

METHODS: We determined the activation status of microglia and astrocytes in hypothalamus of C57Bl/6 mice in response to high-fat-diet and exercise. High fat diet exposure for sixteen weeks induced microgliosis and astrocytosis. Microgliosis and astrocytosis were quantified by immuno-histochemical staining for iba1 and GFAP respectively. RESULTS: High fat diet exposure for sixteen weeks induced microgliosis and astrocytosis. Treadmill running reversed microgliosis induced by HFD. Mice underwent an acute bout of exercise to elucidate the neuronal fractalkine pathway in the hypothalamus. PI3K/Akt pathway activity and inhibiting GSK3β activity.

CONCLUSIONS: While long-term aerobic exercise can reduce tau hyperphosphorylation by increasing PI3K/Akt pathway activity and inhibiting GSK3β activity. It has a positive effect on delaying neurofibrillary tangle formation and improving obesity-related neurological disorders.
Several strategies have been used to combat obesity, including physical exercise. The knowledge of whether exercise can modulate the expression of genes involved in energy homeostasis in hypothalamus of diet-induced obese mice can bring additional information about the treatment of this pathology. **Purpose:** Investigate the effect of voluntary exercise on the hypothalamic expression of genes related to energy homeostasis in high-fat diet fed mice. **Methods:** C57BL/6 mice were divided into 3 groups: control, high-fat (H) and high-fat exercise (HE). Mice had free access to food (C, Chow or H, 34% fat) and running wheel (HE, 5 days/week) for 10 weeks. Hypothalamus was collected and expression of 84 obesity-related genes was assessed by RT PCR with the gene array system. The data was analyzed in the PCR Array System Data Analysis Software (Excel & Web based - SA bioscience). Results are expressed as fold change. Significance was set at p<0.05.

**Results:** High-fat diet modulated (p<0.05) the expression of 14% of the 84 analyzed targets. The anorectic genes Bdnf (0.53 H vs C and 0.57 HE vs C), calcitonin receptor (H 0.63 and HE 0.57 vs C) and ciliary neurotrophic factor receptor (H 0.53 and HE 0.57 vs C) were downregulated in H and HE compared to C. The adenrenergic receptor beta 1 (H 0.53 and HE 0.58 vs C) and interfering 1 receptor type 1 (H 0.54 and 0.58 HE vs C) were also downregulated by high-fat diet. Neuropeptide Y receptor Y1 (H 1.06 and HE 1.15 vs C), protein tyrosine phosphatase non-receptor type 1 (H 1.07 and HE 1.15 vs C), corticotropin releasing hormone receptor 1 (H 1.06 and HE 1.14 vs C), 5-hydroxytryptamine receptor 2C (H 1.07 and HE 1.15 vs C) and zinc finger protein 91 (H 1.07 and HE 1.16 vs C) were upregulated by high-fat diet. Interleukin-1 alpha was upregulated in H (1.06 H vs C) but downregulated in HE (0.57 HE vs C). Only calcitonin receptor was not differentially expressed in HE compared to H. Except for interleukin-1 alpha, all the other genes were upregulated in HE compared to H. **Conclusions:** High-fat diet downregulated anorexigenic and proobesity genes and upregulated genes linked to positive energy balance, favoring obesity. Voluntary exercise only marginally modulated (small magnitude despite significant) the expression these genes, indicating a discrete central effect.

**2505**

**2507**

**2506**

More recently, kisspeptins are reported with a significant role in regulating glucose homeostasis, insulin secretion, as well as food intake and body composition. **Purpose:** To observe the effect of diet induced obesity on the hypothalamic expression of Kiss1 and Gpr54 genes and if exercise could affect these expression levels. **Methods:** After 8 weeks high fat feeding, 20 obesity 11-weeks SD rats were randomly assigned to high-fat diet sedentary (FS, n=8) and exercise (FE, n=8) groups. During the following 8 weeks, obesity rats were continued expose to high-fat diet. SE and FE groups did the 60%–70%VO2 max treadmill training (5 days/week, 1 hour/day). The VO2max, max exercise of groups were remeasured every two weeks. The hypothalamic expression of Kiss1-1 and GPR54 mRNA were tested in each group. **Results:** After the first 8-weeks high fat feeding, the obesity rats were heavier than normal diet group (491.7±26.19 g vs. 410.0±54.77 g, p<0.01). After 8-weeks training, the FS group was lighter than FS group (590.23±35.74 g vs. 681.52±56.17 g, p<0.01). The FS group had higher hypothalamic expression of Kiss1-1 mRNA (1.51±0.66 vs. 0.75±0.27, p<0.05) and GPR54 mRNA (2.43±0.38 vs. 0.61±0.15, p<0.01) than FS group. The FE group had lower hypothalamic expression of Kiss1-1 mRNA (0.69±0.13, p<0.05) and GPR54 mRNA (0.58±0.10, p<0.01) than FS group. The FE group had lower expression of kisspeptin and GPR54 mRNA expression of Kiss1-1 and GPR54 mRNA in the hypothalamus of high-fat diet induced obesity on hypothalamic expression of Kiss1-1 and GPR54 mRNA. 8-weeks 60%–70%VO2 max treadmill training could cure this effect.

**Purpose:** Hypothalamic Leptin Signaling Modulates Spontaneous Physical Activity During Ageing in Mice. Izabelle Dias Benfato1, Francine Pereira De Carvalho, MSC1, Thais Ludmilla Moreto, MSC1, Marcela Barthechito, MSC1, Sandra Maria Ferreira, PhD1, José Maria Costa Júnior, PhD2, Carolina Martinez, MSC1, Carolina Prado De Franca Carvalho, PhD1, Camila Apuraçida Machado de Oliveira, PhD1. **FEDERAL UNIVERSITY OF SÃO PAULO, SANTOS, Brazil.** **STATE UNIVERSITY OF CAMPINAS, CAMPINAS, Brazil.** **Email:** izabelle.benfato@gmail.com

Spontaneous physical activity (SPA) comprehends all daily physical activities other than voluntary exercises (e.g., activities). The energy spent in SPA can represent up to 50% of the total daily energy expenditure. Little is known regarding the biological regulation of SPA, especially during ageing, when SPA is known to decline. As a mediator of energy homeostasis, hypothalamic leptin signaling may be involved. **Purpose:** to investigate the temporal relationship between hypothalamic leptin signaling and SPA in mice from 4 to 10 months of age. **Methods:** Male C57Bl/6 mice were divided into three groups, according to age: 4 (M, n=10), 6 (M, n=10) and 10 (M, n=20) months-old mice. SPA, distance travelled (DT), average speed of locomotion (AS) and energy expenditure (EE) were measured monthly from 4 to 10 months of age in the 10M group. Hypothalamic expression of STAT3 and phosphorylated STAT3 (pSTAT3) by Western Blotting, intraperitoneal glucose tolerance test (ipGTT), and retroperitoneal (RAP) and epidydimal (EAT) adipose tissue weight were determined in all the groups (4M, 6M and 10M). Results are shown as mean ± standard error of the mean. Repeated measures ANOVA or One-way ANOVA were employed and the Newman-Keuls post hoc test was used when necessary. Significance was set at p<0.05. The SPA was recorded to the 4th month, SPA, DT and AS started to decrease in the 6th month (p<0.05) and persisted reduced over all (SPA 30%; DT 25%; AS 25% decrease in the 10th month). EE decreased (p<0.05) in the last three months (19% decrease in the 10th month). Hypothalamic pSTAT3 decreased (p<0.05) in 6M and 10M in relation to 4M (0.83 + 0.28; 6M: 0.52 ± 0.16; 10M: 0.53 ± 0.17 arbitrary units). STAT3 decreased 45% in 10M compared with 6M, but it was statistically 0.54 ± 0.09 arbitrary units under the curve of ipGTT (4M: 31.22 ± 9.87; 6M: 36.77 ± 11.62 10M: 40.54 ± 13.51 mg/dl x 120 minutes), and the weight of RAT (4M: 3.76 ± 1.19; 6M: 9.58* + 3.05; 10M: 9.76* ± 3.25 mg/g) and EAT (4M: 14.59 ± 4.61; 6M: 29.28* + 9.26; 10M: 26.87* ± 8.96 mg/g) increased (p<0.05) in 6M and 10M groups when compared to 4M group. **Conclusions:** Decreases in SPA, DT and AS were accompanied by a reduction of hypothalamic leptin signaling. Besides, glucose intolerance and increased fat pads weight manifested when SPA declined. Supported by: FAPESP and CAPES.

**Board #28**

**2508**

Effects Of Swimming On Learning And Memory And Expression Of Orexin And Ncam In Diet Induced Obesity Rats

Yi Yan, Rui Xu. Beijing Sport University, Beijing, China. **Email:** yanyi22@sina.com

(No relationships reported)

During the space exploration, rats in group M crossed where the platform was fixed more often than group O (p<0.05); (3) mRNA detection: the expression of NCAM of group M was significantly higher than group C and O (p<0.05), rats in group C crossed where the platform was fixed less often than group O (p<0.05); (4) Protein detection: the expression of NCAM of group M was significantly lower than group C (p<0.05) in 6M and 10M groups when compared to 4M group.

**Conclusions:** Decreases in SPA, DT and AS were accompanied by a reduction of hypothalamic leptin signaling. Besides, glucose intolerance and increased fat pads weight manifested when SPA declined. Supported by: FAPESP and CAPES.

**Purpose:** Through the different load intensity swimming exercise intervention in rats, we observed that the movement influenced on rats spatial learning and memory ability and detected the proteins expression of rat hippocampal. **Methods:** 30 male SD rats were selected. After acclimatization to the laboratory for 1 week, the rats were randomly divided into 3 groups: Control Group(C), Medium load Group (M), over load Group (O). Group C were fed naturally; group M did swimming exercise intervention, group O did over load swimming exercise. The Morris Water Maze test (MWM) was performed to evaluate spatial learning and memory ability. Tissue samples were collected after the MWM test. 6 whole brain samples for immunofluorescence assay, while the bilateral hippocampus of the other 6 brains for western blot and real-time PCR analysis. **Results:** (1) Blood testosterone detections: there was no significantly difference between group M and C (P>0.05), the blood testosterone of group O was significantly lower than group M and C (P<0.01); (2) MWM detection: during the navigation experiment, group M performed better than group O (p<0.01). During the space exploration, rats in group M crossed where the platform was fixed more often than group C and O (p<0.05), rats in group C crossed where the platform was fixed more often than group O (p<0.05); (3) mRNA detection: the expression of NCAM mRNA and OXA mRNA of group M were significantly higher than group C (P<0.05). OXIR mRNA of group M was significantly lower than group C (P<0.05). (4) Protein detection: the expression of NCAM of group M was significantly higher than group C (P<0.05), the group O was significantly lower than group C (P<0.05). **Conclusion:** Medium load swimming exercise could improve the rats spatial learning and memory ability and significantly improve the expression of OXA, OXIR
mRNA and OX1R, and significantly reduce the expression of OXA, OX1R mRNA, OX1R. Over load swimming exercise could damage the spatial learning and memory ability of rats, after over load swimming exercise, the expression of NCAM, OXA and OX1R was normal. 

**Acknowledgments:** Supported by the National Natural Science Foundation of China (No.31371202). Supported by the Sports Medicine key laboratory of State Administration of Sports/ Sichuan province Foundation.

**E-25** Free Communication/Poster - Age and Gender Issues

**Friday, June 2, 2017, 7:30 AM - 12:30 PM**

**Room: Hall F**

**2509** Board #29 June 2 11:00 AM - 12:30 PM

**An Analysis of Female Athlete Triad Components in Elite Para-Athletes**

Cheri A. Blauwe1, Emily M. Brook1, Adam S. Tenforde1, Elizabeth Broad2, Elizabeth G. Matzkin1, Brighten and Women’s Hospital/Harvard Medical School, Boston, MA. 1United States Olympic Committee, Chula Vista, CA.

*No relationships reported*

The Female Athlete Triad (Triad) is a syndrome defined as the interaction of three interrelated conditions: low energy availability with or without disordered eating, menstrual dysfunction, and low bone mineral density (BMD). The Triad may also impact males, and may have long-term health consequences if unaddressed. Although participation in elite para-sport is rapidly growing, no studies have assessed the prevalence of Triad risk factors in this population.

**PURPOSE:** To evaluate the prevalence of Triad risk factors in an elite para-athlete population and associations to sex and para-sport type.

**METHODS:** Subjects were United States para-sport athletes who were training to qualify for the 2016 Summer or the 2018 Winter Paralympic Games. Participants completed an online questionnaire characterizing nutrition, menstrual status (if female), bone health, and awareness of the triad. Responses were analyzed to determine overall prevalence of Triad components, and significant differences based on sex and sport type (leanness vs. non-leanness).

**RESULTS:** A total of 248 (144 male, 104 female) athletes completed the survey. Of these, 137 athletes competed in leanness sports and 109 athletes in non-leanness sports. Of the cohort, 40% (53 male, 45 female) of athletes indicated that they were currently trying to lose weight, and 61% (n = 151; 90 male, 61 female) indicated they were attempting to change their body composition to improve sport performance. Only 3% (1 male, 6 female) of athletes indicated that they had been previously diagnosed with an eating disorder. For pre-menopausal women, 32% (n = 29) reported less than 9 menstrual cycles in the past year. A total of 21% (27 male, 25 female) of athletes reported a history of a bone stress injury, yet 9% (8 male, 13 female) reported a diagnosis of low BMD based on DXA scan. There were no differences in risk factor prevalence between sexes or those competing in leanness versus non-leanness sports. Only 9% of athletes were aware of the Triad.

**CONCLUSIONS:** Elite para-sport athletes have high prevalence of Triad components, regardless of sex or sport type. Awareness of the Triad in athletes is low. While consequences of the Triad in a para-athlete population are poorly understood, screening tools and education to increase awareness are required to optimize overall health of this population.

**2510** Board #30 June 2 11:00 AM - 12:30 PM

**Sex Differences in Competition Volume, Club Sport Participation, Specialization, and Injury Among High School Athletes**

Eric G. Post, David R. Bell, Stephanie M. Trigsted, Dan A. Schaefer, Madeline M. Miller, Adam Y. Pfaller, Scott B. Hetzel, M. Alison Brooks, Timothy A. McGuine. University of Wisconsin-Madison, Madison, WI.

*No relationships reported*

Female adolescent athletes are at greater risk for certain injuries, such as ACL injuries or overuse knee injuries. One theory for this increased risk is the increasing trend towards intense, year-round sport participation and specialization. However, it is unknown whether characteristics of sport participation, including competition volume, club sport participation, specialization, or history of lower extremity injury (LEI) differ between female and male athletes.

**PURPOSE:** To compare level of competition volume, club sport participation, sport specialization, and previous lower LEI between males and females in high school athletes.

**METHODS:** 1525 high school athletes (780 female, age=16-11.1±1.0 years old, grades 9-12) from 29 high schools were recruited to complete a pre-season questionnaire regarding their sport participation patterns and previous injury history. Sport competition volume in the previous 12 months was classified as high (>60 competitions), moderate (30-60 competitions), or low (<30 competitions). Sport specialization status was classified as low, moderate, or high using a widely utilized 3-point specialization scale. Chi-square tests were used to investigate associations of competition volume, club sport participation, specialization, and LEI by sex (a-priori p<0.05).

**RESULTS:** Females were more likely than males to participate in high competition volume (23.2% vs 11.0%, χ2=8.74, p<0.001), participate on a club team (61.2% vs 37.2%, χ2=88.3, p<0.001), and be highly specialized (16.4% vs 10.4%, χ2=19.7, p<0.001). A total of 487 subjects (31.5%) reported sustaining a total of 599 previous time-loss LEI. Female athletes were more likely to report a previous LEI than males when considering all sports (36.5% vs. 27.9%, χ2=15.9, p<0.001) and when the sample was restricted to sex-equivalent sports (37.3% vs. 28.2%, χ2=9.0, p<0.003).

**CONCLUSIONS:** Female athletes were more likely to participate in sports at high volumes, on club teams in addition to their high school teams, be highly specialized, and report previous LEI. Female high school athletes may be at greater risk of injury due to these differences in sport participation patterns.

Supported by grants from the American Medical Society for Sports Medicine and the National Federation of State High School Associations.

**2511** Board #31 June 2 11:00 AM - 12:30 PM

**Chronic Training Load, But Not Stress Or Sleep, Is An Independent Predictor Of Illness In Female Youth Athletes**

Andrew Watson, Stacey Brickson, Warren Dunn. University of Wisconsin-Madison, Madison, WI.

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*No relationships reported*

Although training load and subjective well-being have been suggested as risk factors for injury, their relationship with illness in youth athletes is unknown.

**Purpose:** To determine whether training load, stress or sleep are independent predictors of in-season illness in female youth soccer players.

**Methods:** 69 female soccer players (13-18 years) were monitored for 10 months of formal competition. Daily training load (TL) was determined by session-rating of perceived exertion (duration [min] x intensity [1-10]). Every morning, participants recorded sleep hours and rated stress from 1 to 5 (higher being better) and illnesses were recorded throughout the year. Data were aggregated weekly and 2, 3, and 4 week rolling averages were calculated as well as an acute-to-chronic workload ratio (A:C, weekly divided by 4-week TL). TL measures were converted to z-scores and Poisson regression analyses were used to compare the relative abilities of the different TL measures to predict the number of illnesses the following week. Based on this, 2-week TL was classified as low, moderate-low, moderate-high, high, or very high using z-scores, and the relative risk of subsequent illness was compared between the groups. Finally, a multivariable Poisson regression model was developed to predict the number of weekly illnesses, using 2-week TL, sleep, and stress values as covariates.

**Results:** 73 illnesses occurred during the 10 months of competition. Weekly illnesses were significantly and similarly predicted by the preceding 2-week TL (OR=1.74, p<0.001), 3-week TL (OR=1.71, p<0.001), and 4-week TL (OR=1.70, p<0.001), but not 1-week TL (OR=1.21, p<0.15) or A:C (OR=1.22, p=0.22). Compared to low 2-week TL, the risk of illness was increased following 2-week periods of high (RR=2.0) and very high TL (RR=3.5). After inclusion in the multivariable model, 2-week TL remained a significant, independent predictor of subsequent weekly illness (OR=1.81, p<0.001) while sleep (OR=0.78, p=0.59) and stress (OR=0.42, p=0.06) did not.

**Conclusion:** After controlling for sleep and stress, chronic training load is a significant, independent predictor of illness risk, while weekly TL and A:C are not. Monitoring cumulative TL over 2 or more weeks during the competitive season may allow for intervention to reduce the risk of illness in adolescent female athletes.

**2512** Board #32 June 2 11:00 AM - 12:30 PM

**Influence Of Year In School On Health-related Quality Of Life Among Collegiate Athletes**

Jennifer L. Sanfilippo, Liga A. Blyholder, Timothy A. McGuine, Bryan C. Heiderscheit. UW-Madison, Madison, WI. (Sponsor: Joseph Weir, FACSM)

*No relationships reported*

Transitioning from high school to college can be a difficult experience; freshmen must adapt to life away from home, new responsibilities, and higher academic demands. For collegiate athletes, this transition also requires adjusting to more rigorous training and greater performance pressure. Interestingly, these stressors may negatively impact health-related quality of life (HRQoL) among freshmen collegiate athletes. **PURPOSE:** To examine changes in HRQoL over a competitive season among freshmen and senior collegiate athletes. **METHODS:** 69 freshmen (age=18.2±0.47, male=56) and 23 senior (age=21.4±0.49, male=14) collegiate athletes at a large, Division I university.
In this study we have compared the body composition of elite athletes practicing two different sports, we also evaluated bone health in cyclists.

**Purpose:** To determine the effect of MSK injuries sustained during the competitive season on HRQoL, among collegiate athletes.

**METHODS:** 160 Division 1 collegiate athletes (mean age = 19.6 ± 1.4, 117 males) at a large public university completed the Short Form 12v2.0 Acute Recall (SF-12) prior to the start of the competitive season (PRE) and within 1 month following the end of the competitive season (POST). Participants included athletes who did not sustain an injury during the season or 6 months prior to PRE competing in football (freshman = 36, sophomore = 12), soccer (freshman = 16, sophomore = 3), and cross country (freshman = 17, sophomore = 8) over the 2013-2014 or 2014-2015 seasons. Raw scores were converted to norm-based scores via a linear z-score transformation. Changes (median (IQR)) in PRE to Post Mental Composite Score (MCS) and Physical Composite Score (PCS) were analyzed using Wilcoxon signed-rank tests. **RESULTS:** MCS significantly decreased (p = 0.0001) pre- to post-season among freshman collegiate athletes (PRE: 57.06 (54.79, 59.43), POST: 54.67 (48.93, 57.06)). This decrease was observed in both males and females (p = 0.001 and p = 0.027, respectively). There was no change (p = 0.341) in PCS among freshmen. Among senior collegiate athletes, MCS (PRE: 55.34 (54.22, 58.26), POST: 54.20 (49.50, 58.10)) and PCS (PRE: 57.47 (54.39, 57.84), POST: 56.71 (53.54, 58.40)) did not change significantly pre- to post-season (p = 0.487 and p = 0.889, respectively). **CONCLUSION:** Among freshman collegiate athletes, mental aspects of HRQoL decreased over the course of the competitive season. Transitioning from high school to collegiate academics and athletics may produce high levels of psychological stress that can negatively impact HRQoL. University athletes may benefit from offering stress-management and counseling services to help incoming freshman athletes adjust to college life.

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**A Wellness Program for Older Female Golfers: Effects on Golf Performance and Range of Motion**

**Purpose:** To compare the effect of a wellness program on range of motion (ROM) and golf performance in older female golfers.

**METHODS:** Twenty-five healthy, right-handed, female golfers were randomly assigned to either an intervention (N = 12; mean age ± SD: 60.3 ± 8.8) or control (N = 13; mean age ± SD: 65.9 ± 5.4) group. Baseline measures included shoulder, hip, and trunk rotation passive ROM using inclinometers, club head speed (CHS), and self-reported golf performance. The intervention group received a wellness program consisting of flexibility and strengthening exercises. The flexibility component incorporated one exercise for each of the following regions: shoulder, hip, and trunk. The three strengthening exercises focused on abdominal and hip musculature.

A daily exercise log was used to monitor compliance with the wellness program. Subjects were reassessed after five weeks. Repeated measures ANOVAs, with age as a covariate, were performed to determine whether pre and post measures differed between groups. **RESULTS:** The intervention group demonstrated a significant increase in all shoulder rotation ROM values (P ≤ 0.03) with the exception of right internal rotation. For the same group, self-reported golf performance scores (P = 0.02) improved significantly. No significant change in CHS was identified for either group. **CONCLUSION:** The shoulder exercise (cross-body stretch) used in the wellness program has been found to improve shoulder ROM in young adults. Further research is needed to determine whether this program could also be effective for older females. While all ROM measures improved for the intervention group, additional time may have been needed to demonstrate significant change. In general, research concerning the female golfer remains limited. This study begins to define a wellness program for female golfers that could easily be incorporated into their daily routine.

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**The Assessment Of Body Composition In Young Athletes**

Giorgio Galanti, Benedetta Tosi, Martina Bocci, Giulio Tempetti, Gabriele Mascherini, Petri Cristiani. Sport Medicine Center, Florence, Italy.

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(No relationships reported)

**Purpose:** In this study we have compared the body composition of elite athletes practicing two different sports, we also evaluated bone health in cyclists.

**Methods:** We enrolled 64 male athletes (15-21 years old): 52 soccer players and 12 cyclists, belonging to same soccer or cycling team. The athletes were subjected to anthropometric evaluations, measurements of circumferences and skinfolds, DXA and BIA. Specifically, using Durnin & Rahman formula we evaluated fat mass (FM) and fat free mass (FFM). With DXA we evaluated Whole Body Total Fat (WBTF), Whole Body Total Lean (WBLT), Whole Body Total Mass (WBTM) and Whole Body Total Percentage of Fat(WBTPF). Furthermore BIA allowed us to measure Body Cellular Mass (BCM); Total Body Water (TWB); intracellular water (ICW), extracellular water (ECW) and the index of hydration. Cyclists were also subjected to blood samplings.

**Results:** In soccer players we observed (data expressed in Means) BMI 21.75, Waist, hip and bicep circumferences were 73.05, 91.51 and 26.69 cm respectively. Skinfolds sum was 54.57 mm. FM was 16.8% (12.0 kg) and FFM was 59.0 kg. DXA results were: 12.6 kg WBTO, 60.7 kg WBTL and 17.2%, WBTPF. BIA results were: 63.3 kg of FFM. BCM, TWB, ICW, ECW were: 33.6 kg, 43.4 L, 55.0%, 44.1 %, respectively. Index of hydration was 6.6. In cyclists we observed: BMI 21.79, Waist, hip and bicep circumferences were 74.08, 94.84 and 29.13 cm. Skinfolds sum was 65.28 mm. FM was 14.5% (9.9 kg) and FFM was 58.1 kg. DXA results were: 12.1 kg WBTO, 57.96 kg WBTL and 17.4%. WBTPF. BIA results were: 58 kg of FFM. BCM, TWB, ICW, ECW were: 33.6 kg, 43.4 L, 55.0%, 44.1 %, respectively. Index of hydration was 7.2.

**Conclusions:** Values of Vitamin D was 29.87 ng/mL. Z-score was -2.9. Conclusions: In athletes playing ciclicism we observed, in addition to a minor concentration of FM, a lower percentage of FFM, mostly due to a reduction of bone mineral density (BMD), in line with former studies. Moreover, this study underlines how ciclicism can induce a significant reduction of BMD. Therefore we should suspend a suspicion of this activity for a period of about three or four months per year.
variables were compared using paired samples t-tests. **Results:** Participants (mean age = 26.1 ± 4.6 years) completed a mean of 7.5 ± 4.5 rounds of Olympic-style boxing over the course days. Pre-tournament scores were significantly worse than post-tournament scores for total mBESS (5.5 ± 2.9 errors vs. 2.2 ± 1.9 errors, p < .001, d = 1.23) and King-Devick time (18.0 ± 8.3 vs. 14.2 ± 3.9 s, p < .002, d = -0.50). Processing speed was significantly slower prior to the boxing tournament (maze chase task: 1.17 ± 0.44 correct moves/second vs. 1.39 ± 0.34 correct moves/second, p < .001, d = -0.53). No significant changes between testing sessions were detected for the other obtained outcome variables. **Conclusion:** Female boxers demonstrated either improvement or no significant change after competing in an Olympic-style boxing tournament, relative to pre-tournament performance. As many of the tasks employed in our testing battery are novel, practice effects may have contributed to improved performance. Given the relatively short time frame between assessments, clinicians should be aware of potential practice effects when using ringside tests in the diagnosis and management of concussion.

**2517 Board #37**
June 2 11:00 AM - 12:30 PM
The Influence Of Oral Contraceptives On Subjective Physical Condition And Athletic Performance In Japanese Female Athletes.

In Japan, the prevalence of dysmenorrhea and premenstrual syndrome (PMS) in elite female athletes are 25.6% and 70.3%, respectively (Ogura-Nose et al., 2014). However, the use of oral contraceptives (OC) in Japanese female athletes is low (2%)(Ogura-Nose et al., 2014). One of the reasons is because athletes are concerned about the side effects taking OC might have on their athletic performance. **PURPOSE:** To examine the influence of OC on subjective condition and athletic performance. **METHODS:** Fourteen female athletes were recruited. All subjects were examined during the follicular (F) and luteal (L) phases, OC (days 10-20 of their OC use) and withdrawal-bleeding (W) phases (days 2-5 post OC phase). Each phase of the menstrual cycle was confirmed by serum luteinizing hormone (LH), follicular stimulating hormone (FSH), estradiol, and progesterone levels. After natural menstrual cycle tests, all subjects began taking OC. Monophasic OC with ultra low-dose was used. A post-exercise cardiovagal reactivation test, lactate curve test, oxygen consumption (VO2max) test, and Wingate test were performed during all phases. In addition, subjective fatigue, mood states and subjects perceived daily training load were estimated on visual analog scales (100mm). All parameters were analyzed by two-way analysis of variance for repeated measures. **RESULTS:** There were no significant changes in subjective physical condition, post-exercise cardiovagal reactivation, VO2max, and time to exhaustion during all phases. No significant changes in peak power, and mean power of Wingate test were observed. However, at the time of the low-intensity exercise (~ 2mmol/L) in lactate curve test, lactic acid values were high during the OC and W phase (OC: 1.6 ± 0.4, W: 1.5 ± 0.4 mmol/L) compared with the natural cycle (F: 1.3 ± 0.3, L: 1.3 ± 0.3 mmol/L, p < 0.05). In Wingate test, maximum lactate value after the Wingate test was high during the OC and W phase (OC: 12.0 ± 2.4, W: 12.0 ± 2.6 mmol/L) compared with the natural cycle (F: 11.2 ± 2.2, L: 11.1 ± 1.9 mmol/L, p < 0.05). **CONCLUSION:** These results suggest that ultra-low-dose monophasic OC had no influence on athletic performance. Future research is needed regarding the influence of OC on the glycolytic pathway. Supported by Japan Sports Agency’s consignment fund.

**2518 Board #38**
June 2 11:00 AM - 12:30 PM
The Prevalence and Impact of Heavy Menstrual Bleeding Among Exercising Women.
Allyson L. Parziale1, Georgie Bruinvels2, Toby Richards2, Charles R. Pedlar3, Kathryn E. Ackerman, FACSM1. 1Boston Children’s Hospital, Boston, MA. 2University College London, London, United Kingdom. 3Massachusetts General Hospital, Boston, MA. (Sponsor: Kathryn Ackerman, FACSM)

DEFINITION: Heavy menstrual bleeding (HMB) includes flooding through clothes, frequent changes of sanitary products, needing extra protection, and/or passing large clots, is prevalent among exercising females in the UK. HMB has negative associations with training and performance. **METHODS:** 532 females, ages 15-30 years, who exercise ≥ 4 hours per week and presented to a UK-based Sports Medicine clinic, were invited to complete a questionnaire incorporating a four-part diagnostic series for HMB; menstrual cycle characteristics such as typical duration and frequency; reported impacts on training and performance; cramping and bloating symptoms; and the seeking of medical advice for heavy periods. **RESULTS:** HMB prevalence was 29.7%, while 30.6% reported that their menstrual cycle impacts their training and performance. These were significantly related, with more than half (52.5%) of those with HMB reporting that their menstrual cycle affects their training and performance (p < 0.001, phi = 0.27). However, only 41.8% with HMB reported seeking medical advice. On average, those with HMB reported longer bleeding days per cycle than those without HMB (3.5 days vs. 4.5 days, t = -5.554, p < 0.05), and there was no difference in total number of periods per year (p > 0.05). Those with HMB were more likely to report experiencing non-menstrual cycle related cramps (X2 = 19.562, p < 0.05) and feelings of general bloating (X2 = 19.072; p < 0.05). **CONCLUSIONS:** HMB is linked to negative impacts on training and performance, a longer menstrual cycle, cramping and bloating among American adolescent and young adult exercising females. Further research is required to elucidate the physical and psychological impacts of HMB and the clinical implications.

**2519 Board #39**
June 2 11:00 AM - 12:30 PM
Preliminary Evidence Of Sub-optimal Sleep Durations in Trained Middle Eastern Adolescent Soccer Players

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Sub-optimal sleep durations relative to the National Sleep Foundations (NSF) guidelines of 8-10 h per night are seen in adolescents globally, with the Middle Eastern region having specific lifestyle, environmental and cultural factors which can exacerbate these deficiencies. These deficiencies are due to general and athlete specific negative (eg pre-bed screen time, socialising, etc) and non-negotiable (eg schooling, travel, etc) factors. This is concerning given the proposed relationship between sleep and illness/injury risk, athletic performance/recovery and holistic athlete development. **PURPOSE:** Characterise sleep in trained adolescent Middle Eastern soccer players pre- and post-match and the influence of pre-dawn sleep interruption upon these characteristics. **METHODS:** During a 7 day training camp sleep was assessed in 20 male trained adolescent Middle Eastern soccer players prior to (PRE) and night of (POST) three discrete matches (MATCH 1, 2 and 3) on day 5, 9 and 13 of the camp. Quantitative sleep values were obtained by wrist actigraphy, with activity count interpretation determining bedtime (hh:mm), get-up time (hh:mm), time in bed (hh:mm), sleep duration (h) and sleep efficiency (%) as well as whether a player did (YES) or did not (NO) experience pre-dawn sleep interruption. In YES sleep was seen in two bouts, BOUT1 - pre-dawn interruption - BOUT2 Linear mixed models were used to analyse data. **RESULTS:** On average these players do not meet NSF endorsed minimum sleep durations PRE and POST match (6.97 ± 1.27 h vs. recommended 8-10 h] with deficits significantly exacerbated (-10% or -0.76 h) in YES compared to NO (6.49 ± 1.05 h vs. 7.43 ± 1.29 h, p=0.01). Sleep efficiencies were less than the recommended 85% on average across all players (82.13 ± 7.04), and in YES, NO, BOUT1 and BOUT2. No differences in any sleep characteristics were observed between BOUT1 and BOUT2 (p>0.05). **CONCLUSION:** Deficiencies in these players of duration and quality of sleep relative to recommendations may jeopardize athletic development/recovery and holistic adolescent maturation. Given the high inter- and intra-individual variances in sleep characteristics seen, these players require from their practitioners individualised sleep education strategies/interventions, without reliance on sleep medications.

**2520 Board #40**
June 2 11:00 AM - 12:30 PM
Influence of Sports Participation and Bone Stress Injury Anatomical Location on Low Bone Mineral Density in Male Athletes
Adam S. Tenforde1, Allyson L. Parziale2, Kathy E. Ackerman, FACSM2. 1Spaulding Rehabilitation Hospital, Charleston, MA. 2Boston Children’s Hospital, Boston, MA. (Sponsor: Kathryn Ackerman, FACSM)

Deficiencies in these players of duration and quality of sleep relative to recommendations may jeopardize athletic development/recovery and holistic adolescent maturation. Given the high inter- and intra-individual variances in sleep characteristics seen, these players require from their practitioners individualised sleep education strategies/interventions, without reliance on sleep medications.

**CONCLUSION:** These results suggest that ultra-low-dose monophasic OC had no influence on athletic performance. Future research is needed regarding the influence of OC on the glycolytic pathway. Supported by Japan Sports Agency’s consignment fund.

**Purpose:** Sports participation can provide health benefits to male athletes, including improvements in bone mineral density (BMD) and strength. However, a subset of male athletes may experience impairments in bone health associated with sports participation. The aim of this study was to identify the association of sports type and bone stress injury (BSI) location with low BMD (defined as BMD Z-scores < -1) in males athletes. **METHODS:** A retrospective chart review was performed on male athletes (ages 14 - 35 years) referred to a single tertiary-care center for evaluation of BMD following development of bone stress injuries. Included were all male athletes referred to our clinic following the diagnosis of a bone stress injury (BSI) with low BMD. Data were reviewed and entered in a database. **RESULTS:** A retrospective chart review was performed on male athletes (ages 14 - 35 years) referred to a single tertiary-care center for evaluation of BMD following development of bone stress injuries. Included were all male athletes referred to our clinic following the diagnosis of a bone stress injury (BSI) with low BMD. Data were reviewed and entered in a database.

**Results:** A retrospective chart review was performed on male athletes (ages 14 - 35 years) referred to a single tertiary-care center for evaluation of BMD following development of bone stress injuries. Included were all male athletes referred to our clinic following the diagnosis of a bone stress injury (BSI) with low BMD. Data were reviewed and entered in a database.
common in athletes with BSI in anatomical sites with primarily cortical bone content (P=0.02), including tibia (3 of 10), metatarsal (1 of 4), femur (0 of 3), tarsal navicular (0 of 1), and rib (0 of 1). CONCLUSIONS: A subset of athletes with history of BSI met criteria for low BMD; runners and athletes who sustain BSI in regions of higher trabecular bone content appear at increased risk. Clinicians should consider screening male athletes for low BMD and consider methods to optimize bone health in this population.

CONCLUSION: During multi-day youth soccer tournaments, sports medicine teams can optimize staffing and resources by preparing for increased frequency of tent visits along with the middle and end of the tournament, schedule the investigation and treatments, and ensuring adequate supplies for predominantly lower extremity injuries and treatments. Future data collection for multi-day tournaments should include injury time of day, games played, and non-injured player data to allow for incidence calculations and control comparisons.

2523  Board #43  June 2 11:00 AM - 12:30 PM  The Impact of Grant Funding on Physical Fitness Levels of School Children

Michael A. Jennings, Dale D. Brown, FACSM, Kelly R. Laurson, Skip M. Williams, Mary L. Henninger, Daniel Phelps, Illinois State University, Normal, IL. Email: jenningsm@myunit5.org

(Purpose: The purpose of this study was to evaluate the effect of a three year Carol M. White Physical Educational Program (PEP) Grant on fitness levels of students in grades K-12. Methods: A total of 1251 students (616 female and 635 male), 5-18 years of age (mean 11.07) participated in the FitnessGram series of health related physical fitness assessments (aerobic capacity, muscular strength, and muscular endurance) in each of the 3 years of the grant project. Basic anthropometric measures of height and weight were recorded for each student and used in the calculation of body mass index (BMI). Along with BMI, the assessments utilized in this study included: the 20 meter PACER test (PACER), Push Up Test (PT), and Curl Up Test (CT). Results: These assessments were performed as these were directed by a licensed physical education teacher during the spring semester of each of the 3 years of the grant project. Upon completion of the performances, students were classified into Fitness Zones based on FitnessGram standards. The classifications for BMI were as follows: Healthy Fitness Zone (HFZ), Needs Improvement (NI), Needs Improvement – Health Risk (NIHR) or Very Lean (VL). The PACER, PT, and CT only classify students into 2 Fitness Zones: HFZ and NI. Results: The data show an increase in number of students in the HFZ for each of the assessments from year 1 to year 2, with an average increase of 8.75%. The PT garnered the greatest percentage of increase at 12%, while the percentage of students in the HFZ for BMI only increased 6%. Conversely, the data from year 2 to year 3 show decreased percentages of student in the HFZ for all assessments, except for the PACER test which remained unchanged (63%). The percent of student in the HFZ decreased 2%, 11%, and 10% for BMI, CT, and PT respectively. Even with the decrease in percent of students in the HFZ for these assessments, the year 3 percentages remained higher than the initial assessment year for both the BMI and PACER with a 4% and 7% increase respectively. Conclusion: The increase in overall percent of students classified in a HFZ for multiple physical fitness assessments shows that a 3-year PEP grant had a positive impact on students’ physical fitness levels. This improvement coupled with the increased availability of resources and funding make the PEP grant an asset.}

E-26  Free Communication/Poster - Behavioral Aspects of Sport

Friday, June 2, 2017, 7:30 AM - 12:30 PM  Room: Hall F

2524  Board #44  June 2 11:00 AM - 12:30 PM  Effect of Yoga, Meditation or Body Awareness on Sports Performance and Attention in Futsal Players

Marcio Cascante-Rusenchak, Gerardo Araya-Vargas, Walter Salazar-Rojas, Alejandro Salicetti-Fonseca, Jose Moncada-Jimenez, University of Costa Rica, San José, Costa Rica. Email: marcio.cascante@ucr.ac.cr

(Purpose: To determine the chronic effect of yoga, meditation or body awareness practice produces significant improvements in attention and sports performance in Futsal players. A second aim was to determine the association between attention and sports performance. METHODS: Thirty subjects (15 men, 15 women) were randomly assigned to four groups. Meditation (MO) (n = 8, mean age = 20.8 ± 2.4 yr.), Yoga (YG) (n = 8, mean age = 21.2 ± 1.6 yr), Body awareness (BA) (n = 7, mean age = 20.5 ± 1.4 yr), and Control Group (CG) (n = 7, mean age = 21.0 ± 2.3 yr). Before (pre) and after (post) nine yoga, meditation or body awareness sessions, the subjects were measured on attention with the Stroop Test, and on sports performance with the Loughborough soccer passing test. RESULTS: There was no significant interaction in attention and sport performance (p > 0.05). There were significant main effects in measurement (pre- to -post) on attention (Pre = 51.7 ± 5.7 vs. Post = 54.6 ± 4.5 hits, p < 0.05), and for sport performance (Pre = 65.2 ± 5.7 vs. Post = 63.6 ± 5.1 s, p < 0.05).}
No significant correlations were found between the change in attention scores and sport performance in experimental groups MG (r = 0.62), VG (r = 0.20), BA (r = 0.16), and CG (r = 0.20) (p > 0.05). CONCLUSIONS: Meditation, yoga and body awareness exercises do not influence attention or sport performance in Futsal players.

2525 Board #45
June 2 11:00 AM - 12:30 PM
The Utilization of Different Cues in Visual Anticipation in Skilled Table Tennis Players
Chenglin Zhou, Yingzhi Lu, Yingying Wang, QiQi Yang. Shanghai University of Sport, Shanghai, China.
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It is reported that expert motor performance is superior to less skilled individuals to predict the outcome of an object in striking sport, such as table tennis, due to the ability of using advance information, such as body kinematics cue. Meanwhile, it also revealed that the accuracy would be improved with the visual information (such as the ball trajectory cue). It is unclear the utilization strategies on these two cues in striking sports between expert and novice.

PURPOSE: To investigate the utilization of body cue and ball cue in the visual anticipation and compare the utilization strategies among skilled players, less skilled players and non-skilled players.

METHODS: 74 participants were grouped into Elite group (EG, n=24), Amateur group (AG, n=26) and Novice group (NG, n=24) based on the table tennis and skilled level. Participants were presented with short video-clips of serve that were partially occluded (racket-ball contact (T), 50ms after the contact (T+1), 100ms after the contact (T+2)) and probably congruence or incongruence (T+1, T+2) within the body cue and ball cue. The task was to judge whether the ball would land on left or right side and the accuracy was analyzed.

RESULTS: The results showed that the EG (.92 ± .07) had a higher accuracy than the other two groups (AG: .82 ± .07, p < .001; NG: .78 ± .10, p < .001) when the video-clips were occluded before the ball cue was showed, while both the EG (T+1: .98 ± .04; T+2: .97 ± .04) and AG (T+1: .95 ± .05; T+2: .95 ± .07) had a better accuracy than the NG (T+1: .88 ± .07; T+2: .87 ± .11) when the ball cue was offered in the video-clips. Meanwhile the accuracy of EG (T+1: .67 ± .16; T+2: .90 ± .17) and AG (.T+1: .64 ± .16; T+2: .90 ± .14) was sharply decreased in the incongruence video-clips, but their ability to discriminate these two cues was better, comparing with the NG (d-prime: F12, 68 = 10.491, P < .001; EG: .77 ± .41; AG: .61 ± .41; NG: .52 ± .27).

CONCLUSIONS: This leads us to argue that experts (both elites and amateurs) had the anticipatory advantage than the novice in striking sport. They mainly utilized the body cue to anticipate the outcome, while the novice needed the ball cue to do anticipation. Also, the experience levels of the experts moderated the utilization strategy in visual anticipation. Supported by NSFC (No. 31571151).

2526 Board #46
June 2 11:00 AM - 12:30 PM
Socially Prescribed Perfectionism Might Predict Enhanced Performance When Racing Against an Opponent
Lieke Schiphof-Godart1, Marco J. Konings2, Florentina J. Hettinga3. 1University of Groningen, Groningen, Netherlands. 2University of Essex, Colchester, United Kingdom. 3University of Winchester, Winchester, United Kingdom.

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No relationships reported

Recent research has shown that racing against an opponent can improve endurance exercise performance (Konings et al, 2016). To what extent athletes can be motivated by racing against an adversary might depend at least partially on personality characteristics such as type of perfectionism.

PURPOSE: We sought to explore the relationship between self-oriented (SO) and socially prescribed perfectionism (SPP) (Hewitt & Flett, 1991) and time-trial performance. We hypothesized that SPP would be related to performance and socially prescribed perfectionism (SPP) (Hewitt & Flett, 1991) and time-trial performance (TT).

METHODS: Two youth sport leagues offering a choice of both youth tackle and flag football for players aged 5 to 15 years distributed an online survey to 859 parents of youth football participants. The 50-item online survey was administered via Qualtrix and gathered responses on several variables that included parental preference for flag or tackle, history of football participation, injury history, and concussion knowledge. A series of chi-square analyses with odds ratios (OR) and 95% confidence intervals (CI) were used to test associations and likelihood of select variables and youth football preference.

RESULTS: A total of 29% (245/859) of parents completed the online survey. Seventy-seven percent (157/203) of parents preferred tackle instead of flag football. Parents that previously played or had a spouse/partner that played football were 2.61 times more likely to prefer flag over tackle football (p<1, 199) = 4.87, p = .03, 95% CI = 1.09 - 6.25). Parents fearful of their child getting a concussion were 2.41 times more likely to prefer flag instead of tackle football (p<1, 199) = 6.31, p = .01, 95% CI = 1.4 - 4.86). Parental history of concussion (p = .42), concussion knowledge (p = .67) or sex of child (p = .04), speed (p = .51), and strength (p = .25) were not associated with football preference.

CONCLUSIONS: When given a choice between flag or tackle football for their children, a majority (77%) of parents prefer tackle football. However, parents who played football or are fearful of their child getting a concussion are more likely to prefer flag for their children. Flag football may provide children with a physically active sport that parents view as less risky than tackle football.

2527 Board #47
June 2 11:00 AM - 12:30 PM
Exploring Parental Preferences for Choosing Youth Flag or Tackle Football
Mallory McElroy1, Katie Stephenson-Brown1, Samantha Mohler1, Nathan D’Amico1, Anthony Kontos2, R.J. Elbin3. 1University of Arkansas, Fayetteville, AR. 2University of Pittsburgh, Pittsburgh, PA.

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No relationships reported

Youth football participation rates have decreased 27.7% over the last six years. One of the primary reasons posited for this decline is parental concerns about concussion. In an attempt to provide an alternative to tackle football, many youth leagues are offering a choice of flag or tackle football. In fact, flag football participation has risen by 8.7 percent from 2014-2015. However, there is a lack of research exploring factors associated with parental preferences for choosing flag over tackle football.

PURPOSE: To explore factors associated with parental preferences for choosing youth flag and tackle football.

METHODS: Two youth sport leagues offering a choice of both youth tackle and flag football for players aged 5 to 15 years distributed an online survey to 859 parents of youth football participants. The 50-item online survey was administered via Qualtrix and gathered responses on several variables that included parental preference for flag or tackle, history of football participation, injury history, and concussion knowledge. A series of chi-square analyses with odds ratios (OR) and 95% confidence intervals (CI) were used to test associations and likelihood of select variables and youth football preference.

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CONCLUSIONS: When given a choice between flag or tackle football for their children, a majority (77%) of parents prefer tackle football. However, parents who played football or are fearful of their child getting a concussion are more likely to prefer flag for their children. Flag football may provide children with a physically active sport that parents view as less risky than tackle football.

2528 Board #48
June 2 11:00 AM - 12:30 PM
Pain Coping Skills of Competitive High School Pole Vaulters
Joshua T. Holland, Cody M. Smart, Michael C. Meyers, FACSM. Idaho State University, Pocatello, ID.

No relationships reported

For competitive pole vaulters, their abilities to cope with painful challenges and subsequent injuries are crucial to overcome obstacles in sport development. In a sport with highly technical and explosive training, the failure to adapt to these competitive challenges could result in suboptimal performance and rehabilitative outcomes.

Therefore, the ability to appropriately cope with pain and potential injury is essential for competitive success, especially at this young stage of development.

PURPOSE: To quantitively the coping skills of pain and injury in competitive high school pole vaulters.

METHODS: Following informed consent, 59 high school pole vaulters completed the Sports Inventory for Pain (SIP; Meyers et al., 1992); direct coping (COP), cognitive (COG), catastrophizing (CAT), avoidance (AVD), body awareness (BOD), and a composite score referred to as total coping resources (TCR). Data were grouped by skill level (novice, intermediate, advanced), gender, and academic classification (upperclassmen, lowerclassmen).

RESULTS: MANOVAs (Wilks’ Lambda) indicated no significant main effects across skill level (F1,57=1.51; p=0.146), gender (F1,57=1.128; p=0.357), or academic classification (F1,57=1.440; p=0.225). Although, there was no trend for upperclassmen to respond higher in COP, COG, CAT, BOD, and TCR.

CONCLUSION: Although, findings may have been influenced by a limited sample size, pain coping skills among this group reflected above average responses when compared to normative data across other athletic populations. At this early stage of mental and physical development, it is imperative that coaches devote time to the psychological challenges these athletes will face during competition. Further research is warranted assessing challenges from larger populations, as well as to determine the efficacy of pain coping skills interventions.
Parents’ knowledge and attitudes towards concussions are often a vital factor affecting care for injured adolescent athletes. It is important to understand the role previous experiences play in regards to current concussion knowledge and attitudes.

**PURPOSE:** To determine the influence of parental and child concussion history on parental knowledge and attitudes regarding concussion. Parents reported the frequency of concussion diagnosis and/or experience of concussion-related symptoms, and whether their child had a diagnosed concussion or experienced concussion symptoms (yes/no). A linear regression model was used to understand the association between concussion history variables (parental or child) and attitudes. **RESULTS:** There were no associations between any of the concussion history variables and knowledge and attitudes (alpha level 0.05). There were no significant differences between any of the concussion history variables (parent or child) and attitudes. **CONCLUSIONS:** Parents with no previous diagnosis of concussion had a significantly lower total knowledge scores (mean=23.0±2.5; p<0.001), compared to those with a previous concussion (mean=23.9±2.3). Those who had never experienced symptoms of a concussion trended towards significance (p=0.05). There were no associations between any of the concussion history variables (parental or child) and attitudes.

**METHODS:** Participants with no previous diagnosis of concussion or symptoms had a significantly lower total knowledge scores (mean=23.0±2.5; p<0.001) than those with a previous concussion (mean=23.9±2.3). Those who had never experienced symptoms of concussion trended towards significance (p=0.05). There were no associations between any of the concussion history variables (parental or child) and attitudes. **RESULTS:** There were no significant differences between any of the concussion history variables (parental or child) and attitudes. **CONCLUSIONS:** Parents with no previous diagnosis of concussion had a significantly lower total knowledge scores (mean=23.0±2.5; p<0.001) than those with a previous concussion (mean=23.9±2.3). Those who had never experienced symptoms of a concussion trended towards significance (p=0.05). There were no associations between any of the concussion history variables (parental or child) and attitudes. **METHODS:** Participants with no previous diagnosis of concussion or symptoms had a significantly lower total knowledge scores (mean=23.0±2.5; p<0.001) than those with a previous concussion (mean=23.9±2.3). Those who had never experienced symptoms of concussion trended towards significance (p=0.05). There were no associations between any of the concussion history variables (parental or child) and attitudes.

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Psychosocial aspects are factors that influence the psyche of the human being in development. Such aspects infer about the behavioral patterns of the individual, causing physical, cognitive and social changes throughout his life (Myers, 2012). One of the effective ways to experience these practices is the sport (Noble et al., 2014).

**PURPOSE:** Identify the relationship between age and skills perceived by children assisted by a sports program.

**METHODS:** The sample consisted of 50 children of a municipal sports center of Anápolis, who practiced sport twice a week at the school turn against for more than 6 months (30 boys and 20 girls), aged between 7 and 12 years old. The psychosocial aspects of children were assessed using the Brazilian version of the Self-Percision Profile for Children, validated by Valentini et al. (2010). The Brazilian version called Self Perception Child scale (SPCS) is configured in a questionnaire that assesses six specific areas of competence: cognitive skills, emotional skills, motor skills, physical appearance, behavioral conduct, in addition to the global self-worth.

**RESULTS:** The children answered the showed moderate levels of self-perceived competence in the dimensions evaluated in the present study, by gender and age. Such skills are psychosocial aspects that can be influenced when compared to children who do not participate in sports programs. It was evident that the younger children, the lower the influence of the sports program on the skills perceived except in motor racing, which takes place from 9 years old. The sport seems to exert an influence on the self-perception skills (ie, cognitive, social, motor and behavioral), especially when there is a longer practice. **CONCLUSIONS:** The skills perceived by children assisted by a sports program only are perceived as the children mature (i.e 11 and 12 years old). Although no significance, there was a trend for upperclassmen to respond higher in PEAK (7.81±3.146 vs. 5.82±2.736; p=0.013) than female athletes, whereas group reflected subnormal response when compared to normative values across other circumstances is essential for creating a strong mental capacity that leads to competition is crucial for optimal development. Therefore, the ability to cope under stressful situations during face during competition. Further research is warranted assessing challenges from larger groups (Pearson chi = 0.9, p=0.34). When situational questions were analyzed for return to play following an early season concussion with persistent symptoms, 70% demonstrated safe behavior (X²=8.9, p=0.003) by not returning the athlete to play with no difference between groups (Fisher p=0.35). If the situation posed included returning a symptomatic concussed athlete to play in a playoff game, 75% selected unsafe (X²=40.8, p<0.0001) return to play with no difference between groups (Fisher p=0.91). **CONCLUSIONS:** As youth football athletes mature, they improve in concussion understanding. However, players’ attitudes and behaviors regarding situational return to play decisions did not improve with age, but continue to demonstrate unsafe behavior.

Endurance athletes recognize that a leaner and lighter body can improve performance outcomes. Currently, there is limited data assessing disordered eating, including orthorexia nervosa, in endurance athletes choosing to adhere to gluten- and wheat-free diets (GWDs). **Purpose:** The aim of this study was to assess disordered eating, including orthorexia behaviors, in endurance athletes following GWDs compared to athletes following a normal diet (ND). **Methods:** Endurance athletes (ages 18-55y) were invited to participate in a web-based questionnaire via multiple sporting websites. The survey included demographic information, questions regarding beliefs and behaviors regarding nutritional and behavioral risk in endurance athletes presenting with disordered eating, orthorexia nervosa, in endurance athletes choosing to adhere to gluten and wheat-free diets (GWDs).

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Preparation for an endurance event amongst amateur athletes requires a major investment in time as well as a proper physical and mental training. Even if there is an increase of participation for endurance events in the country, there are few studies that have reported the psychological effects of such a demanding training for age groups athletes. PURPOSE: The aim of this study was to characterise the psychological state of recreational athletes during a six months training prior to a half Ironman triathlon. METHODS: Thirty-one amateur athletes were recruited for this observational study. Participants were 40 ± 9.1 years old; and had a body weight of 74 ± 12.7 kg and a height of 172 ± 10.12 cm. All participants underwent a physical fitness assessment in January and two weeks prior to the half ironman event, held in June. They followed a training program supervised by a registered kinesiologist based on the Ironman University® annual planning. The training volume was 410.4 ± 201.48 min per week. For each month of training, participants received an email with a link to complete a monthly series of questionnaires that included: Facets Mindfulness Questionnaire Short Version (FMMQ-sv), Profil mood scale (POMS), Positive and Negative Affect Schedule (PANAS) and Sport Motivation Scale 2 Revised (SMS-2R).

RESULTS: Vigour, anxiety and fatigue, POMS sub scale, significantly changed during training (p <0.05). Positive emotions increased over 3 months to stabilise until the competition. Participants felt different types of motivation regulation: intrinsic (15.9 ± 1.90) > extrinsic (13.3 ± 1.62). They were significantly different (p<0.01) among the age groups (15-20 years: 17.0 ± 1.28; 21-30 years: 16.2 ± 1.24). There were no differences among the gender groups (male: 15.7 ± 1.95; female: 16.0 ± 1.98). Athletes who engages in this type of event have a high intrinsic motivation. We also noted that motivation, mindfulness and mood state follow the macrocycle of training. Thus, specific interventions and mental training could be structured around these important elements.

CONCLUSION: Mental training is of utmost importance in endurance events. Further research should focus on different periods of life and in accordance with contextual factors that can contribute to the development of established traits and present experience. This case suggests that you need to incorporate different parameters that take into account the active and continuous interaction with the environment.
**Modifications Of Negative Attitudes Toward Obesity In pre-professionals Of Exercise Sciences.**

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**PURPOSE:** To investigate the effect of short intervention programs for changing negative attitudes towards obesity through strategies of dynamics intergroup contact in pre-professionals of exercise sciences and determine the most effective strategy.

**METHODS:** A total of 56 students of exercise sciences (23.95 ± 4.70-years; 75% male) from Ecuadorian universities participated in this study. The sample was randomly divided into a control group (CG: without intervention, n = 14) and three experimental groups with different dynamics intergroup contact interventions (DC: Direct-Contact, n=14, IC: Imagined Contact, n=13 and CTP: Contact to Take-Perspectives, n=15). Participants were assessed before and after interventions through the AFA (Antimat Atitudes Questionnaire) for explicit attitudes towards obesity in three dimensions (aversion, fear of gaining weight and unwillingness), and the IAT (Implicit Association Questionnaire Antifaz, electronic version) for measuring implicit attitudes. The body mass index was normal (22.5 ± 1.75) for the participants. Statistical comparisons between groups before and after the interventions were analyzed using the Mann-Whitney U test for the AFA, and Chi-square test for the IAT.

**RESULTS:** AFA questionnaire revealed that the implementation of short intervention programs decreased attitudes toward obesity with significant differences among all groups in aversion subscale (p=0.06) and unwillingness (p=0.007). In addition, DC group showed the lowest ranges whereas the CG showed the highest ranges for both subscales. The IAT questionnaire showed that DC group significantly decreased the number of participants with implicit negative attitudes towards obesity (x² < 0.04). The CG showed the smallest decrease compared to the rest of study groups.

**CONCLUSIONS:** Social psychology programs of short intervention, and in particular by dynamics direct contact programs could modify the implicit and explicit attitudes towards obesity in pre-professionals of exercise sciences.

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**Sex Differences in Perceived Achievement after an ACL Injury Prevention and Yoga Program**

Kirsten R. Buchanan¹, Carly A. Keafer¹, Alison E. Newell¹, Karissa M. Wells¹, Irene S. Davis, FACSM.¹ University of New England, Portland, ME. ²Harvard Medical School, Cambridge, MA. (Sponsor: Irene Davis, FACSM)

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Females are more likely to tear their ACL than their male counterparts. A preponderance of ACL injury prevention programs (ACL IPP) have shown that these interventions are effective in decreasing the risk of ACL injuries. Research has shown that girls have a lower general perception of achievement in sports than boys. Little research has investigated sex-specific perceived achievement on lower extremity alignment, flexibility, strength or performance after an ACL IPP.

**PURPOSE:** The purpose of this study was to investigate the perceived achievement after 8 weeks of an ACL-yoga IPP between male and female high school soccer players.

**METHODS:** 98 high school soccer players (45 girls, 53 boys; 14-19 yrs) participated. Intervention included a 30 minute ACL IPP followed by yoga once a week for 8 weeks. Athletes reported if they injured their ACL and/or had any injuries during the season. An 11 point Likert scale (anchors: -5= worse, 0= no change, 5= better) was used to determine perceived outcomes on lower extremity alignment, flexibility, strength, and performance. An independent t-test (p<0.05) was used to determine significant differences between male and female responses.

**RESULTS:** There were no ACL injuries in either group. Males reported over twice the number of overall injuries (22) than females (10). Males exhibited significantly greater perceived improvement in lower extremity alignment (p<0.03), flexibility (p<0.01) and performance (p<0.05), however, not for strength (p>0.45) (Figure 1).

**CONCLUSIONS:** While there were no ACL injuries in either group, and lower overall injuries in the female group, males had a significantly higher perceived improvement than females on lower extremity alignment, flexibility, and performance.

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**Perceived Stress has a Negative Impact on Variables Related to Exercise Recovery in Adolescent Athletes**

Katelyn A. Born, Erin E. Dooley, Andy Cheshire, John B. Bartholomew, FACSM, University of Texas, Austin, Austin, TX. (Sponsor: John Bartholomew, FACSM)

Email: katelynborn@utexas.edu (No relationships reported)

**PURPOSE:** Psychological stress has been shown to impair recovery in laboratory settings, but no study has done so in field settings. This study was designed to test the impact of perceived stress on variables related to recovery in an adolescent athlete population who were participating in a 6-week Summer training program.

**METHODS:** Participants included 100 high school athletes (M age = 15.1; 78% Male; 46% African American). Data were collected during 4 consecutive days in the middle of the training program. Recovery was indicated by measures of feeling states and arousal, fatigue, and soreness. These were collected prior to each day's training. The Perceived Stress has a Negative Impact on Variables (×² < 0.04). The CG showed the smallest decrease compared to the rest of study groups.

**CONCLUSIONS:** Social psychology programs of short intervention, and in particular by dynamics direct contact programs could modify the implicit and explicit attitudes towards obesity in pre-professionals of exercise sciences.

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**Lived Experiences of College Athletes Misuse of Drinking Alcohol with their Teams: A Phenomenological Study**

Debra L. Fetherman, Joan A. Cebrik-Grossman. The University of Scranton, Scranton, PA.

Email: debra.fetherman@scranton.edu (No relationships reported)

This work describes college athletes’ shared experiences of the misuse of drinking alcohol with their teams. **PURPOSE:** To explore the essential meaning that college athletes use to characterize their experiences of alcohol misuse when drinking with their teams. **METHODS:** The modified Van Kaam Method of Analysis was used in this psychosocial phenomenological study. Participants (n=15) represented a convenience sample of Division III athletes. The majority of participants (67%) were female. Eight out of 18 (44%) of the campus, intercollegiate teams were represented. Freshmen (27%, n=2), sophomore (20%, n=3), junior (32%, n=5) and senior athletes (20%, n=3) were represented. Over a 7-week period, data was collected during in-depth, semi-structured interviews. Two questions guided the inquiry: What have you experienced when drinking with your team? and What has influenced or affected your experience of drinking with your team? Interviews were recorded and transcribed verbatim. Saturation and validity were confirmed through triangulation of data, bracketing and peer debriefing.

**RESULTS:** College athletes characterize the misuse of drinking alcohol with their teams as a primary mechanism for navigating college life. The four interrelated, interdependent, and embedded themes included acceptance, comradeship, safety and protection, and a gateway to college social life.

**CONCLUSION:** This examination highlighted the important role that participants’ psychosocial development played in their alcohol misuse behaviors. The reported changes in participants’ motives throughout college acted as a moderator of alcohol.
misuse. The interplay of multiple factors and the malleability of athletes’ identities (team identity, student identity) also influenced changes in alcohol misuse behaviors. Participants identified teammates as having the greatest potential to moderate their team’s culture of alcohol misuse. Health promoters ought to target transitions in psychosocial development by creating prevention strategies based on the malleability of athletes’ social identities.

Supported by a NCAA CHOICES Grant.

Medicine & Science in Sports & Exercise®

2545 Board #65 June 2 11:00 AM - 12:30 PM The Psychological Parameters of Sports Related Injuries in Female Collegiate Athletes Courtenay Stewart-Reiner. Valparaiso University, Valparaiso, IN.

Email: courtenaystewartreiner@gmail.com (No relationships reported)

Purpose: To determine if psychological parameters previous to injury had any impact on injury in female collegiate athletes.

Methods: Participants were female athletes (n=51) from four various sports teams (basketball, golf, soccer, and softball) at a Division 1 college. Five questionnaires were completed, an injury report, The Life Events Coping Scale for Collegiate Athletes (LESCA), The Sport Anxiety Scale (SAS), The Sport Competition Anxiety Test (SCAT), and The Athletic Coping Skills Inventory-28 (ACSI-28). Data collection and analysis were completed to calculate mean, median, mode, range, standard deviation, and a t-test for the injury by each team and overall.

Results: Seventy-one percent of respondents suffered at least one injury in the previous 18 months. There was a statistically significant correlation found between life events and injury (P < .05, P = .03) and no significant correlation between the SAS and injury (P > .05, P = .12), the SCAT and injury (P > .05, P = .12), and coping skills and injury (P > .05, P = .47). Basketball, a correlation between injury and non-injury for life events, anxiety, and coping could not be found due to the fact that there was only one non-injured athlete. In golf, there was no significant correlation found between life events and injury (P > .05, P = .35), anxiety and injury (P > .05, P = .32, P=<.22), and a somewhat significant correlation found between coping skills and injury (P > .05, P = .08). For soccer, there was a definite significant correlation found between life events and injury (P < .05, P = .01), and no significant correlation found between anxiety and injury (P > .05, P = .20, P=.27), and coping skills and injury (P > .05, P = .32). For softball, there was a somewhat significant correlation found between life events and injury (P > .05, P = .09), and no significant correlation found between anxiety and injury (P > .05, P = .43, P=.29), and coping skills and injury (P > .05, P = .20). Conclusions: The findings show that almost all athletes, non-injury or injury have a history of negative life events and a large amount of sport anxiety, but a increased amount of coping skills. The findings suggest that certain psychosocial variables moderated the relationship between life stress and injury, supporting the components of Williams and Anderson’s model for stress and athletic injury.

2546 Board #66 June 2 11:00 AM - 12:30 PM Health and Well-being Mindset and Behavior Patterns: A Qualitative Analysis of Swim Coaches Krista M. Kezers1, Bridget M. Miller1, Jamie C. Clark1, Suraj Vadhlal Sivakumar2. 1Oklahoma State University, Stillwater, OK. 2Barry University, Miami Shores, FL.

Email: krista.kezers@okstate.edu (No relationships reported)

Full-time sports coaches face a unique, challenging, and constantly changing work environment. Understanding the experiences and perceptions of individual coaches is paramount to appreciating the implications of the profession on a coach’s behavior and ultimately their health and well-being.

Purpose: The purpose of this interpretative phenomenological analysis is to understand in-depth the individual perceptions and experiences of health and well-being for swim coaches.

Methods: Six focus groups were conducted as part of an annual worldwide swim coaches’ clinic. Twenty-three participants, aged 23-70, were asked a series of open-ended questions to gain a better understanding of participants’ experiences, perceptions, and beliefs related to health and well-being in their profession. Questions aimed to address three research questions: (1) How do swim coaches perceive their health and well-being? (2) What are the lived experiences of swim coaches pertaining to health and well-being? (3) If a coach is a former athlete, how are health and well-being experienced in coaching? All audio files were transcribed verbatim and coded separately by 3 coders. The 3 coders thoroughly discussed each transcript before coming to consensus on finalized codes and developing major and minor themes.

Results: A number of major themes emerged including the notion that (1) coaches experience some of the same challenges of maintaining a healthy lifestyle that the general adult population also faces (lack of motivation and limited supporting infrastructure from employer), but also that (2) the profession of coaching is distinctive in the way the job becomes a lifestyle which presents unique challenges to maintaining work/life balance, regular physical activity, and healthy nutrition. Conclusion: Swim coaches have a complex occupation that directly influences their health and well-being. Many coaches express interest in learning how to improve their health and well-being by suggesting that targeted programming on the topic could be quite popular. The findings presented here can be instrumental in the development of such programs and recruiting professional organizations to support such endeavors.

2547 Board #67 June 2 11:00 AM - 12:30 PM Underserved Boys’ Self-efficacy, Pacer Performance and Ethnicity In A Summer Sports Camp Yiyu Wang. Texas A&M University, College Station, TX. (Sponsor: Zan Gao, FACSIM).

Email: yydavid@tamu.edu (No relationships reported)

Purpose: This study investigated the relationship between underserved boys’ self-efficacy, PACER performance and whether these variables differed by ethnicity in a summer sports camp.

Methods: Participants included 94 boys (13.1±2.1yrs) enrolled in summer camp in 2015. The boys came from low-income families and were 20.2% African American, 20.2% Caucasian, and 59.6% Hispanic American. Their social self-efficacy (SSE) and physical activity self-efficacy (PASE) were measured using a previously validated questionnaire on a 5-point Likert scale during the first week of the camp, and fitness performance was assessed by PACER in the third week of the camp.

Results: SSE was significantly correlated with PASE (r = 0.52, p < 0.01), while PASE was significantly correlated with PACER performance (r = 0.26, p<0.01). A MANOVA yielded a significant main effect for ethnicity (λ = 0.61, p < 0.01). An ANOVA yielded a significant main effect for ethnicity (F (2, 94) = 6.86, p < .01, η² = 0.14). Follow-up tests revealed significant ethnicity differences in the mean scores of PASE only (F (2, 94) = 6.86, p < .01, η² = 0.13), with African American boys scoring the highest (M = 4.16), followed by Hispanic American boys (M = 3.82) and Caucasian boys (M = 3.51). Conclusion: Similar to previous research, boys in this study believing in their physical activity ability had better PACER performance than boys who did not. This finding provides additional evidence for the importance of physical activity self-efficacy in physical activity settings. Observed ethnicity differences support the notion that ethnicity is related to children’s self-efficacy.

This study was funded by the Sydney and J.L. Huffines Institute for Sports Medicine and Human Performance at Texas A&M University.
RESULTS: There was an interaction with torque and Mth (p<0.001). There were no differences across Pre (p=0.312) but there were for Post (p<0.001) with torque. Increasing load [e.g. 10/40: -5.2 (-7.2, -3.2) Nm vs. 20/40: -24 (-4.3 -32.9, -15.8) Nm] and pressure [e.g. 15/40: -15 (-2.2, -7.9) Nm vs. 15/80: -20.7 (-7.9, -2.2) Nm] resulted in a gradient pre-post decrease in torque (p<0.001). Increasing load [e.g. 10/40: -0.18 (0.1, 0.25) cm vs. 20/40: 0.38 (0.29, 0.47) cm] and pressure [e.g. 15/40: 0.31 (0.23, 0.4) cm vs. 15/80: -0.43 (0.37, 0.48) cm] resulted in a gradient pre-post increase in Mth (p<0.001). For EMG amplitude there was a condition (p=0.002) and time (p=0.019) effect. EMG amplitude increased across time [e.g. 1st set: 40 (12.6) %MVC vs. 4th set: 45 (14.4) %MVC, p=0.033] and was augmented by increasing the load to 20% 1RM [15/80: 40 (9 %MVC vs. 20/40: 55 (15) %MVC, p=0.003] with no effect of pressure [20/80: 54 (20) %MVC].

CONCLUSIONS: These acute findings provide important information for implementing BFR with very low loads. We wish to suggest that higher pressures may be useful when implementing BFR with loads less than 20% 1RM.

PURPOSE: To characterize the cardiovascular and perceptual responses to pressures below 40% AOP and compare them to a moderate (50% AOP) and higher (90% AOP) relative pressure.

METHODS: Twenty-six participants performed four sets of unilateral elbow flexion using 30% of their one-repetition maximum (1RM) while a 5cm wide nylon cuff was placed at the proximal portion of their upper arm. The cuff was inflated to one of six relative restriction pressures (0%, 10%, 20%, 30%, 50%, 90% AOP). AOP was measured before (pre) and immediately after four sets (post) of exercise at the radial artery. Ratings of perceived exertion (RPE) and discomfort were taken prior to (pre) and following each set of exercise. A repeated measures ANOVA determined differences in AOP. A Friedman test was used to determine differences for perceptual responses. Data presented as mean (95% CI) except for perceptual responses represented as the 25th, 50th, 75th percentiles. Statistical significance was set at p≤ 0.05.

RESULTS: AOP increased from pre to post (p < 0.001) in all conditions but was augmented further with higher pressures [e.g. 0%: 36 (30 - 42) mmHg vs. 10%: 39 (34 - 44) mmHg vs. 90%: 46 (41 - 52) mmHg]. For RPE and discomfort, there were significant differences across conditions for all sets of exercise (p < 0.01) with RPE [e.g. 0%: (13, 14.5, 17) vs. 10%: (12, 13.5, 17) vs. 90%: (14.7, 17.0, 19.0) during last set] and discomfort [e.g. 0%: (1.5, 3.5, 6.2) vs. 10%: (1, 3, 6) vs. 90%: (4.5, 7.6, 9.0) during last set] generally being greater at higher restriction pressures.

CONCLUSIONS: The results provide additional information to the BFR literature by categorizing the cardiovascular and perceptual response to pressures < 40% AOP. The cardiovascular response is different depending on the relative restriction pressure applied. These findings may guide future studies to provide a safer and more tolerable stimulus for the individual who still wants to increase muscle size while concomitantly minimizing the cardiovascular response.

Blood flow restriction (BFR) allows individuals to exercise with lower loads while producing similar increases in muscle size as high load training. Most studies implement moderate to high pressures with loads corresponding to 20-30% of their one-repetition maximum (1RM). No study has examined perceptual cardiovascular and perceptual responses using loads lower than 20% 1RM, which may provide a more widely inclusive and palatable stimulus.

PURPOSE: To determine the cardiovascular and perceptual response to very low load BFR exercise using both moderate (40%) and high (80%) relative arterial occlusion pressures (AOP).

METHODS: 14 participants came to the lab on four separate days to complete six exercise protocols (2 per visit on visits 2-4) consisting of 4 sets (1 set of 30 followed by 3 sets of 15) of BFR elbow flexion exercise with either a 10%, 15% or 20% 1RM load, each of which was performed with a moderate (40%) and high (80%) AOP condition. A repeated measures ANOVA was used to determine differences in AOP pre and post exercise and a Friedman test was used to determine differences in discomfort and ratings of perceived exertion (RPE) following each set. AOP expressed as [mean (95% confidence interval)] with RPE and discomfort expressed as [median (25%, 75% percentile)].

RESULTS: There was an interaction for AOP (p=0.002) with higher pressures and loads producing a gradient increase. The pre to post changes ranged from 21 (95% CI: 10-32) mmHg in the 10% 1RM/AOP condition to 62 (95% CI: 45-78) mmHg in the 20% 1RM/80% AOP condition. Ratings of discomfort were primarily dependent on the level of restriction pressure applied, with higher pressures resulting in greater discomfort (p<0.001) ranging from 2.5 (1.5, 3.5) in the 15% 1RM/40% AOP condition to 6.5 (5.5, 7.5) in the 15% 1RM/80% AOP condition. Additionally, a gradient increase in RPE accompanied higher pressures and loads which ranged from 8.5 (7.12) at the conclusion of the 10%1RM/40% AOP condition to 15.5 (12.75, 17.25) at the conclusion of the 20% 1RM/80% AOP condition.

CONCLUSIONS: Increases in load and restrictive pressure resulted in elevated AOP and RPE, but higher pressures were primarily responsible for increased discomfort. Individuals experiencing discomfort during low load BFR exercise may wish to decrease the applied pressure and increase the exercise load.

Blood flow restriction exercise provides a means to control the intensity of a specific stimulus. Hence, determining the effects of different levels of restriction pressure and loads is critical in the development of a BFR protocol. This study investigated the acute muscular responses to even lower pressures (AOP) and loads (0-20% 1RM) while a 5cm wide nylon cuff was placed at the proximal portion of the upper arm. The cuff inflated to one of six relative restriction pressures (0%, 10%, 20%, 30%, 50%, 90% AOP) and exercise loads (0%, 10%, 20% 1RM).
E-28 Free Communication/Poster - Cardiac Physiology

2552 Board #72 June 2 9:30 AM - 11:00 AM
Global And Regional Cardiac Function In Lifelong Endurance Athletes With And Without Myocardial Fibrosis
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CONCLUSIONS: MF is associated with larger cardiac dimensions, normal global cardiac function but evidence of co-localised regional cardiac dysfunction in lifelong veteran endurance athletes. Given the heterogeneous phenotype of MF, we propose that follow-up studies and a case-by-case approach are needed for appropriate risk assessment in athletes with MF.

METHODS: Cardiac magnetic resonance imaging with late gadolinium enhancement was used to detect MF and global cardiac structure in 9 lifelong veteran endurance athletes (58±5 years, 43±5 years of training). Transthoracic echocardiography using tissue-Doppler and myocardial strain imaging assessed global and regional (18 segments) longitudinal left ventricular function.

RESULTS: MF was present in 4 athletes (range 1-8 g) and not present in 5 athletes. MF was located near the insertion points of the right ventricular free wall on the left ventricle in 3 athletes and in the epicardial lateral wall in 1 athlete. Athletes with MF demonstrated a larger end diastolic volume (205±24 vs 173±18 ml, p=0.06) and posterior wall thickness (11.1±1 vs 9.1±1 mm, p=0.03) compared to those without MF. The presence of MF did not mediate global tissue velocities or global longitudinal strain (22.0±4.3 vs 21.7±1.8) and strain rate (0.95±0.20 vs 0.90±0.15; A': 0.61±0.16 vs 0.66±0.17), however, regional analysis of longitudinal strain demonstrated reduced function in 5 out of 8 wall segments associated with the presence of MF in 3 athletes (Figure).

CONCLUSIONS: MF is associated with larger cardiac dimensions, normal global cardiac function but evidence of co-localised regional cardiac dysfunction in lifelong veteran endurance athletes. Given the heterogeneous phenotype of MF, we propose that follow-up studies and a case-by-case approach are needed for appropriate risk assessment in athletes with MF.

PRESIDENTIAL AWARD - TRUE EXCELLENCE IN RESEARCH AND PRACTICE IN PHYSICAL EDUCATION, LEISURE, AND RECREATION

2553 Board #73 June 2 9:30 AM - 11:00 AM
Accuracy Of Mobile HRV Devices For Measuring RMSSD: A Systematic Review And Meta-analysis
Michael R. Esco, FACSM, Michael V. Fedewa, Hayley V. MacDonald. University of Alabama, Tuscaloosa, AL.

(No relationships reported)

There are a number of commercially available heart rate variability (HRV) mobile devices that provide a measure of root mean square of successive R-R differences (RMSSD). However, their accuracy compared to electrocardiography (ECG) remains questionable. PURPOSE: To compare a range of mobile devices to ECG for measuring RMSSD under a variety of conditions. METHODS: This review was conducted in accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) statement guidelines. Articles published before July 22, 2016 were located using searches of the Physical Education Index (n=1,007), PubMed (n=1,145), Scopus (n=1,562), and SPORTDiscus (n=2,137) online databases using combinations of the terms: heart rate variability, HRV, valid, and validity. Duplicate publications were removed, yielding 4,686 original records for review. In addition, three publications were identified through a manual reference search. All studies included in the meta-analysis were peer reviewed and published in English. Each study effect size (ES) was calculated as the difference between the RMSSD measures recorded from the mobile device compared to ECG, divided by the pooled standard deviation and adjusted for small sample bias. Random-effects models were used to aggregate a mean ES and 95% confidence intervals (CI). In addition, a multi-level model was used to account for the nesting of multiple effects within a single study. RESULTS: The cumulative data results from 35 effects extracted from 14 articles published between 2005 and 2016 indicate no difference between the mobile devices and ECG for RMSSD measures (ES = -0.0040, 95% CI = -0.0687, 0.0608, p = 0.9039). The multi-level model yielded similar results (ES=0.0040, 95% = -0.0687, 0.0608, p=0.9059). The number of effects obtained from each studied ranged from 1 to 12 (mean=2.92, standard deviation=3.90). We observed minimal heterogeneity among our effects (Q = 4.516, p=0.99; F<0%, with 100% of the observed heterogeneity explained by sampling error. CONCLUSIONS: These results suggest that mobile HRV devices provide similar measures of RMSSD compared to ECG.

PURPOSE: Cardiovascular (CV) factors undergo progressive time-dependent changes beginning approximately 10 min into a bout of prolonged, submaximal exercise. One expected response is a gradual rise in heart rate (HR) throughout a prolonged sustained exercise bout. The purpose of this study was to determine whether a large increase in exercise HR was observed in a group of young men and women during a prolonged, submaximal swimming endurance trial. METHODS: Thirty-two older adults and consider the influence of TNF-α on cardiac myosin heavy chain (MHC) expression and the influence of TNF-α on exercise tolerance. RESULTS: Forty, postmenopausal (65 ± 3 years) women, provided blood samples and completed a modified-thallium protocol to measure maximum oxygen uptake. Local pulse contour analyses were used to assess large artery compliance while rate-pressure product (RPP), a reliable index of myocardial oxygen demand, was measured at rest and during two submaximal workloads. RPP was calculated by dividing the product of heart rate and systolic blood pressure (via auscultation) by 100. Exercise tolerance corresponded with the cessation of the graded exercise test. P-values ≤ 0.05 were considered statistically significant for all analyses. RESULTS: Multiple linear regression revealed a positive association between TNF-α and RPP during submaximal exercise (partial r = 0.43; p = 0.015) adjusted for maximal heart rate, maximal oxygen uptake, large artery compliance, and percent body fat. Path analyses revealed a significant indirect effect of TNF-α on exercise tolerance through TNF-α, β = 0.13, CI [0.03, 0.35] such that heightened levels of TNF-α translated to poorer exercise tolerance. CONCLUSIONS: These data indicate that TNF-α is independently associated with myocardial oxygen demand during submaximal exercise equating to 5 METs but not at rest and TNF-α mediates the indirect effects of large artery compliance on exercise tolerance. Future studies should explore differential responses to standardized exercise tasks among older adults and consider the influence of exercise training on myocardial oxygen demand and activity-related energy expenditure.

2555 Board #75 June 2 9:30 AM - 11:00 AM
Absence of Cardiac Drift during a Prolonged, Submaximal Swim Bout
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(No relationships reported)
sec rest interval between each repetition. HR was collected in 15 second epochs using a commercially available cardio-tachometer (Actiheart) for the entire bout. During the 60 min and after each bout, participants were instructed to "steady state" (10 min after the beginning of the bout), the HR data were averaged each minute. A series of 6 one-tailed paired t-tests were used to compare the group mean HR at 10 min to each of the subsequent 10 min time interval of group mean HR. Standard deviations, and the subsequent average of those standard deviations, were calculated for each subject's HR data. RESULTS: HR data were collected throughout exercise and recovery following an incremental treadmill test to exhaustion in young adults [age range=19-21 yrs; male: n=14, Ht=173±7cm, Wt=71.7±11.4kg, BF=16±8.6%, VO2peak=48±0.6ml/kg/min, HRpeak=200±11; female: n=18, Ht=162±5cm, Wt=67.8±15.9kg, BF=32±9.4%, VO2peak=33±3.9ml/kg/min, HRmax=195±12]. Nonlinear regression techniques were used to fit the first 5 min of R-R intervals for each bout. Only 20% of the variance in R-R interval data following the cessation of exercise was observed to demonstrate either CV drift did not occur or the results were related more to athlete pacing than any CV response per se.

2556 Board #76 June 2 9:30 AM - 11:00 AM Cardiovascular Structure and Function in Lifelong Competitive Swimmers Wesley J. Manz1, Michael S. Emery1, Joel T. Greenshields2, Laurence D. Rink3, Joel M. Stager1, FACSM1, University, Bloomington, IN. 1Indiana University, Bloomington, IN, 2University of Zurich, Zurich, Switzerland. 3Trinity Health, Greensboro, NC. (Sponsor: Joel M. Stager, FACSM)

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(No relationships reported)

It is known that intense aerobic exercise elicits physiological adaptations of the cardiovascular system. However, it is unclear whether these adaptations exist over a lifetime of training. Little published data exists quantifying such adaptations in older competitive athletes, & even less data exists on populations engaged in long-term interval training, such as swimmers.

PURPOSE: To assess & compare the cardiovascular remodeling status of chronically trained Master’s swimmers to age-matched, inactive reference values.

METHODS: Chronically trained (20.0 ± 14.5 yrs), competitive men (M, n=7) & women (F, n=21) Master’s swimmers (age 55.2 ± 6.0 yrs) were studied just prior to competing in the 2009 US Masters Swimming Long Course Nationals. Demographics, anthropometrics, training history & resting hemodynamics were recorded. Subjects then underwent 2D transthoracic echocardiography with Doppler. Septal wall thickness (IVS), posterior wall thickness (PWT), left ventricular internal diastolic & systolic dimensions (LVDDs), end diastolic & systolic volumes (EDV/ESV), relative wall thickness (RWT), LV mass measured via truncated ellipsoid method (LVM), & left atrial volume (LAV) were assessed & indexed to body surface area where appropriate. RWT & LVM were used to characterize remodeling status per American Society of Echocardiography (ASE) guidelines. Sex-specific means as well as individual values were compared to ASE published normal values (mean = 2SD = ULN, upper limit of normal). A one-sample T-test was used to compare published ASE values to subject sex-specific means (p<0.05). RESULTS: 64% of all athletes demonstrated normal geometry, with 7% demonstrating concentric remodeling (M 14%, F 24%), 14% eccentric hypertrophy (M 29%, F 10%), & 0% concentric hypertrophy. No statistical difference was shown between sex-specific means for LVDD, LVIDs, EDV, EDV, ESV, ESI, LAV & ASE reference values. However, 29% of men displayed LVEDVi above age-specific ASE ULN, compared to only 5% of women. CONCLUSIONS: Compared to inactive reference values nearly a third of the active men showed signs of exercise-induced cardiac remodeling. This trend was not observed in women suggesting a difference in physiological response to training, or a difference in long-term training parameters.

2557 Board #77 June 2 9:30 AM - 11:00 AM Heart Rate Variability During Acute Recovery from Maximal Exercise; Utility of a Nonlinear Dynamics Approach

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(No relationships reported)

The non-stationary trend of the heart rate (HR) response immediately following the cessation of exercise mathematically biases traditional measures of heart rate variability (HRV), during acute recovery. Fitness-induced alterations in resting HR, HRV and heart rate recovery (HRR) are observed in response to changes in cardiac autonomic nervous system modulations. PURPOSE: To pilot the utility of nonlinear dynamics to characterize the patterns of fluctuation and complexity surrounding the non-stationary drift in HRV during acute recovery from exercise. METHODS: HR data was collected throughout exercise and recovery following an incremental treadmill test to exhaustion in young adults [age range=19-21 yrs; male: n=14, Ht=173±7cm, Wt=71.7±11.4kg, BF=16±8.6%, VO2peak=48±0.6ml/kg/min, HRpeak=200±11; female: n=18, Ht=162±5cm, Wt=67.8±15.9kg, BF=32±9.4%, VO2peak=33±3.9ml/kg/min, HRmax=195±12]. Nonlinear regression techniques were used to fit the first 5 min of R-R interval data following the cessation of exercise. Residuals were calculated from individual-specific regressions and used to create a secondary time-series. Detrended fluctuation analysis (DFA) and sample entropy (SampEn) were used to characterize self-similar patterns and the complexity of fluctuation in HRV-R, respectively.

RESULTS: We successfully removed the non-stationary trend associated with post-exercise HRV data. Preliminary analyses show a significant interaction between VO2peak and HRpeak as predictors of complexity (SampEn) surrounding the post-exercise HR response (p<0.001). A significant interaction between gender and HRpeak predicted DFA, (p<0.02); after controlling for HRpeak, DFA was greater in women than men during acute recovery. CONCLUSIONS: Nonlinear dynamics provide an additional perspective on HRV during acute exercise recovery. The complexity surrounding the nonlinear trend of HRV during recovery may provide additional context for the role of fitness on cardiac autonomic nervous system modulation which has been previously described during resting HRV data. Future analyses should investigate the utility of this residual approach to examine the relationships across pre-, during-, and post-exercise HRV measures.

Impedance cardiography (IC) is a non-invasive method for measuring cardiovascular hemodynamics during exercise. However, the consistency of measurements obtained via IC across different exercise modes has not been investigated.

PURPOSE: To investigate whether hemodynamic measures assessed via IC are consistent between treadmill (TM) and cycle (C) exercise at a given intensity.

METHODS: Ten men (age = 21 ± 2.2 yrs; BMI = 24.8 ± 3.7) completed three exercise tests, two TM and one C. Within each test, a five minute, steady-state stage was completed with a target intensity of 5 METs. Oxygen consumption (VO2) was measured by indirect calorimetry. Hemodynamic measures were obtained via IC (PhysioFlow, PF07 Enduro) and included stroke volume (SV), heart rate (HR), cardiac output (CO), cardiac index (CI), end diastolic volume (EDV), end diastolic filling ratio (EDFR), ejection fraction (EF), ventricular ejection time (VET), and systemic vascular resistance (SVR).

RESULTS: There were no significant differences in VO2 and hemodynamic measures between repeated TM tests (P > 0.05). Steady-state VO2 (19.2 ± 1.1 vs 19.1 ± 1.2 ml/kg/min) and HR (112 ± 14 vs 113 ± 16 beats/min) did not differ between exercise modes (TM vs C). There were no significant differences between TM and C in SV, CO, CI, EDV, EF, and SVR, but VET differed between trials. Significant intraclass correlation coefficients (r = 0.70 – 0.90, p < 0.05) were observed between modes for SV, HR, CO, EDV, EF, and SVR, but not for CI, VET, and EDFR. Bland-Altman analyses indicated good agreement between TM and C for in SV, HR, CO, CI, EDV, EF, and SVR.

CONCLUSION: The majority of hemodynamic measurements obtained via IC during moderate exercise showed moderate-strong consistency between TM and C modes. Future research utilizing IC during exercise should be conducted across a greater range of exercise intensities. In addition, hemodynamic variables obtained with IC should be compared with invasive methods to confirm their validity.

2559 Board #79 June 2 9:30 AM - 11:00 AM Comparison of Heart Rate Variability in Intercollegiate Explosive Power vs. Sustained Power and Endurance Athletes

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(No relationships reported)

Heart rate variability (HRV) provides valuable feedback about heart function by measuring the RR interval change over time (Poincare SD1 and SD2, RMSSD, PNN50), sympathovagal activity (trend with low frequency (LF) activity and high frequency (HF) power). PURPOSE: To investigate HRV and autonomic activity in intercollegiate explosive power (EXP) vs. sustained power and endurance athletes (SEN). METHODS: A standard operating procedure was created.
to assess resting HRV and autonomic activity over 10-15 minutes in 27 Intercollegiate athletes (EXP n=17, SEN n=10). Data were sorted and analyzed by sport type using t-tests. RESULTS: Despite a 43% variation, EXP athletes’ LF Power did not differ significantly from SEN athletes (p=0.08); however, EXP had a significantly higher HF Power (56%) than SEN (p<0.03). EXP did not differ significantly in HRV via Poincaré SD1 compared with SEN athletes (p=0.09). LF/HF ratio was similar in all athletic types.

<table>
<thead>
<tr>
<th>HRV Measure</th>
<th>Explosive Power (n=17)</th>
<th>Sustained Power and Endurance (n=10)</th>
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</thead>
<tbody>
<tr>
<td>LF Power (ms²) ± SEM</td>
<td>3863 ± 847</td>
<td>2191 ± 352</td>
</tr>
<tr>
<td>HF Power (ms²) ± SEM</td>
<td>3107 ± 725</td>
<td>1366 ± 192</td>
</tr>
<tr>
<td>Mean LF/HF ± SEM</td>
<td>1.64 ± 0.23</td>
<td>1.69 ± 0.21</td>
</tr>
<tr>
<td>Poincaré SD1 (ms) ± SEM</td>
<td>61.6 ± 7.7</td>
<td>46.9 ± 3.6</td>
</tr>
<tr>
<td>Poincaré SD2 (ms) ± SEM</td>
<td>114.6 ± 11.5</td>
<td>115.5 ± 10.1</td>
</tr>
<tr>
<td>RMSSD (ms) ± SEM</td>
<td>87.1 ± 10.9</td>
<td>66.3 ± 5.1</td>
</tr>
<tr>
<td>PNN50 (%) ± SEM</td>
<td>26.8 ± 5.4</td>
<td>20.1 ± 5.0</td>
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</tbody>
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CONCLUSION: Differences in HRV were observed between EXP and SEN athletes, with the major significance in HF Power indicating EXP athletes demonstrated greater parasympathetic activity at rest compared with SEN athletes. Most HRV studies have focused on endurance trained athletes. This finding is of interest as cardiovascular variability studies in explosive athletes have potential to elucidate autonomic and cardiovascular regulation.

Supported by Miami University Student Tech Grant

Recent data from our laboratory has shown that increasing sympathetic activity to the heart via muscle metaboreflex activation speeds heart rate kinetics during transitions in the lower moderate intensity domain (from 20W to ~60% of the ventilatory threshold, VT). Whether the magnitude of the exercise transient and heart rate change influences the effects of elevated sympathetic activity on heart rate kinetics is not known.

PURPOSE: We tested the hypothesis that increasing sympathetic activity to the heart via muscle metaboreflex activation would speed heart rate kinetics throughout the entire moderate intensity exercise transient. METHODS: Five healthy and active, but not trained, adults (m/f = 3/2; age = 22 ± 2 yrs; peak VO2 = 46 ± 8 ml/kg/min) performed square-wave moderate intensity exercise transitions from 20W to 90% VT. Each subject was tested in two conditions. Condition 1 was a control (CTRL) condition. In condition 2, the muscle metaboreflex activation was induced by 2 min of handgrip at 40% maximal voluntary contraction during the pre-transition 20W baseline followed by 5 min of circulatory occlusion (OCCCL) during the transition to 90% VT. Trials were randomized and three repetitions of each condition were completed, time-aligned, and averaged by condition. Heart rate kinetics were determined using mono-exponential curve fitting and data was analysed with non-parametric tests. Results: The pre-transition baseline heart rate was not different between CTRL (93 ± 8 beats/min) and OCCCL (90 ± 10 beats/min), P = 0.138. Heart rate amplitude was not different between CTRL (29 ± 6 beats/min) and OCCCL (29 ± 5 beats/min), P = 0.500. Finally, the heart rate time constant, tau, was not different between CTRL (34 ± 10 s) and OCCCL (36 ± 16 s), P = 0.686. CONCLUSIONS: Heart rate kinetics are not altered by sympathetic activation via the muscle metaboreflex during the exercise transition from 20W to 90% VT. These findings suggest that the magnitude of step-change in exercise intensity and/or the magnitude of change in heart rate plays an important role in heart rate kinetics under a sympathetically elevated condition.

Increased blood pressure (BP) and autonomic dysfunction are independent risk factors for cardiovascular disease. Heart rate variability (HRV) is used as a measure of cardiac autonomic function in many research settings, including the evaluation of the autonomic control during and after physical activity. A prolonged sympathovagal predominance and a slow parasympathetic reactivation contribute to a delayed BP and heart rate (HR) recovery after exercise which is thought to be associated with increased risk of acute cardiac events. Therefore, understanding the impact of various exercise modalities on the post-exercise autonomic modulation and BP would allow for appropriate exercise prescription in susceptible populations. Kettlebell (KB) training has become an extremely popular training modality for improving both muscle strength and aerobic fitness. However, the HRV and BP responses induced by an acute KB exercise session are currently unknown. PURPOSE: To evaluate the effects of an acute session of KB exercise on HRV and BP responses in healthy young adults. METHODS: 17 young healthy adults (M=10, F=7) completed a KB exercise or a no-exercise control trial in a randomized order. During the KB trial, participants completed twelve-30s sets of KB swings followed by 30 seconds of rest. Men and women used a 16kg and 8kg KB, respectively. Low-frequency power (LF), high-frequency power (HF), the LF to HF ratio (LF/HF), HR and BP were collected in the supine position at baseline, 3, 10 and 30 min after each trial. LF and HF were normalized to total power resulting in nLF, nHF and nLF/nHF. RESULTS: There were significant group-by-time interactions (P < 0.05) for nLF (sympathetic activity), nHF (vagal tone), nLF/nHF (sympathovagal balance), HR, systolic and diastolic BP. There were significant increases (P<0.01) in nLF, nLF/nHF and HR as well as significant decreases (P < 0.01) in nHF, systolic (~4mmHg) and diastolic (~3mmHg) BP for 30 min after KB compared to no changes after control. CONCLUSIONS: Our findings indicate that KB exercise increases sympathovagal balance 30 min post-exercise which is concurrent with a sustained hypotensive effect in young healthy adults. Further research is warranted to evaluate the potential clinical application of KB in populations that might benefit from post-exercise hypotension.
were decreased at Rec1 and Rec2 compared to Rest after the acute resistance exercise. CONCLUSIONS: These data suggest that acute RE using free-weights has a profound impact on autonomic modulation that is similar between the sexes.

2563 Board #83 June 2 9:30 AM - 11:00 AM The Effects Of Ultra-endurance Event Participation On Biomarkers Of Cardiac Damage - A Systematic Review And Meta-analysis

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Meta-analysis has not yet collectively evaluated biomarkers of cardiac damage following ultra-endurance races or factors which modulate these biomarkers.

PURPOSE: To quantify the response of creatine kinase MB (CK-MB) and cardiac troponin (cTn) isoforms following a single ultra-endurance event and determine whether patient and ultra-endurance race characteristics modulated changes in these markers of cardiac damage.

METHODS: A systematic review was conducted and reported according to PRISMA guidelines. A generic search strategy using PubMed, CINAHL, and SportsDiscus was employed to comprehensively identify all peer-reviewed publications which evaluated health-related effects of participating in an ultra-endurance event. Data from observational studies which reported pre- and post-race measurements of CK-MB (k=16 studies), cTnT (k=8), and cTnI (k=6) were analyzed following random-effects assumptions.

RESULTS: On average, ultra-endurance participants were middle-aged males who competed in running, cycling, or triathlon race distances ~156-235 km and ~20 h duration. Overall, ultra-endurance events significantly increased CK-MB (d = 11.29; 95%CI: 7.90, 14.69) and cTnT levels (d = 2.18; 95%CI: 1.39, 2.97) post- compared to pre-race. Collectively, these effects sizes lacked homogeneity (I² = 95%; 95%CI: 92.2, 95.9); cTnI = 90.9% [96.4, 93.8]). Bivariate moderator analyses revealed that older versus younger samples experienced greater increases in CK-MB following a single ultra-endurance event (β = 0.543, p < 0.030). Ultra-endurance running events elicited greater increases in cTn-MB compared to cycling and triathlon events (p = 0.583, p = 0.018). In contrast, greater increases in cTn levels were observed among younger compared to older samples following a single ultra-endurance event (β = -0.067, p < 0.020). Furthermore, cycling and triathlon events elicited greater increases in cTn compared to running events (p = 0.472, p = 0.036). Effects were similar whether cTn isoforms were analyzed separately or combined.

CONCLUSIONS: Cardiac biomarkers were consistently elevated following ultra-endurance events and dependent on age and race type. Further research is necessary to determine the long-term clinical significance of repeated ultra-endurance races.

2564 Board #84 June 2 9:30 AM - 11:00 AM Influence of Exercise Mode on Post-Exercise Cardiac Parasympathetic Reactivation and Sympathetic Withdrawal

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PURPOSE: This study investigated indirect measures of post-exercise parasympathetic reactivation (using heart rate variability, HRV) and sympathetic withdrawal (using systolic time intervals, STI) following upper- and lower-body dynamic exercise. METHODS: 13 males (age 26.4±4.7 y) performed maximal incremental arm-crank and leg cycling exercise tests (MAX-ARM and MAX-LEG, respectively). Subsequently, participants performed separate 8-min bouts of submaximal HR-matched exercise of each mode (SUBMAX-ARM and SUBMAX-LEG). HRV (including the natural-logarithm of root mean square of successive differences, Ln-RMSSD) and STI (including the pre ejection period, PEP) were assessed throughout 10-min seated recovery. RESULTS: Peak HR was higher (p = 0.001) during MAX-LEG (182±7 b.min⁻¹) compared with MAX-ARM (171±12 b.min⁻¹), while HR (p = 0.012) and Ln-RMSSD (p = 0.010) recovered more rapidly following MAX-ARM. PEP recovery was similar between maximal exercise bouts (p = 0.16). HR during submaximal exercise was 146±7 and 144±8 b.min⁻¹ for SUBMAX-LEG and SUBMAX-ARM, respectively (p = 0.139). The recovery of HR and Ln-RMSSD was also similar between submaximal modes (p = 0.120 and 0.110, respectively), although these variables did not return to resting levels (p > 0.001). PEP was similar at end-exercise (SUBMAX-LEG 70±6 ms; SUBMAX-ARM 72±9 ms; p = 0.471), however PEP recovery was slower following SUBMAX-ARM (p = 0.021), with differences between modes apparent over 1 to 10-min recovery (p = 0.036). By 10-min post-exercise, PEP had recovered to near-resting levels (132±21 ms) following SUBMAX-LEG (p = 0.143) but not after SUBMAX-ARM (121±17 ms; p = 0.001). CONCLUSION: Compared with submaximal HR-matched lower-body exercise, upper-body dynamic exercise elicited a similar recovery of HR and HRV indices of parasympathetic reactivation, but a delayed recovery of PEP (index of sympathetic withdrawal). These data indicate that exercise mode influences acute exercise parasympathetic reactivation and sympathetic withdrawal in a manner that is moderated by exercise intensity. These results may be of practical relevance to multi-discipline athletes, as well as for clinical monitoring applications where the mode of exercise testing may vary.

2565 Board #85 June 2 9:30 AM - 11:00 AM Early Life Nutrition Alters the Electrocardiogram of Adult Mice with Dobutamine Stimulation

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Email: viskerjo@msu.edu (No relationships reported)

PURPOSE: Under nutrition in early life has been shown to increase the risk of cardiovascular disease (CVD) in adult life. Thus, the purpose of this study was to determine if early life undernutrition at various windows of development (Postnatal days (PND) 1-21) produced cardiac arrhythmias at rest and when pharmacologically stressed (PST) with dobutamine. METHODS: Mouse FVB/N dams were fed a semi-purified diet (CON: 20% protein), or a low-protein (LP: 8%) diet beginning 1 week prior to mating. In order to evaluate the phases (N=16/group) of early life undernutrition (early-EUN; PND-1, late-EUN; PND-21, E-L, E-PUN, PUN-21) a cross fostering model was used where pups suckled to dams fed diet received a global reduction in caloric intake (~18% as compared to CON) during the designated window prior to weaning. After weaning all mice were fed the control diet until PN80. At PN80 body composition (BC) was measured by MRI, and then evaluated for cardiac function via electrocardiogram (ECG) under 1% isoflurane anesthesia. After baseline measure, the mouse was administered an intraperiosteal injection of dobutamine (1.5 µg/g BW) and measurements repeated. Quantitative ECG analysis was performed using EMKA Tech. software. RESULTS: At PN80 Undernutrition significantly (p < 0.05) reduced weight in the LUN (22.6±8.88g) and PUN (19.9±6.32g) but there was no difference between CON (25.0±9.96g) and EUN (25.2±8.61g). Similarly fat mass was reduced (p < 0.05) in all groups compared to controls (CON: 8.00±1.2g, EUN: 8.32±1.2g, LUN: 8.34±1.1g, PUN: 9.00±2.5g), however lean mass was only significantly reduced (p < 0.05) in the PUN group (CON: 17.79±9.02g, EUN: 17.78±9.03g, LUN: 17.34±0.33g, PUN: 15.85±0.28g). Heart weight when standardized to body surface area was only significantly (p < 0.05) reduced in the EUN group (1.001288±0.00031 kg/cm²) as compared to CON group (1.001405±0.00089 kg/cm²). With LUN (1.00135±0.0004 kg/cm²) and PUN (1.001342±0.0003 kg/cm²) not different from CON. ECG analysis showed that with dobutamine, EUN group had a 6.25% increase in 1st degree AV block and PUN group had a 43.75% increase in wide QRS complex. CONCLUSION: Thus, EUN reduces heart size with a predisposition for conduction delays to left ventricle but ischemia is primarily associated with prolonged undernourishment in postnatal life (PUN).
with BFR=6±2.6 bpm; P<0.001). Compared to baseline, the standard deviation of R-R intervals was lower during high-intensity handgrip without BFR (baseline=58±8, vs. 60% of BFR=4±4.6 ms, P=0.3). A similar finding was noted for root mean square of R-R standard deviations (P=0.01). The low and high frequency HRV components (markers of sympathetic and parasympathetic activity, respectively) were lower during exercise (P<0.05), but comparable across all handgrip bouts (P<0.05). CONCLUSIONS: These preliminary findings suggest that both low- and high-intensity handgrip exercise performed with BFR produces a comparable cardiac autonomic stress (i.e., parasympathetic withdrawal) as high-intensity handgrip exercise without BFR.

2567 Board #87  June 2 9:30 AM - 11:00 AM  Multi-layer Myocardial Mechanics In The Athlete’s Heart  Glenn Stewart1, Surendran Sabapathy2, Bryce Balmain3, Bruce Johnson4. 1Mayo Clinic, Rochester, MN. 2Griffith University, Gold Coast, Australia.  Email: stewart.glenn@mayo.edu  (No relationships reported)

Introduction: Endurance exercise training provokes numerous adaptive changes to the morphology, structure and function of the human heart that are chamber and region specific. Accordingly, regional non-uniformity of the human heart may play an important role in ventricular contraction and relaxation, and contribute to myocardial efficiency during exercise. Purpose: This study examined regional and transmural myocardial tissue deformation (strain) in a cohort of endurance trained (active >10/hr/ week) and untrained (active <2hr/week) men to characterise multi-layer myocardial tissue mechanics in the athlete’s heart. Methods: Echocardiography was used to measure biventricular strain in 12 endurance trained men (ET; Age: 27±4.1yr, BMI: 22.2±0.7m2, VO2peak: 4.4±0.3L·min⁻¹) and 12 healthy untrained men (UT; Age: 26.5±1.0yr, BMI: 22.6±0.8m2, VO2peak: 3.1±0.2L·min⁻¹). Results: Left ventricular global longitudinal strain (ET: -18.8±0.8% vs. UT: -18.5±0.5%) was similar in trained and untrained men, while right ventricular global longitudinal strain (ET: -18.3±0.8% vs. UT: -23.5±1.8%, P<0.01) was lower in trained men. Left ventricular transmural strain increased from the epicardium to the endocardium in trained (Epi: -16.6±0.4%; Mid: -18.4±0.3%; Endo: -21.0±0.5%, P<0.01) and untrained (Epi: -16.0±0.6%; Mid: -18.7±0.7%; Endo: -21.2±0.8%, P<0.01) men. Right ventricular transmural strain was similar across myocardial layers in untrained men (Epi: -23.2±1.7%; Mid: -23.4±1.8%; Endo: -21.8±1.8%), while right ventricular transmural strain increased from the epicardium to the endocardium in trained (Epi: -16.9±0.4%; Mid: -18.1±0.7%; Endo: -19.7±0.6%, P<0.01) in trained men. Conclusion: Functional non-uniformity is more pronounced in the left ventricle than the right ventricular free wall; however, right ventricular functional changes develop following endurance training. Differences in myocardial architecture and exercise-induced wall stress in the left and right ventricles are possible explanations for the marked functional non-uniformity throughout the myocardium, and in response to exercise training.

2568 Board #88  June 2 9:30 AM - 11:00 AM  Cardiac Autonomic Modulation and High Intensity Interval Training in Physically Inactive Men  Jamie M. O'Driscoll, Steven Wright, Katrina A. Taylor, Damian D. Coleman, Jim D. Wiles, Jim D. Wiles. 1Canterbury Christ Church University, Canterbury, United Kingdom.  Email: jamie.odriscoll@canterbury.ac.uk  (No relationships reported)

Purpose: Cardiac autonomic dysfunction and physical inactivity are associated with increased risk of cardiovascular disease. Short duration high intensity interval training (HIIT) has been shown to improve aerobic capacity; however, adaptations of the cardiac autonomic nervous system are less clear. Therefore, the aim of the present study was to assess cardiac autonomic adaptations to HIIT. Methods: In a randomised crossover controlled trial, 40 physically inactive males (21 ± 1.7 years; 179.9 ± 5.4 cm; 82.6 ± 11.5 kg; mean ± SD) completed 2-weeks of HIIT and a matched duration control period. The HIIT protocol consisted of 3 x 30-second maximal cycle ergometer sprints against a resistance of 7.5% body weight, interspersed with 1-minute of active recovery (50 rev∙min⁻¹ with no resistance). In total 6-sessions were performed. Cardiac autonomic function was measured pre and post-training and control period using a plethysmographic device (Task Force® Monitor). Total power spectral density (PSD) and associated low-frequency (LF) and high-frequency (HF) power spectral components were recorded in absolute (ms²) and normalised units (ms⁻¹). Results: Each participant completed 18-maximal cycle ergometer sprints over a 2-week period. The HIIT intervention produced an improvement in cardiac autonomic function with significant increases in total PSD (361.8±200.1 vs. 19.8±141, P<0.001), HF (ms²) (210.6±159.3 vs.156±86.9, P<0.001) and HF (ms⁻¹) (3.6±12.5 vs. 0.23±1.7, p<0.001), coupled with a significant decrease in LF (ms⁻¹) (3.6±12.5 vs. -0.23±1.7, p<0.001) and LF/HF ratio (-0.3±0.3 vs. 0.01±0.2, P<0.001) compared to the control period. There were no significant changes in LV mass. Conclusion: A short-term programme of HIIT was associated with a significant increase in cardiac autonomic modulation, demonstrated by a residual increase in cardiac vagal activity. Further research is required to establish whether these adaptations are sustained with regular HIIT training and any impact this may have on long-term cardiovascular disease risk.

2569 Board #89  June 2 9:30 AM - 11:00 AM  Post-exercise Heart-rate Recovery Correlates To Resting Parasympathetic Modulation In Apparently Healthy Men  Guilherme E. Molina1, Keila E. Fontana1, Giliard L. Garcia1, Carlos J. da Cruz2, Edgard M. K. V. Soares1, Luiz G. G. Porto1, Luiz F Junqueira Jr1. 1University of Brasilia -UnB, Brasilia, Brazil. 2UniEuro - University Center - Brasilia, Brasilia, Brazil.  (No relationships reported)

Post-exercise heart rate (HR) recovery (HRR) has recently been considered to be a powerful and independent predictor of risk for cardiovascular disease and mortality. The short-term post-exercise cardiovascular adaptation is associated to simultaneous rapid increase in parasympathetic and a progressive decrease in sympathetic activity However; the relationship between HHR and rest parasympathetic modulation is not yet fully understood. PURPOSE: We aimed to correlate HRR with resting parasympathetic status. METHODS: We evaluated 70 apparently healthy men, aged 27.5±6.3 years showing BMI 24.4±2.3 kg/m². All participants underwent a sub-maximal exercise testing (SET). At 85% of the maximal predicted HR, the recovery protocol started. The HRR was calculated as the absolute difference from the peak HR to the HR at the 1st min to 5th min during 5-min period of active recovery at 2.4km/h and 2.5% grade. HRR at the 1st min to 5th min following SET were correlated with 5 min time domain (pNN50 and rMSSD), frequency domain (HF and Poincaré Plot (SD1)) indices of heat rate variability (HRV) at rest in supine position. Due to non-normal distribution of variables (Shapiro-Wilk test) we used the Spearman correlation at the 5% level of significance. RESULTS: We observed positive correlation of HRR from the 1st to 5th min with parasympathetic indices in the supine position, as shown in Table 1. Table 01: Spearman correlation coefficients and p value (in parenthesis) of the correlation of heart rate recovery (HRR), at different post exercise times, with the parasympathetic indices in resting supine position, in 70 healthy men

<table>
<thead>
<tr>
<th>Variables</th>
<th>1st min</th>
<th>2nd min</th>
<th>3rd min</th>
<th>4th min</th>
<th>5th min</th>
</tr>
</thead>
<tbody>
<tr>
<td>pNN50 (%)</td>
<td>0.18 (0.05)</td>
<td>0.29 (&gt;0.01)</td>
<td>0.25 (&gt;0.01)</td>
<td>0.35 (&gt;0.01)</td>
<td>0.36 (&lt;0.01)</td>
</tr>
<tr>
<td>rMSSD (ms)</td>
<td>0.25 (0.01)</td>
<td>0.23 (0.02)</td>
<td>0.43 (&gt;0.01)</td>
<td>0.35 (&lt;0.01)</td>
<td>0.42 (&lt;0.01)</td>
</tr>
<tr>
<td>HF (%)</td>
<td>0.24 (0.02)</td>
<td>0.18 (0.05)</td>
<td>0.27 (0.01)</td>
<td>0.25 (0.01)</td>
<td>0.25 (0.01)</td>
</tr>
</tbody>
</table>

CONCLUSIONS: HRR from the 1st to 5th min post-exercise positive correlated with parasympathetic indices in resting supine position. Our results demonstrate that the highest is the tonic (resting supine) parasympathetic modulation, the greater is the decrease of HRR after SET in apparently healthy men.

2570 Board #90  June 2 9:30 AM - 11:00 AM  Long-term Intensive Exercise Induced Atrial Fibrosis Is Associated With Tgf-β1-Mir-21 Signaling Pathway  yun chung. chinag institute of sport science, beijing, China.  Email: changyun2518@vip.com  (No relationships reported)

PURPOSE: To explore the long-term intensive exercise induced atrial fibrosis relates to cardiac injury and TGF-β1/mir-21 Signaling Pathway and provides experimental evidence for determine the mechanism of exercise-induced atrial fibrillation. METHODS: SD rats were grouped to control group (C), moderate intensity group (M) and high intensity group (H) with 24 animals in each group. M and H group were conditioned to run for 4, 8, and 16 weeks, 5 days/weeks, 1h/day. Rats were euthanized to obtain hearts within 24h after exercise. Right atrial were collected. Plasm Ctnl was detected, hydroxyproline was measured by lkali hydrolysis method. TGF-β1 and miR-21 gene expression was evaluated by real-time PCR. TGF-β1 protein was quantified by Western Blot. RESULTS: Compared with control and M group, rats serum Ctnl increased at 8 weeks/12 weeks/16 weeks(P<0.01). Compared with C and M group, hydroxyproline content of H group showed significant increase at 12 weeks and 16 weeks(P<0.01).
Hydroxyproline of H group confirmed a gradual increase with training time, with significant increase from 8 weeks to 16weeks(P<0.05). TGF-β1 gene and protein expression of H group increased compared to their control group at 8/16/24 weeks. Compared with their controls, miR-21 expression of H group significantly decrease from 8 weeks to 16weeks(P<0.05).

CONCLUSIONS: Long-term intensive exercise induced sustained myocardial damage, resulted in sustained collagen increase which induced myocardial fibrosis. TGF-β1/miR-21 signaling pathway, upregulated by long-term intensive exercise, may involve in the pathology of intense exercise -induced myocardial damage and atrial fibrillation.

CONCLUSIONS: It appears that the time domain and supine position are more reliable than the frequency domain and sitting position, respectively. Frequency domain itself may be more reliable on the second day of testing.

PURPOSE: Obesity is linked to diastolic dysfunction and left atrial enlargement (LAE). The mechanisms responsible for LAE in obesity are unknown. We hypothesize that diastolic dysfunction, which is common in obesity, is the mechanism through which LAE occurs.

Methods: 37 middle-aged, obese patients (8M: 29F; 49±6years) with an average body mass index (BMI) of 38±5 kg/m² were compared to age and sex matched non-obese healthy controls. Diastolic function (IVRT; isovolumic relaxation time, Vp; propagation velocity) was assessed using echocardiography. Left atrium (LA) size was measured using 3D echocardiogram, and normalized to height to account for the effects of body size.

Results: Obese individuals had a significantly enlarged atrial volume when compared to healthy individuals (52.5 ± 31.2 vs. 23.1 ± 10.5 mL/m²; p<0.01). Obese patients had a significantly faster IVRT when compared to non-obese patients (68 ± 11 vs 100 ± 16 msec; p<0.01). Obese patients also had a significantly faster Vp when compared to non-obese patients (75 ± 19 vs. 56 ± 13 cm/sec; p<0.01). In obese subjects, there was a significant negative-relationship between LA volume index and IVRT (R²=0.27; p<0.05) as well as a significant positive-relationship between LA volume index and Vp (R²=0.18; p<0.05). (Figure 1)

Conclusions: Obese patients had larger LA and markers of elevated LA filling pressures (faster IVRT and Vp) compared to age matched controls. LAE in obesity may be driven by sub-clinical elevations in left atrial filling pressures.

**Figure 1**

LA volume and Diastolic Parameters (IVRT and Vp)

<table>
<thead>
<tr>
<th>LA Volume</th>
<th>IVRT (ms)</th>
<th>Vp (cm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>68 ± 11</td>
<td>75 ± 19</td>
</tr>
<tr>
<td>Normal</td>
<td>100 ± 16</td>
<td>56 ± 13</td>
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</table>

**PURPOSE:** The study purpose was to evaluate the test-retest reliability of our heart rate variability (HRV) assessment method in cancer survivors, and healthy-active and healthy-inactive females. The study also determined the impact on reliability of the body position and of the time compared to frequency domains. METHODS: Subjects were 25 females, 18 years or older. Testing was on two different days 2-7 days apart. Each day had exactly the same protocol. Participant started in the sitting or supine position (order randomized) and breathed in rhythm with a metronome (12 beats/min). Following 10 minutes of rest, ECG data were collected for 10 minutes. Blood pressure and then cardiac output (Q, by CO2 rebreathing) were then measured.

**RESULTS:** Long-term intensive exercise induced sustained myocardial damage, resulted in sustained collagen increase which induced myocardial fibrosis. TGF-β1/miR-21 signaling pathway, upregulated by long-term intensive exercise, may involve in the pathology of intense exercise -induced myocardial damage and atrial fibrillation.

Our classical understanding of heart rate kinetics is that a sympathovagal balance favouring parasympathetic tone at rest or during low level exercise contributes to a rapid heart rate adaptation (i.e. fast kinetics) during low level exercise transitions. Conversely, higher-level exercise transitions elicit slower heart rate kinetics, due in part to a sympathovagal shift to greater sympathetic tone. PURPOSE: To test the hypothesis that increasing sympathetic activity to the heart via muscle metaboreflex activation would slow heart rate kinetics during lower vs higher level exercise transitions. METHODS: Twelve healthy, active, and untrained adults (M² = 6/6; age = 22 ± 3 yrs; peak VO2 = 40 ± 3 ml/kg/min) performed square-wave moderate intensity exercise transitions in two equal step changes between 20W to 90% ventilatory threshold (VT). The first transition was in the low moderate domain (LMD: 20W to 55 ± 13 W) and the second transition in the high moderate domain (HMD: 55 ± 13 W to 90 ± 27 W). These transitions were performed without (control); LMD-CTL and HMD-CTL) and with muscle metaboreflex activation induced by 2 min of handgrip at 40% maximal voluntary contraction during the pre-transition baseline followed by 5 min of brachial occlusion (OCC) during either the LMD (LMD-OCC) or HMD (HMD-OCC) transition. Trials were randomized and three repetitions of each condition were completed, time-aligned, and averaged by condition. Heart rate kinetics were determined using mono-exponential curve fitting. Data was analysed with non-parametric tests. P < 0.05 was significant. RESULTS: Heart rate amplitude was lower during LMD-OCC vs LMD-CTL (15 ± 5 vs 17 ± 6 beats/min; P = 0.012) and the heart rate time constant, tau, was faster during LMD-OCC vs LMD-CTL (1.9 ± 26 vs 11 s; P = 0.01). Heart rate amplitude was not different between HMD-OCC vs HMD-CTL (19 ± 23 vs 16 ± 24; all P > 0.05). CONCLUSIONS: In contrast to our hypothesis, an increase in sympathetic activity induced by the muscle metaboreflex speeded heart rate kinetics during LMD but not HMD exercise transitions. Our data suggests that elevating sympathetic activity can speed heart rate kinetics to a certain point, beyond which heart rate kinetics via sympathetic activity may already be maximized.

**CONCLUSIONS:**

<table>
<thead>
<tr>
<th>Sit</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Supine</th>
<th>Day 1</th>
<th>Day 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDNN</td>
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<td>0.91</td>
<td>0.96</td>
<td>0.96</td>
<td>0.97</td>
</tr>
<tr>
<td>LF/HF</td>
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<td>0.65</td>
<td>0.86</td>
<td>0.88</td>
<td>0.74</td>
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<tr>
<td>HR min⁻¹</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
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<tr>
<td></td>
<td>73.5</td>
<td>14.5</td>
<td>75.6</td>
<td>18.1</td>
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<tr>
<td></td>
<td>12.8</td>
<td>14.2</td>
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</tr>
<tr>
<td>SV mL·b⁻¹</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
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<td>Mean</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**P**: 0.108 but significant (p < .001) position effect for HR and SV.
INTRODUCTION In heart failure with preserved ejection fraction (HFpEF), the underly ing systemic inflammatory state is related to myocardial stiffening. However, optimal treatment remains largely undefined.

PURPOSE: To investigate the effects of exercise training (ExT) on left ventricle (LV) stiffness in a rat model of HFpEF.

METHODS: The study was performed with nine-week-old ZSF1 obese rats (Ob n=20). At the 16th week, they were randomly divided in sedentary (ObSED, n=10) and exercised (ObEX, n=10; treadmill Ext during 4 weeks, 5 days/week, 60 min/day, at a speed of 20m/min). In the 18th week, all animals underwent echocardiographic evaluation. In the 20th week, animals were sacrificed and samples from heart and LV were collected for: i) histological analysis (cross-sectional area, CSA); collagen content; ii) passive tension analysis in skinned cardiomyocytes; iii) assessment of expression on matrix metalloproteinases (MMP-2,9) and its tissue inhibitors (TIMP-1 and 2) by western blot analysis and iv) zymography assessment of proteolytic activity.

RESULTS: Both groups presented preserved exercise fraction (f<0.70). ExT improved diastolic function evidenced by E/E' ratio (14,81±2,27 vs.16,53±1,47; p<0.05).

Moreover, in skinned cardiomyocytes, the ObEX showed decreased passive tension, which suggests a reduction in myocardial stiffness (p<0.05). No significant differences were observed between the groups in body mass, heart and LV weight, CSA, and MMPs and TIMPs expression and activity (p>0.05). However, the ratio collagen/muscle was significantly reduced in ObEX, compared to ObSED (0.08 vs. 0.12; p<0.05).

CONCLUSION: ExT improves diastolic function mainly due to the decrease in collagen deposition and diminished cardiomyocyte stiffness.

FUNDING: Grant from the European Commission FP7-Health-2010; MEDIA-261,409. CIAFEL is funded by European Regional Development Fund through the Operational Competitiveness Programme, and by FCT (UID/ MEDIA-261,409. CIAFEL is funded by European Regional Development Fund through the Operational Competitiveness Programme, and by FCT (UID/MED/00617/2013). Schmidt, C.: CAPES (BEX 0554/14-6). Moreira-Gonçalves, D.: FCT (SFRH/BPD/90010/2012).

2577 Board #97 June 2 9:30 AM - 11:00 AM Exercise Improves Diastolic Function In Hfpef By Reducing Intrinsic Cardiomyocyte Stiffness And Fibrosis

Cristine Schmidt1, João Coelho2, Rita Ferreira1, Nuno Paiva1, Inês Falcão-Pires2, André Lourenço3, Adelino Leite-Moreira4, José Oliveira2, Daniel Moreira-Gonçalves1. CFAEL, Faculty of Sports, University of Porto, Porto, Portugal. 1Faculty of Medicine, University of Porto, Porto, Portugal. 2University of Aveiro, Aveiro, Portugal.

Email: schmidtcristine@gmail.com

(No relationships reported)
white athletes. Despite the wide availability of ECG analysis, echocardiographic studies on young black and white athletes are lacking in literature. We aimed to assess the secondary LV remodelling to load training in young black players compared to matched white players. Methods: 77 young black soccer players (BP) and 53 white matched soccer players (WP) (mean age = 17.3±0.50 and 18.25±0.77 yo in BP and WP, respectively) were enrolled. The athletes, training with the same load and having the same lifestyle, were evaluated with echocardiography. 30 BP and 27 WP were followed up for 4 years end-stage at the first 3.90±0.50 yo in BP and WP, respectively). Contractile function was determined using speckle-tracking echocardiographic global longitudinal strain (GLS). Results: No significant differences in basal anthropometric parameters were found in both groups. BP showed higher level of LV remodelling, consisting in higher interventricular septum (IVS) and posterior wall (PW) thicknesses (IVS: 10.04±0.14 and 9.35±0.10 mm, p < 0.001; PW: 9.70±0.20 and 9.19±0.10 mm, p < 0.05; in BP and WP, respectively). A regular parallel increase in LV wall thickness and diameter, proportionally with body-size and LV mass, was observed in both groups during the follow-up period (IVS= 10.52±0.17 and 0.03±0.22 mm; p < 0.001; PW: 10.06±0.17 and 8.82±0.19 mm; p < 0.001; in BP and WP respectively). Conclusion: LV remodelling in BP seems to be a specific and normal phenotype already present in pre-adolescent period, suggesting the central role that ethnicity plays in it since the first years of life in elite athletes and the need for echocardiographic specific ethnic criteria.

2579 Board #99 June 2 9:30 AM - 11:00 AM
Effects Of Endurance Exercise Training On Doxorubicin-induced Changes In Cardiac Insulin-like Growth Factor-1 Expression
Nicole R. Wood, Reid Hayward, David S. Hydock. University of Northern Colorado, Greeley, CO.
Email: nicole.wood@unc.edu

(Doxorubicin (DOX) is a highly effective chemotherapeutic agent used in the treatment of cancer; however, its clinical use is limited due to a dose-dependent cardiotoxic side-effect. Insulin-like growth factor-1 (IGF-1) signaling regulates contractility, metabolism, hypertrophy, apoptosis, and many other process related to optimal cardiac function. DOX treatment has been shown to decrease IGF-1 expression and down-regulate other markers in the IGF-1 signaling pathway. Although exercise training has been shown to mitigate the cardiotoxic side-effects of DOX, it is unclear whether exercise may mediate its effects via IGF-1 expression. PURPOSE: The purpose of this study was to examine the effects of endurance exercise on DOX-induced changes in cardiac IGF-1 expression. METHODS: Male Sprague-Dawley rats (n = 12) were randomly assigned to either sedentary (SED) or treadmill (TM) exercise groups. The TM protocol included 10 weeks of running, 5 days/week, with progressive intensities in intensity and duration on a motorized treadmill, while SED animals were limited to normal cage activity for 10 weeks. Following the 10-week treatment period, animals were further randomized to receive saline (SAL) or a 12.5 mg/kg bolus dose of DOX. Cardiac IGF-1 was quantified in all hearts three days following injection. RESULTS: Cardiac IGF-1 expression decreased 22% in the SED/DOX group when compared to SED/SAL (Cohen’s d = 0.774). Results also indicate a 22% increase in IGF-1 expression in the TM/SAL group when compared to the SED/SAL (Cohen’s d = 0.022, p = 0.1; in BP and WP respectively). A regular parallel increase in LV wall thickness and diameter, proportionally with body-size and LV mass, was observed in both groups during the follow-up period (IVS= 10.52±0.17 and 9.03±0.22 mm; p < 0.001; PW: 10.06±0.17 and 8.82±0.19 mm; p < 0.001; in BP and WP respectively). Conclusion: LV remodelling in BP seems to be a specific and normal phenotype already present in pre-adolescent period, suggesting the central role that ethnicity plays in it since the first years of life in elite athletes and the need for echocardiographic specific ethnic criteria.

2050 Board #100 June 2 9:30 AM - 11:00 AM
Effect of Cardiac Resynchronization Therapy on Arterial-Ventricular Coupling during Exercise in Heart Failure with Reduced Ejection Fraction
Corey R. Tomczak1, Mark J. Haykowsky2, Ian Paterson1.
1University of Saskatchewan, Saskatoon, SK, Canada. 2University of Alberta at Arlington, Arlington, TX. University of Alberta, Edmonton, AB, Canada.
Email: corey.tomczak@usask.ca

Exercise intolerance in heart failure with reduced ejection fraction (HFrEF) is mediated, in part, by an impairment in arterial-ventricular coupling. Cardiac resynchronization therapy (CRT) improves resting and paced arterial-ventricular coupling. The effect of chronic CRT on arterial-ventricular coupling during exercise in HFrEF has not been studied. PURPOSE: To study the effects of 6 months of CRT on arterial-ventricular coupling during exercise in patients with HFrEF. METHODS: Seven patients with HFrEF (EF < 40%; 5 M, 2 F; NYHA II/IV = 6/1; EF = 18±3%; peak VO2 = 12.5±3.6 ml/kg/min) were studied pre-CRT and 6 months following (post-CRT). After resting measurements, subjects performed cycle ergometry at 22 ± 8 W (70 ± 13% of peak VO2) for 4 min. Left ventricular volumes were determined using contrast enhanced echocardiography. Blood pressure was measured manually at the brachium. End-systolic pressure (ESP) was approximated as 0.9 x systolic blood pressure. Effective arterial elastance (Ea) was calculated as ESP/stroke volume and end-systolic elastance (Ees) was calculated as ESP/end-systolic volume. Arterial-ventricular coupling was calculated as Ea/Ees. Comparisons were made with a 2 (rest, exercise) × 2 (pre-CRT, post-CRT) repeated measures factorial ANOVA and t-tests. Data are mean ± SD and P < 0.05 was significant. RESULTS: There was a main effect of CRT on Ea, where the pre-CRT Ea increased 0.28±0.45 mmHg/mL during exercise and the post-CRT Ea decreased 0.12±0.25 mmHg/mL (P < 0.05). There was no main effect of CRT on Ees, as both the pre-CRT (0.04±0.03 mmHg/mL) and post-CRT (0.08±0.04 mmHg/mL) increase in Ees from rest to exercise was not significant (P > 0.05). However, resting and exercise Ees tended to be higher post-CRT. Lastly, there was a main effect of CRT on Ea/Ees, where Ea/Ees increased 1.35±0.35 mmHg/mL from rest to exercise pre-CRT and Ea/Ees decreased 0.69±0.35 mmHg/mL from rest to exercise post-CRT (P < 0.05). CONCLUSION: The improvement in arterial-ventricular coupling during exercise following chronic CRT in HFrEF can be attributed to improvements in arterial loading on the left ventricle, as contractility changes related to CRT were modest.

E-29 Free Communication/Poster - Children-Exercise Responses
Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2581 Board #101 June 2 11:00 AM - 12:30 PM
Predictive Formulas To Improve The Interpretation Of Cardiorespiratory Fitness In Children
Joël Blanchard1, Samuel Blais2, Philippe Chetaille1, Michele Bisson2, François-Pierre Counil1, Thelma Huard-Girard1, Jade Berbari2, Pierre Boulay2, Frederic Dallaire2. University of Sherbrooke, Sherbrooke, QC, Canada. 1Laval University, Quebec, QC, Canada.
Email: joel.blanchard@usherbrooke.ca

(Adequate reference values for cardiopulmonary exercise testing (CPET) is crucial for accurate interpretation and prognostic purposes for children with a chronic disease. Current reference values in healthy children have been developed using heterogeneous exercise protocols and often incorrect adjustment for body size. PURPOSE: To update current reference values from CPET and provide new reference values for several parameters previously unstudied in children using a prospectively recruited cohort of healthy children. METHODS: In this cross-sectional multicenter study, we prospectively recruited 269 healthy children (7-117; 172) between the ages of 12-17 years old (14.8±1.5) in local schools. We measured height, weight, waist circumference, pubertal development and fat free mass (FFM) and performed a symptom-limited CPET (Vmax Encore Metabolic Cart, Sensormedic, San Diego, CA) on an electronically-braked ergocycle using a progressive ramp protocol. Reference values and Z score were computed by testing several regressions models for each CPET measurement. Variation around the predicted mean was modeled to account for heteroscedasticity and residual association with growth-related parameters was assessed. RESULTS: Using currently published reference values, up to 31.2% of children were classified as having abnormal CPET results despite being free of chronic disease. Our weighted non-linear parametric modeling allowed more precise and well-adjusted Z scores and percentile values. The table shows a selection of our predicting equations as well as the percentage of children below the 3rd percentile. Selection of prediction equations for males

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Equation</th>
<th>Reference 95% CI</th>
<th>Z score equation</th>
<th>Percentage below 3rd percentile</th>
<th>% of children below the 3rd percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak VO2</td>
<td>Z score equation = (−3.86 ± 0.13) × Peak VO2 + (4.00 ± 0.14) × Peak VO2 + (3.20 ± 0.14)</td>
<td>-3.86 ± 0.13</td>
<td>5.6%</td>
<td>5.6%</td>
<td></td>
</tr>
<tr>
<td>Peak O2 pulse</td>
<td>Z score equation = 0.08 × Peak O2 pulse + 0.01 × O2 pulse + 0.06</td>
<td>0.08 ± 0.01</td>
<td>6.7%</td>
<td>6.7%</td>
<td></td>
</tr>
<tr>
<td>O2 pulse</td>
<td>Z score equation = 0.05 × O2 pulse + 0.01 × O2 pulse + 0.06</td>
<td>0.05 ± 0.01</td>
<td>6.7%</td>
<td>6.7%</td>
<td></td>
</tr>
<tr>
<td>VE/VCO2 slope</td>
<td>Z score equation = 0.00 × VE/VCO2 slope + 0.06 × VE/VCO2 slope + 0.14</td>
<td>0.00 ± 0.06</td>
<td>6.7%</td>
<td>6.7%</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSION: The use of weighted non-linear regression model resulted in a decreased false-positive rate. These updated and new reference values provide an accurate lower limit of normal thus improving their value for prognostic and risk stratification in children with chronic diseases.

Abstracts were prepared by the authors and printed as submitted.

FRIDAY, JUNE 2, 2017

S545
Children after the Fontan operation have reduced heart rate variability (HRV) and altered blood pressure control, consistent with autonomic dysfunction. We tested the hypothesis that increasing sympathetic nerve activity via the muscle metaboreflex may improve post exercise blood pressure responses in children after the Fontan operation. PURPOSE: To determine resting HRV and the mean arterial pressure (MAP) response to post-handgrip exercise muscle metaboreflex activation in children after the Fontan operation compared to age- and sex-matched healthy controls. METHODS: Five children after the Fontan operation and 10 controls (12 ± 2 yrs) underwent resting electrocardiography and continuous finger arterial plethysmography. Children then completed 2 min of isometric handgrip exercise at 30% of maximal voluntary contraction, followed in random order by either (1) 3 min of rest with no occlusion or (2) min of brachial cuff occlusion to produce post exercise ischemia and increased sympathetic nerve activity via the muscle metaboreflex. Post-handgrip MAP changes were calculated as the 1 min average value after 3 min of recovery minus the pre-handgrip resting 1 min average value. Comparisons were made using unpaired t-tests. RESULTS: MAP changes were lower in children after the Fontan operation vs. controls (78 ± 14 vs. 67 ± 5 beats/min; P = 0.041). HRV spectral analyses were similar in the low frequency domain (24 ± 10 vs. 22 ± 13%; P < 0.05) but increased in the high frequency domain (23 ± 15 ± 52 ± 16%; P = 0.005) and low/high frequency domain ratio (1.5 ± 1.3 vs. 0.6 ± 0.4; P = 0.046) for children after the Fontan operation vs. controls, indicating autonomic dysfunction. Following isometric handgrip exercise with no occlusion, the change in heart rate (2.5 ± 5 vs. -3.5 ± 5 beats/min; P = 0.66) was similar, but children after the Fontan operation had greater lowering in MAP (-5 ± 1 vs. -0.5 mmHg; P = 0.024) vs. controls. With brachial occlusion, changes in heart rate (0 ± 5 vs. -1 ± 6 beats/min; P = 0.701) and MAP (6 ± 7 mmHg; P = 0.980) were similar between children after the Fontan operation vs. controls. CONCLUSION: Our findings suggest that increasing sympathetic nerve activity via the muscle metaboreflex helps to improve post exercise blood pressure responses in children after the Fontan operation.

CARDIOVASCULAR PERFORMANCE AND ADAPTATIONS IN CHILDREN AFTER THE FONTAN OPERATION

2584 Board #104 June 2 11:00 AM - 12:30 PM Relationship between Self-Reported Physical Activity Levels and Exercise Capacity in Pediatric Fontan Patients
Kelli Teson, David White, Jessica Hall, Suma Goudar. The Children’s Mercy Hospital, Kansas City, MO. Email: kmteson@cmnh.edu (No relationships reported)

Cardiopulmonary exercise testing is routine in the care of children with cardiac disease. Those with single ventricle physiology after Fontan completion have limitations in cardiac function and exercise tolerance. Hemodynamic adaptations may be affected following surgery, and it is unclear if this alters the relationship between leisure time physical activity (PA) and peak oxygen consumption (VO2). PURPOSE: To examine the relationship between self-reported leisure time PA and peak VO2 in pediatric Fontan patients. METHODS: Twenty-six youth with Fontan physiology (age 14.2±2.1 yrs, male 57%) underwent routine cardiopulmonary exercise testing. Peak VO2 (ml/kg/min), respiratory exchange ratio (RER), VE/VO2 slope, oxygen pulse (ml/beat), and maximal heart rate (bpm) were measured. Subjects exercised to volitional fatigue on a cycle ergometer using the Modified James protocol. Subjects were excluded if RER at peak VO2 was <1.0. Self-reported leisure time PA was assessed using the interview administered Modifiable Activity Questionnaire for Adolescents (MAQ-A). Relationships were assessed using Pearson partial correlations and nonparametric Kruskal-Wallis tests. RESULTS: Significant positive relationships were found between VO2 peak (24.44 ± 5.8 ml/kg/min) and self-reported hours per week of PA (r=0.534, p<0.05) and MET hours per week of PA (1.36 ± 1.15 hrs) (r=0.481, p<0.05) and MET hours per week of PA (7.11 ± 6.60 MET hrs) (r=0.481, p<0.05) and MET hours per week of PA (7.11 ± 6.60 MET hrs) (r=0.481, p<0.05) and MET hours per week of PA (7.11 ± 6.60 MET hrs) (r=0.481, p<0.05). Days per week of light exercise was associated with VE/VO2 slope (X2=9.97, p=0.005) and O2 pulse (X2=12.9, p<0.005). CONCLUSIONS: Greater self-reported hours per week and MET hours per week of leisure time PA were associated with higher peak VO2 and lower VE/VO2 slopes. Despite the hemodynamic compromises in single ventricle Fontan physiology, routine leisure-time PA appears to have a beneficial effect on both aerobic capacity and ventilatory efficiency, thus improving their prognosis in cardiac mortality risk.

2585 Board #105 June 2 11:00 AM - 12:30 PM Adolescent Children Born Preterm Have An Inhibited Stroke Volume And Cardiac Output Response To Exercise
Kristin Haraldsdottir, Andrew Watson, Arij Beshish, Laura Tetti, Kara Goss, Mari Paltta, Marlowe Eldridge. University of Wisconsin, Madison, WI. Email: haraldsdottir@wisc.edu (No relationships reported)

Purpose: Young adults born preterm exhibit lower ejection fractions and higher right ventricular mass but little is known about the consequences of premature birth on cardiac performance during exercise, particularly in children. The aim of the present
study was to compare the cardiac response to maximal exercise between adolescent children born preterm and age-matched controls. Methods: Seven children born preterm (PT) (age 12-13, birthweight <1500 g, gestational age 24-31 weeks) and 6 age-matched children born full term (CT) (gestational age 38-40 weeks) underwent progressive maximal exercise testing on a cycle ergometer, with continuous measurement of O2 consumption (ml/kg/min), and cardiac output (Q), stroke volume (SV) and heart rate (HR) using thoracic bioimpedance. SV and Q were indexed to body surface area (BSA (m2), SVi and Qi, respectively). HR was recorded for two minutes following exercise, and HR recovery (HRR) was calculated as decrease in HR at 2 minutes after maximal exercise. Statistical analysis was done using multiple t-tests. Results: PT had lower relative maximal oxygen consumption (VO2peak) compared to CT (38.3 ± 9.3 vs 51.5 ± 7.3 %/min/kg, p=0.003). PT decreased in VO2 from rest to maximal exercise (51.7 ± 9.0 to 53.3 ± 8.2 %/min/kg, p=0.77), while SV increased significantly in CT (47.4 ± 4.0 to 67.7 ± 14.4 ml/m2/min/kg, p=0.01). The change in SV from rest to maximal exercise was significantly smaller in PT compared to CT (1.6 ± 6.5 vs 20.3 ± 17.0 ml/m2/min/kg, p=0.04). The increase in Q from rest to exercise was also significantly smaller in PT than CT (5.6 ± 1.1 vs 9.0 ± 2.6 L/min/m2, p=0.02). There was no difference in resting or maximal HR between the groups (p=0.05 for all). HRR2min was lower in PT than CT (54 ± 64 beats, p=0.01). Maximal arterio-venous O2 difference was not different in PT compared to CT (13.2 ± 6.5 vs 13.2 ± 2.3 ml/dL, p=0.98). Conclusion: Adolescent children born preterm exhibit lower maximal aerobic capacity and significantly smaller maximal SVi and Qi than age-matched controls. PTs also demonstrated slower HRR after maximal exercise. This data suggests that PTs may not be able to increase SV in response to increasing metabolic demand, and this may reduce their ability to exercise at higher intensities. National Institutes of Health: 1R01 HL086897 (ME) and R01 HL38149 (MP), and UW CVRC T32. HL 07936 (KH).

METHODS: Altogether 448 children (214 girls) aged 6-8 years participated in the study. We assessed fat mass (FM), percent body fat (%BF) and LM by dual-energy X-ray absorptiometry, and Wmax by incremental cycle ergometer exercise test. Absolute and by body weight, FM and LM scaled Wmax were used in the analysis. We used age and sex-specific criteria (Ahrens et al. Int J Obes, 2014;38:S4-S14) to define dyslipidemia (elevated triglycerides or high density lipoprotein cholesterol), elevated blood pressure and elevated insulin resistance (HOMA-IR), and 90th percentile for cardiometabolic risk score (CMS). We used area under the curve (AUC) by receiver operating characteristics to investigate the accuracy of the measures of cardiopulmonary fitness and adiposity to discriminate elevated cardiometabolic risk, and the Youden index to assess the thresholds discriminating elevated CMS.

RESULTS: In boys, %BF and Wmax/FM were able to discriminate CMS (AUC 0.86, p<0.001), HOMA-IR (AUC 0.79-0.80, P<0.001), elevated blood pressure (AUC 0.73- 0.74, P<0.001), and dyslipidemia (AUC 0.64, P<0.05). While Wmax/body weight had AUC 0.82 (P<0.001) for CMS, and AUC 0.71 (P<0.001) for HOMA-IR and AUC 0.64 (P<0.05) for elevated blood pressure, Wmax/LM had AUC 0.65 (P<0.05) for CMS and the absolute Wmax had AUCs >0.6. In girls, %BF, Wmax/FM and Wmax/body weight were able to discriminate CMS (AUC 0.75-0.78, P<0.001) and HOMA-IR (AUC 0.69- 0.71, P<0.001). Proposed thresholds in girls and in boys were 2.3 and 2.6 W/kg of body weight (sensitivity 67 and 64%; specificity 80 and 85%); and 3.9 W/kg of LM in boys (sensitivity 82%; specificity 45%).

CONCLUSIONS: Measures representing adiposity (%BF, Wmax/FM, Wmax/body weight) were the best discriminators for cardiometabolic risk, and Wmax/LM showed ability to discriminate elevated CMS only in boys.

High-intensity interval training (HIIT) is superior compared to moderate-intensity continuous training for improving anaerobic fitness, agility and aerobic fitness. However, for children and adolescents with a chronic disease or condition the effects of HIIT as a training modality is relatively unknown. PURPOSE: To investigate the effect of eight weeks of HIIT on physical fitness in children and adolescents with a chronic disease or condition who 1) are able to run, 2) walk independently but are not able to run, and 3) propel a manual wheelchair. METHODS: A total of 68 children and adolescents were recruited from schools for special education in the Netherlands (mean age 13±2.8, range 8-19 years, 56% boys). They had various chronic diseases; cerebral palsy (41%), spina bifida (18%), other neuromuscular diseases (34%), musculoskeletal (4%), cardiovascular (4%) and metabolic diseases (9%). The sample consisted of 35 runners, 24 independent walkers, and 9 wheelchair users. All subjects performed HIT twice a week for 45 minutes. Every session consisted of 8-12 intervals containing a 30 seconds all-out exercise followed by 90 or 120 seconds of active recovery. Anaerobic fitness was measured by the Muscle Power Sprint Test (MPST), agility with the 10x5 meter sprint test and a shuttle run/ride test (SRT) was performed to determine aerobic performance (shuttles) and aerobic capacity (VO2peak). RESULTS: Exercise attendance was 85%. A significant improvement in respectively mean and peak power on the MPST was only found for children and adolescents who are able to run (p=0.043; p=0.028). Both agility and aerobic performance on the SRT showed a significant training effect in all groups; runners (p<0.001; p<0.001), independent walkers (p=0.024; p=0.006) and wheelchair users (p=0.024; p=0.012). However, VO2peak (ml/kg/min) did not change significantly in all groups of functional mobility. CONCLUSION: HIT is feasible in children and adolescents independent of mode of mobility. Agility and aerobic performance, both parameters containing motor-skills, improved. However, since anaerobic fitness improved only in children and adolescents who are able to run, the 30s all-out HIT principle is probably not applicable for independent walkers and wheelchair users. Future studies about HIT protocols to improve VO2peak as well are warranted.
Physical activity is a key modulator for arterial health and greater arterial stiffness increases mortality risk. Children with congenital heart disease (CHD) are often less physically active compared to healthy children and this may predispose them to greater arterial stiffness. PURPOSE: To explore the relationships of body composition, aerobic fitness and physical activity levels with arterial stiffness in healthy African-American children. METHODS: Nineteen children with CHD and healthy age- and sex-matched controls (n=12/10; age 11 ± 3 years) were studied. Carotid-radial pulse-wave velocity (PWV) was assessed with application tonometry (foot-to-foot method) to determine arterial stiffness. Average daily minutes of moderate-to-vigorous physical activity (MVPA) was assessed by 7-days of accelerometry. Total lean body mass (LBM) was measured by BIA. RESULTS: There was a significant correlation of LBM with PWV in all participants pooled (r = 0.536, P < 0.001) and in controls only (r = 0.686, P < 0.001), but not in CHD only. There was no significant correlation of 6MWT or MVPA with PWV in pooled analyses or when split into CHD and control groups. When split by physical activity level, in the high MVPA group, LBM significantly predicted PWV (R² = 0.224, P = 0.03), and in the low MVPA group, LBM and 6MWT distance significantly predicted PWV (R² = 0.571, P = 0.001). CONCLUSIONS: In children with CHD and healthy controls, body composition predicts arterial stiffness independent of physical activity levels. Aerobic fitness further predicts arterial stiffness only in children with low physical activity levels. Aerobic fitness and physical activity are key modulators for arterial health in less physically active children, independent of health status.

Purpose: To compare heart rate (HR) and oxygen uptake (VO₂) among ACSM recommended intensities for obese adolescents (70% of maximum heart rate - HRmax, 60% of maximum oxygen uptake - VO₂max) and ventilatory threshold (1VT). METHODS: One-hundred and twenty-seven obese adolescents (age=15.2±1.5 yrs.; BMI=34.6±3.9 kg/m²; Fat mass=48.8±5.3%;) performed an incremental treadmill test. The initial load was set at 3 km/h (3 minutes) and increased 1 km/h each minute until exhaustion, while the grade was kept constant at 1%. VO₂ was measured directly in an open circuit respiratory metabolic system (Quark, PFT, Cosmed, Italy). VT was determined by visual inspection using Wasserman’s criteria by two independent researchers. ANCOVA adjusted for gender, age and fat percentage was used to compare HR and VO₂ among the three intensities (70%HRmax, 60%VO₂max and VT), with Tukey test for post-hoc comparisons.

Results: HR at VT was achieved at 67% ± 9% of VO₂ max (ranging from 45 to 93%). HR at VT was higher than HR at 60% VO₂ max and 70%HRmax (p<0.05). HR at 60%VO₂ max was higher than at 70%HRmax (p<0.05). VO₂ was also higher at VT compared to 70%HRmax (p=0.05), with no differences in further comparisons (p>0.05) (Figure 1). Conclusion: In obese adolescents, an aerobic exercise prescription based on ACSM recommendations requires lower cardiorespiratory effort than VT intensity. The exercise prescription at 60%VO₂ max induces higher cardiorespiratory stimulus than at 70%HRmax.
PURPOSE: To investigate physiological and anthropometric characteristics of elite US college rugby union players (ECP). METHODS: Thirty-six elite US college rugby union players (20 forwards, 16 backs) were measured for height (cm), body mass (kg), percentage of body fat (3 sites), muscular power (vertical jump, power clean), speed (10m and 40m sprint), strength (back squat, bench press) and maximal aerobic power (Yo-Yo test). RESULTS: Forwards were significantly taller (183.8±6.0cm vs. 176.8±4.9cm) and more massive (110±13.9kg vs. 86.4±8.1kg), had higher percent body fat (p<0.01), more muscular power (vertical jump, power clean), speed (10m and 40m sprint), and maximal aerobic power (Yo-Yo test). These findings suggest that position specific training is effective in ECP. A greater importance should be placed on developing ECP's aerobic power and enhancing anthropometric characteristics to aid success in the future at higher competitive levels of rugby union. CONCLUSION: Certain physiological characteristics (muscular strength & power) of ECP are of the same level when compared to other competitive rugby union players. While strength and conditioning training can improve athlete skills and physical attributes, little is known on how effective an interdisciplinary approach can be when focused on additional factors (medical, psychological, nutrition) shown to influence such variables. PURPOSE: to evaluate the effectiveness of an interdisciplinary athlete development program for improving skills and physical attributes related to the NFL combine. METHODS: Retrospective review (2008-2016) of 108 elite level football athletes that completed the St. Vincent Sports Performance NFL Pre-Draft Program. Results: health and fitness professionals created 6-week individualized training programs based on 4 disciplines: 1) Physical Training (strength, speed, position skills), 2) Medical (diagnostic, treatment, corrective exercises), 3) Nutrition (dietary analysis, meals), and 4) Psychological (mental preparation, composure). Anthropometric and skill measurements for strength, power, speed, and agility were obtained pre- and post-program. Paired t-test (p<0.05) was used to assess pre to post differences for all athletes and for subgroups of position demands (speed, hybrid, power). Independent t-test was used to compare both pre- and post-program to NFL combine averages. RESULTS: All variables significantly improved pre- to post-program (Table 1), which moved our athletes from worse than combine averages at pre-program, to the same or better at post. Subgroup outcomes showed the same general pattern of improvements, except for fat weight where hybrid (tight end, quarterback, linebacker) showed significant change (38.4 to 36.8 lbs, p<0.03). CONCLUSION: While our athletes were of elite status pre-program, this little room for gains, all outcomes improved post-program and were the same or better than the NFL combine averages. This was likely due to the interdisciplinary approach focused on the total athlete. Future studies should assess how such gains translate to performance.

Table 1. Pre- and post-program outcomes and NFL Combine averages for anthropometrics (percent body fat, fat weight, lean weight) and skill tests for bench press (maximum repetitions of 225 lbs), vertical and broad jumps, and linear and multidirectional speed.

<table>
<thead>
<tr>
<th>Weight (lb)**</th>
<th>% Body Fat</th>
<th>Fat Weight (lb)**</th>
<th>Lean Weight (lb)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>230.3††</td>
<td>18.1% (7.9%)</td>
<td>40.8 (25.6)</td>
</tr>
<tr>
<td>Combine</td>
<td>243.8 (4.4)</td>
<td>15.5% (7.9%)</td>
<td>39.9 (25.3)</td>
</tr>
</tbody>
</table>

The critical speed (CS) concept helps characterize the aerobic and anaerobic fitness of an athlete. Rugby players should hypothetically have modest CS values but extremely high curvature constant (D') values, yet, normative data are unavailable. PURPOSE: To gather normative data of CS and D' on high-level male rugby athletes. METHODS: A total of 30 male rugby players were recruited from the Eastern Cape of South Africa. All subjects performed the running 3-min all-out exercise test (3 MT) using global positioning system (GPS) technology to determine CS and D'. The GPS data were used to determine the total distance and velocities performed, and to examine for pacing effects. Summary statistics of mean ± SD are provided. RESULTS: High total running speeds for the initial 150 s (V150 = 5.79 ± 0.59 m/s) and total distance (3 MT distance = 871.5 ± 71.9 m) were observed. A total of 13 of 30 subjects surpassed the 300 m D’ value (mean D’ = 288.2 ± 49.1 m). The CS of the total group was 3.87 ± 0.55 m/s. Skewness of CS and D’ was observed between forwards and backs, therefore between-group differences in neither CS nor D’ were observed (p > 0.05). CONCLUSION: Comparisons with previous literature indicate male rugby players have higher CS values than female rugby players. Using referent data on male Olympic distance runners, male rugby players have markedly higher CS’ values and markedly lower CS values. Feature utility of the CS concept is anticipated as we begin to understand norms for CS and D’ of different athletes and different running conditions (e.g., load carriage, shuttle running).
PERSPECTIVES IN MEDICINE & SCIENCE IN SPORTS & EXERCISE®

A Comparative Study of Shoulder ROM, Proprioception and Balance Ability between General People and Pro Golfers

Deuk-Su Park, Moo-Yeop Ji, Shun-Zhe Piao, Da-Woon Park, Dong-Woo Kim, Tae-Yeon Kim, Hyoeng-Jun Park, Jae-Keun Oh. Korea National Sport University, Seoul, Korea, Republic of. (No relationships reported)

PURPOSE: The purpose of this study is to identify the differences of shoulder range of motion, proprioception and balance ability between general peoples (28.1 ± 3 yrs, n = 9) and pro golfers (members of Korea Professional Golfers’ Association, 26.4 ± 4 yrs, n = 9).

METHODS: Data of the results was analyzed by using the SPSS/PC Window version 21.0 statistics program. To verify differences between the groups, Independent T-test was conducted. All the statistical significance level was set at α = 0.05.

RESULTS: 1. In shoulder range of motion (ROM), pro golfers group showed higher shoulder range of motion in flexion, abduction, internal rotation than the general people, but there was no significant difference. Pro golfers group showed significant higher range of motion than general people in external rotation (p<0.05).

2. In shoulder passive joint position sense (PJPS) test, there was no significant difference between the groups, but in shoulder active joint position sense (AJPS) test, pro golfers group showed significant low error angle than general people (p<0.05).

CONCLUSION: As a result of this study, pro golfers were identified that they have higher shoulder ROM in external rotation and they were showed a low error angle of AJPS than general people. This results might come from the superior motor ability of the pro golfers, however to improve athletic performance and prevent injury & rehabilitation, exercises to improve shoulder range of motion and proprioceptive sense should be included.

Comparison of Agility and Approach Jump in Elite Sand and Indoor Collegiate Volleyball Athletes

Morgan H. Kocher, Heather C. Boyan, Matthew E. Niesen, Ronald K. Hetzler, FACSM. University of Hawaii at Manoa, Honolulu, HI. (Sponsor: Ronald Hetzler, FACSM) (No relationships reported)

The differences between sand and indoor volleyball courts can affect an athlete’s performance, most notably jumping and agility performance. Maximal jumps have been reported to be lower when performed on sand compared to rigid surfaces similar to a wood-flooring court. PURPOSE: To examine the performance of elite female sand and indoor collegiate volleyball players in agility and approach jump testing in sand and on an indoor surface; including heart rates and ratings of perceived exertion. METHODS: Participants (n=21, age 19.8±1.1yrs, height 1.78±0.08m, body mass 73.62±9.63kg) were members of NCAA Division I women’s indoor and sand volleyball teams who finished their seasons ranked in the top 8 nationally. Two thirty minute sessions (one sand, one indoor) were completed for each test and the outcome measures were the participant’s time for both approach jump (cm) and agility time (sec), as well as their ratings of perceived exertion (RPE) and heart rate recovery (HRR) following agility testing. RESULTS: There was a significant difference between surfaces for both approach jump (57.57±7.26cm vs. 51.03±5.47cm sand, mean difference 6.52±4.3cm, p=0.001) and agility times (6.65±0.52sec indoor vs. 6.90±0.68sec sand, mean difference 0.25±0.46sec, p=0.021), but not in HRR (36.4±10.2bpm indoor vs. 36.3±9.9bpm sand, p=0.05), peak HR (139.5±12.1bpm indoor vs. 142.3±11.9bpm sand, p=0.05), and RPE (9.6±2.1 indoor vs. 9.4±2.2 sand, p=0.05). There were no significant differences in approach jump or agility time for athletes who competed in sand, indoor, or both (p>0.05 for all), although the difference in RPE trended towards significance (p=0.082). Although not significant, sand athletes and hybrid (compete in sand and indoor) athletes consistently performed better than indoor athletes on both surfaces (mean difference 0.593±0.238 sec and 0.553±0.79 sec, respectively). CONCLUSIONS: Significant differences exist between sand and indoor surfaces when performing approach jump and agility drills, but not between sand and indoor volleyball athletes.

2598 Salivary Cortisol Responses After A Women’s Basketball Match In Elite Athletes

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Cortisol can negatively affect athletic performance, potentially causing fatigue and inflammation, and high levels of this hormone have been associated with impaired performance in elite athletes. Monitoring hormones in saliva has distinct advantages over doing it in other biological fluids. However, little is known about the salivary cortisol responses in female athlete and particularly after a basketball match.

PURPOSE: The purpose of this study was to examine the salivary cortisol responses in elite female athletes after a women’s basketball final match. METHODS: Fifteen elite female basketball players participated in the study. Unstimulated mixed saliva samples were collected in saline swabs before and immediately after the basketball match. Specifically, the swab was placed in the mouth for one minute, then it was transferred into plastic tubes, centrifuged and the resulted saliva sample was analyzed. Saliva samples were assayed in duplicate using a commercially available ELISA kit for cortisol. Differences between the cortisol levels before and after the match were analyzed using student’s T-test, while Pearson correlation coefficient (r) was used to reveal potential relationship between post-match cortisol levels and participation time in the match. RESULTS: Salivary cortisol levels were significantly higher after the completion of the basketball match compared to the baseline levels (2425.6±1927.6 pg/ml vs. 1014.5±548.8 pg/ml, p<0.005). No significant correlation was revealed between the participation time (in minutes) of the elite basketball players and their salivary cortisol levels (r=0.22, p>0.05). CONCLUSIONS: The findings of the present study suggest that monitoring cortisol in saliva can be a useful, non-invasive and sensitive method to assess this hormonal response in female athletes after a basketball match. The increased cortisol levels appear not to be associated with the total participation time of the elite basketball players. However, the possible negative effects of these cortisol responses on the female elite basketball players’ performance needs to be further investigated.

2599 Profiling Inflammatory Markers During The Competitive Season And Post Season In Collegiate Wrestlers

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The wrestlers trained 3-4 hours per day during the season. The self-reported level of muscle soreness and fatigue was significantly higher from pre-season through mid-season, but leveled off late into the season (p<0.05). Creatine Kinase levels peaked early into the season at time point 2 versus pre-season (391.3 ± 48.6 vs. 220.75 ± 54.18, p=0.05), but decreased at the end of season versus pre-season (158.11 ± 44.23 vs. 287.79 ± 44.34, p=0.05). Plasma TNFα levels increased late into season (time point 4) compared to pre-season (5.26 ± 0.38 vs. 3.34 ± 0.36, p=0.05). Plasma IL-8 followed a similar trend and peaked at time point 4, however this value was not significant (p=0.08). Sleep quality correlated with plasma levels of IL-8 (~r=0.120, p<0.05). No other plasma cytokine data was statistically significant (p>0.05). CONCLUSIONS: Muscle soreness and fatigue values peaked early in the competitive season and decreased as the season progressed, without a reduction in training volume; suggesting an adaptive response to training load. Low grade systemic inflammation increased late into the season (measured by plasma cytokines), and correlated with poor sleep quality. Sleep quality may be a simple marker to track inflammation among wrestlers. Based on these data, wrestlers may benefit by additional recovery time early into the season to prevent fatigue and muscle damage. As the season progresses, low-grade inflammation may be prevented by tracking the quality of sleep. Combined these measures may prevent injury and improve performance.
Olympic athletes are overexposed to training and daily routine, and the training log should be matched with multifactorial issues, such as nutrition, physiotherapy, psychologic, and health, focusing on improvement of performance. Evaluate how the athletes in answering to each period of preparation is challenging, specially on a 4 year Olympic cycle. Interdisciplinary approach is mandatory and any mismatch may lead to injury or decrement of performance. Canoeing has specific demands and methods for evaluation, and multifactorial analysis such as biomechanical, metabolic and clinical aspects should be encouraged. PURPOSE: The aim of this study was to evaluate athletes participating in Rio 2016 Summer Olympics Games on a multidisciplinary and multifactorial aspect.

METHODS: 2 male athletes (Bronze Medalists) were evaluate during a 1,000m sprint on an ergometer, analyzing aerobic capacity (VO2), Heart Rate (HR) and Power (W) on every 250m. Blood samples were collected for muscle-damage biomarkers: Creatine-Kinase (CK) and Lactate Dehydrogenase (LDH); Electrolytes: Sodium (Na) and Potassium (K).

RESULTS: Descriptive data demonstrate that VO2 (mL/kg/min), HR (bpm), W (watts) were, during 250m: 39.3 ±172/133 x 39.2 ±159/107, 500m: 31.2 ±170/105 x 37.3 ±160/109, 750m: 36.7 ±178/110 x 34.9 ±168/100, and 1,000m: 43.5 ±184/182 x 45.1 ±178/118, respectively. CK levels (mg/dL) and LDH (U/L) were, pre vs post protocol, 835 ±1081 and 548 ± 682 for the first athlete, and 255 vs 340 and 488 vs 492 for his teammate. Electrolytes, Na (mEq/L) and K (mEq/L) were 143 vs 151 and 5.8 ± 5.6, and 141 vs 151 and 5.4 ± 5.9. The time for completing the 1,000m protocol were 5m12s08ms vs 5m22s02ms.

CONCLUSIONS: The protocol described evidences multidisciplinary variables that should be focused when detailing improvement in performance, on cardiorespiratory and metabolic approach.
in the lowest tertile showed smaller displacements compared with middle tertile in conditions OBEOa (1.99±0.48 vs. 2.9±0.53 cm, p=0.012), OBEOa (1.23±0.44 vs. 1.52±0.47 cm, p=0.03), OBEC (2.35±0.65 vs. 2.72±0.60 cm, p=0.022), and OBEC (1.29±0.48 vs. 1.56±0.55 cm, p=0.034). CONCLUSION: WC was the adiposity index best correlated with postural instability, and subjects with greater WC also exhibited the poorest BC in older women. These results suggest that WC, an easy and low cost measure, might be associated with the risk of falling in the elderly, and support the concept that obesity impairs BC.

2604 Board #124 June 2 9:30 AM - 11:00 AM Gait And Pelvic Angle Symmetry As A Function Of Age In Women 55 And Older
Courtney B. Kirkeide, Chi Na Moua, Nicole S. Szyzszka, Marcella J. Myerts. St. Catherine University, St.Paul, MN. (Sponsor: Dr. Mark Blegen, FACSM) Email: cbkirkeide@stkate.edu (No relationships reported)

Serious injuries due to falls in people 65 years and older is a critical cost and quality of life issue in our society; slow walking and delayed gait is of particular concern in older women. Falling often correlates with impaired gait and balance caused by loss of muscular strength and/or sensory impairments. Gait and pelvic angle symmetries (between left and right sides of the body) are key measures of gait quality. PURPOSE: The goal of this study, an initial phase in a larger project, was to characterize the relationship between age and several gait symmetry measures in women 55 and older. METHODS: 20 healthy female participants (ages 55-83) walked along a hallway while their gait characteristics were monitored; each participant walked 4 times at their self-selected pace. Data on pelvic tilt, obliquity, and rotation symmetry, as well as overall gait symmetry (similarity of trunk accelerations on the left and right sides) were assessed using an inertial sensor (BTS-G Walk) placed on the low back (L5). RESULTS: Pelvic tilt symmetry, which ranged from 30-98%, showed a statistically significant relationship with age in these older women walkers (p=0.009); age explained 33% of the variance in pelvic tilt symmetry. Neither pelvic rotation (p=0.33), pelvic obliquity (p=0.09), or gait symmetry (p=0.46) showed significant relationships to age. CONCLUSIONS: These initial findings reveal a particular focus of gait impairment as a function of age in older women – pelvic tilt symmetry. Interventions to address this aspect of gait may improve walking patterns, and thus dynamic stability, in older walkers.

2605 Board #125 June 2 9:30 AM - 11:00 AM Variability and Stability of 13-19 Month Old Infants’ Gait Affected by External Perturbation
Sally-Marie Futch, Sydni Willihoite, Brandonn Harris, Barry M. Munkasy, Li Li, FACSM. Georgia Southern University, Statesboro, GA. (Sponsor: Li Li, FACSM) (No relationships reported)

Although there has been research conducted on motor development, children’s walking behavior, differences between adult and children’s gait with perturbation, and the effect of diaper perturbation versus unclothed on gait, there has been little to no research on different diaper perturbations on gait. PURPOSE: The purpose of this study was to examine how a physical perturbation (a dry and a wet diaper versus underwear) affects 13 to 19 month old children’s gait. METHODS: The project was approved by the University’s IRB, and participation was granted with written consent from a legal guardian. Sixty children ranging from 13 to 19 months in age were recruited for this study. Each child completed five trials for three conditions in a single session. Each trial consisted of the child walking on an instrumented walkway (Gaitrite CIR Systems, Sparta, NJ) for at least five continuous steps wearing a dry diaper, a wet diaper, and underwear, all of which were provided to the participants. Diapers were wet using a 100 ml syringe of room temperature water. Step length (m), step rate (steps/min) for left and right support base (m) were analyzed using a 7x3 MANOVA. RESULTS: Significant main effects for age and condition, but no significant interaction were observed. For step length and rate, 13 and 19 months deviate from the means of each other and all the other ages. Step length: 0.21±0.04, 0.33±0.03, Step rate: 3.0±0.4, 3.7±0.6, 1.5±0.3, 13 and 19 month respectively. Significant age difference was observed for left and right support base. Significant differences were also observed for left and right support base (1.4±36, 1.5±36 for wet diapers and underwear respectively), but not for step length and rate. CONCLUSION: A wet diaper did not affect step length or step rate. However, there was an effect that occurred between age group and step length, step rate, left and right support base. These factors are impacted by maturation. Further research needs to address whether these conditions influence other gait parameters.

2606 Board #126 June 2 9:30 AM - 11:00 AM Relationship Between Body Fat And Selected Gait Parameters
Alec Russell, Spencer Petersen, Michael Bohne, Tyler Standifird, Andrew Creet. Utah Valley University, Orem, UT. (Sponsor: Scott Drum, FACSM) (No relationships reported)

Over the years obesity has become a widespread pandemic that has affected many people. Obese persons experience difficulty ambulating and conducting daily activities. While body mass index is typically used to identify obese individuals percent body fat was preferred for this study because body mass index presents as an inaccurate obesity classification (Shah, 2012). It has been proposed that as percent body fat increases joint mechanics of the hip, knee, and ankle will increase as well and on all three planes. PURPOSE: The purpose of this study is to show the correlation between body percent fat and lower extremity joint mechanics. METHODS: 54 participants (24 male, 30 female; Height:170.9±9.2 cm, Weight: 74.4±18.8 kg ) were fit with reflective markers on the bony landmarks of the lower extremity and asked to walk across Bertec force plates (Bertec, Inc, Columbus, OH) a total of 10 times. Kinematic data were collected and normalized to body weight and collected with Vicon Nexus 2.4 (Vicon, Inc., Oxford, UK) and processed through Visual 3D software (C-Motion, Inc., Germantown, MD). Body composition was measured using a Bod Pod (CosmedIUSE, Inc., Chicago, IL). Data were analyzed using a Pearson correlation coefficients (p<0.05). RESULTS: The data revealed a significant relationship between percent body fat and stride width (r² = 0.368) as well as peak ankle plantarfexion flexion (r² =0.373) (p<0.032 and p<0.005 respectively). No other significant relationships were observed. CONCLUSIONS: Based on this data, step width and peak plantar flexor moments were increased with increased body fat percentage, suggesting that persons with a larger percent body fat require more force to propel themselves forward to toe off. Strengthening plantar flexors, or reducing body fat percentage, may allow those with high percent body fat to ambulate and perform other daily tasks efficiently. Further research is needed to examine non-normalized data to show practical effects. Additionally, the current study used primarily active individuals, a comparison to sedentary individuals is needed.

2607 Board #127 June 2 9:30 AM - 11:00 AM High Capacity Older Adults Exhibit More Biomechanical Plasticity than Low Capacity Older Adults
Daniel Kuhman, Victoria Price, Blake Schnurr, Dyshone Jordan-Brown, John Willson, Chris Mizzelle, Paul DeVita, FACSM. East Carolina University, Greenville, NC. (Sponsor: Paul DeVita, FACSM) Email: kuhmandl5@students.ecu.edu (No relationships reported)

Old compared to young adults exhibit increased hip and decreased ankle joint work during level walking. This distal-to-proximal redistribution of joint work is known as biomechanical plasticity and is a successful strategy for maintaining walking performance into old age. It is unknown however whether high-functioning adults, (e.g. those with relatively fast walking speed) exhibit larger magnitudes of plasticity enabling them to walk well or whether low-functioning adults exhibit larger magnitudes of plasticity to simply enable them to walk. The literature weakly suggests that “low-performing” compared to “high-performing” old adults exhibit larger magnitudes of biomechanical plasticity. We seek to more precisely identify the nature of biomechanical plasticity with age and its relationship with physical capacity. PURPOSE: To compare magnitude of biomechanical plasticity between high and low capacity old adults during level walking. METHODS: 3D motion capture gait analyses were conducted on 30 old adults (n = 19 females; age = 74.7 yrs.) walking at self-selected speeds. Short Form Health Survey (SF-36) physical component scores were used as measures of physical capacity. Ratios of positive hip work to positive ankle work, peak positive hip extensor power to peak positive plantarflexor power were used as measures of biomechanical plasticity. Student’s t-tests were used to compare the top 10 (n = 8 females; age = 76.5 yrs.) and bottom 10 (n = 5 females; age = 72.8 yrs.) individuals based on their SF-36 PC scores. RESULTS: High capacity adults exhibited larger ratios of both hip/ankle positive work (0.948 vs 0.613, p = 0.01) and hip/ankle peak positive power (0.399 vs 0.375, p = 0.003) compared to low capacity adults. High capacity adults exhibited faster self-selected walking speed (1.39 vs 1.22 m/s, p = 0.01) and longer stride lengths (1.46 vs 1.29 m, p = 0.002) compared to low capacity adults. CONCLUSION: Old adults with high physical capacity exhibited a larger magnitude of biomechanical plasticity compared to old adults with low physical capacity. This allowed the high capacity individuals to maintain faster self-selected walking speeds and longer stride lengths compared to the low capacity individuals – two variables that may help these individuals maintain higher capacities.
We recently showed that the observed walk-to-run transition stride frequency agrees with a transition stride frequency predicted in a novel way by the two stride frequencies applied during treadmill walking and running at freely chosen velocities and freely chosen stride frequencies. The two latter stride frequencies are defined as behavioral attractors. PURPOSE: To test the day-to-day reliability of the predicted walk-to-run transition stride frequency determined by this novel approach. METHODS: Healthy individuals (n=25, 19 men and 6 women of age, height, and body mass of 26.6±4.2 years, 1.77±0.08 m, and 76.4±11.6 kg, respectively) were recruited for a laboratory test of treadmill walking and running. The two behavioral attractors were determined during walking and running at freely chosen velocities and stride frequencies. Subsequently, the walk-to-run transition stride frequency was predicted to occur at the point where the walking stride frequency starts to get closer to the running attractor than to the walking attractor. The laboratory test was repeated after 4-8 days. Intraclass correlation coefficient (ICC3,1), standard error of measurement (SEM), and smallest real difference (SRD) were calculated as measures of reliability.

RESULTS: The freely chosen stride frequency during walking was 57.7±4.1 and 59.1±4.8 strides min⁻¹ in test 1 and 2, respectively (p=0.03). The freely chosen running stride frequency was 81.8±3.7 and 81.9±3.1 strides min⁻¹ in test 1 and 2, respectively (p=0.67). The predicted walk-to-run transition stride frequency was 69.7±3.3 and 70.5±3.4 strides min⁻¹ in test 1 and 2, respectively (p=0.08). The ICC3,1 of the predicted walk-to-run transition stride frequency was 0.89, the SEM was 1.1 strides min⁻¹ and the SRD was 3.1 strides min⁻¹. CONCLUSION: The predicted walk-to-run transition stride frequency showed almost perfect relative reliability and high absolute reliability.
were calculated to collect trunk lean relative to the vertical axis (degrees). A 3-way repeated measures ANOVA was used to determine effects of pack, load, and speed on trunk lean with an alpha level set a priori at p<0.05. Post-hoc pairwise comparisons were performed with Bonferroni corrections. RESULTS: A significant main effect of speed on trunk lean (F(1,13)=44.1, p<0.001) was observed where forward lean was greater at faster speeds (Slow: 3.8±0.6; Fast: 7.5±0.7, F(1,13)=44.1, p<0.001). There was a significant pack x load interaction on trunk lean (AP-Light: 1.4±2.1; AP-Heavy: 4.8±3.1; EHB-Light: 5.3±3.4; EHB-Heavy: 10.0±3.3, F(1,13)=15.5, p=0.002). Subjects using the EHB walked with greater increase in forward lean when carrying the heavy load. CONCLUSION: Walking with heavy loads and carrying the EHB produced greater increase in forward lean when compared to the AP. This suggests a potential nonlinear effect of pack and load on trunk lean. The weight cost or oscillation of the EHB may also contribute to these changes in gait. Phase relationships between the user and EHB centers-of-mass may be examined in future research to study the effects on gait biomechanics. Further analysis is also warranted to determine tradeoffs in power generated from the EHB and Soldier biomechanics while walking with the system.

Infant walkers have immature gait patterns. Small perturbations to gait, such as a dry diaper, could impact their already unstable spatial-temporal gait characteristics. However, little is known regarding the test-retest reliability of spatial temporal measurements as measured by the GAITRite of novice walkers in dry diapers. PURPOSE: To determine the reliability of spatial-temporal gait characteristics, such as Velocity, Cadence, Stride length, and Base of Support in 13-16 month old novice walkers wearing a dry diaper. METHODS: The project was approved by local IRB board and participated with written consent from legal guardians. 18 novice walkers, 9 males and 9 females, (14.4±1.1 months of age) participated in a series of 5 walking trials at a self-selected pace in a dry diaper on the GAITRite System (sampling rate 120Hz) on two separate testing sessions one week apart (Day 1 and 2). During each session, participants were fitted with the dry diaper and encouraged to walk 5 or more steps continuously for each trial, five trials total, over the GAITRite. Upon completion of each testing session, the raw data was exported and averaged across five trials for each day. Average gait velocity (cm/s), cadence (steps/s), stride length (cm) and base of support (cm) were calculated at each time point. Intraclass Correlations were employed to assess between-day reliability. RESULTS: Gait Velocity, 92.3 ± 25.0 and 93.6 ± 20.0, for Day 1 and 2 respectively, ICC = 0.848 (95% CI = 0.594 to 0.943); Cadence, 208.6 ± 34.7 and 209.9 ± 25.8, for Day 1 and 2 respectively, ICC = 0.838 (95% CI = 0.561 to 0.939); Stride Length = 53.0 ± 9.0, and 53.5 ± 7.8, for Day 1 and 2 respectively, ICC = 0.916 (95% CI = 0.777 to 0.969); Base of Support, 10.9 ± 2.6, 10.9 ± 1.6, for Day 1 and 2 respectively, ICC = 0.767 (95% CI = 0.376 to 0.913) . CONCLUSION: The results of the study demonstrated excellent test-retest reliability for Gait Velocity, Cadence, and Stride Length and good test-retest reliability for Base of support when testing 13-16 month old novice walkers in a dry commercially available diaper on the GAITRite. Future research needs to address the test-retest reliability of infants wearing a wet diaper since wet diapers introduce great perturbation to walking.

Lateral ankle sprains are common among athletes and often times lead to chronic ankle instability (CAI). Altered hip joint biomechanics during functional activity has been noted in CAI patients. However, few studies have comprehensively examined locomotive hip joint movement strategies in subjects with CAI. PURPOSE: To examine gait patterns of frontal and sagittal hip kinematics, kinetics, and muscle activation in those with and without CAI. METHODS: 100 CAI patients (M=49, F=51; 22±2 yrs, 174±10 cm, 71±14 kg, 82±9% FAAM ADL, 62±13% FAAM Sports, 4.5±2.6 ankle sprains) and 100 controls (M=56, F=44; 22±3 yrs, 172±13 cm, 72±18 kg, 100% FAAM ADL & Sports, no previous sprains) performed five walking trials, while hip joint angles, moments and muscle activation were collected during the stance phase. Functional analyses (n=5) were used to compare the entire stance phase of gait between groups. Functions of each group as well as 95% confidence intervals (CI) were plotted to determine significant differences. If functions and associated 95% confidence intervals did not cross zero, group differences existed. RESULTS: Figure 1. CAI subjects demonstrated increased hip flexion and extension, likely a result of greater hip joint moments during stance. CAI patients decreased hip adduction during 45-70% and increased hip abduction between 90-100% of stance. CAI subjects decreased hip abduction moment during 10-14% of stance. Gastrocnemius maximus and medius activation decreased during mid- and terminal stance of gait. CONCLUSION: Lack of EMG activation combined with altered biomechanics at the proximal joint may alter the position and loading of distal joints in the chain, potentially affecting injury risk.

Purpose: Recent literature suggests activity-related pain in older adults may play a role in gait impairment and lead to declines in mobility that pose threat to older adult independence. While research shows this to be a function of adopting slower but more variable physical movements, the underlying mechanism is unclear. The purpose of this study was to test whether activity-related pain during walking plays a role in gait impairments that may be responsible for slower, more varied walking typically experienced by older adults. METHODS: 16 young (26.7±6.2 yrs), 44 middle-aged (54.5±6.7 yrs), and 40 older adults (72.6±6.1 yrs) were asked to walk 4-meters at a usual pace over a computerized gait analysis system. Gait characteristics were averaged over three trials. Self-reported pain was measured using the Borg CR10 pain scale immediately following four separate walking tasks of various intensity (5-8 min duration each). Average scores were then used to categorize people into either a pain (n=57) or no pain category (n=43). Among those reporting pain, the average self-reported scores across all activities ranged from 0.1 to 4.3 with a mean of 1.0±1.0. Regression models were used to estimate the difference of gait characteristics between those with and without pain during different walking scenarios. Results: In middle-aged adults, individuals with pain had a faster gait cycle time than individuals without pain (1.2±0.1 vs 1.1±0.1 s, p=0.036), but there was no difference between those reporting pain and those not in young (p=0.622) or older adults (p=0.688). Additionally, no difference was found in walking speed, step length, and cadence, nor average base of support between individuals with and without pain across all age categories (p>0.05). Conclusion: While individuals with pain did have faster gait cycle than individuals without pain in middle-aged adults, this effect was not observed among older adults. However, the similarity in walk speed between individuals with and without pain in older adults may suggest the use of strategies to compensate for the walking-related pain and maintain gait characteristics. Future work is needed to investigate mid-age differences in gait cycle due to pain and possible gait maintenance strategies as aging with pain occurs.
Knee osteoarthritis (KOA) is one of the most predominant causes of pain, functional decline and disability in elderly. In China the prevalence of radiographic KOA was 42.8% in women and 21.5% in men. Medial KOA has been shown to affect a multitude of biomechanical and gait parameters.

**PURPOSE:**
The objective of the study was to investigate the multi-joint of lower extremity motor coordination during walking in individuals with KOA, and then supplies biomechanics theoretical basis for the prevention and rehabilitation of KOA.

**METHODS:**
Motion analysis system and force platforms were used to measure biomechanical data of medial KOA individuals and age-matched controls during walking. Each participant walked at a self-selected, comfortable pace on a 10-m walkway. All biomechanical variables characterizing sagittal-plane joint function were compared between two groups using Independent-Samples T test. The level of significance was set at α=0.05.

**RESULTS**
Significant reductions were observed for medial KOA group compared to control group in terms of the left, right step length (0.62±0.05 cm vs. 0.70±0.02 cm, P<0.05; 0.61±0.05 cm vs. 0.68±0.05 cm, P<0.05) and gait speed (1.28±0.12 m/s vs. 1.39±0.13 m/s, P<0.05).

Significant differences were obtained in the peak flexor (0.77±0.13 Nm/kg vs. 1.00±0.23 Nm/kg, P<0.05) and extensor muscle torque (-0.58±0.16 Nm/kg vs. -0.88±0.20 Nm/kg, P<0.05) of left hip between medial KOA and controls; Ankle joint angle at the heel-strike portion in medial KOA individuals were greater than controls (-1.11±0.22° vs. -1.03±0.37°, P<0.05). Besides, peak dorsiflexor moment (0.19±0.05 Nm/kg vs. 0.29±0.07 Nm/kg, P<0.05) were different between two groups. During the heel-strike portion, midstance portion and terminal portion of stance phase, Significant differences were obtained in the peak angle of left knee between two groups: 6.4±9° vs. -2.2±1.6°, P<0.05; 16.6±2.5° vs. -18.0±2.6°, P<0.05; 9.2±2.3° vs. -5.5±1.9°, P<0.05). Besides, knee extensor muscle torque of heel-strike in KOA group are less than that in control group.

**CONCLUSION:**
The biomechanical changes of knee induced by disease will alter the angle, muscle torque of adjacent joints. So in future rehabilitation and prevention of medial KOA, we should not only do focus on knee joint alone, but also other joints motion.

Increased plantar pressure has been found to be related with higher incidence of foot pain, reduced physical activity and a greater risk of falling. Although there is no theoretical basis for the prevention and rehabilitation of KOA.

**PURPOSE:**
To determine the effect of the prototype KT Flex product, knee sleeve with stabilizing springs and two other KT Tape conditions on lower extremity hip and knee kinematics and ground contact time during running and walking.

**Methods:**
23 Healthy College aged individuals (18 men, 5 women) (age 23.42 ± 2.66, 177.04 cm ± 7.72, 68.73 kg ± 12.95) served as their own control and completed all 5 conditions in random order. All subjects walked (3 mph) and jogged (7 mph) on an instrumented treadmill for 30 seconds under 5 separate conditions: 1) Normal (no intervention), 2) KT Flex on lateral knee, 3) KT Flex on lateral and KT Tape on medial knee, 4) KT Tape on medial and lateral knee, and 4) Knee sleeve with medial and lateral support springs. 18 reflective markers were used with 12 Vicon motion analysis cameras. Peak knee flexion during both stance and swing, peak hip flexion during swing, and peak knee and hip rotation were measured. Motion capture data was processed using Visual 3D. The results were evaluated using a General linear model ANOVA with pairwise comparisons for both walking and jogging conditions.

**Results:**
The only significant difference was found in Peak knee flexion angle during stance phase of walking between the knee sleeve and KT Flex with Medial KT Tape (p=0.034). The knee sleeve kept the knee in 3° more flexion. No other significant (p<0.05) differences were found between any of the measured variables within walking or jogging conditions.

**Conclusion:**
The KT Flex prototype product and generic knee sleeve with spring support do not alter gait kinematics during running and the effect on measured variables were similar. The knee sleeve caused more flexion in stance during walking. Both types of equipment can be used without interfering with normal running mechanics. These findings are significant to serious runners considering using knee support products which have been reported in the literature to help reduce various pain related syndromes.

Patients with chronic ankle instability (CAI) have been shown to display altered gait mechanics. While many studies have focused on the ankle joint, knee-gait mechanics are not well documented.**PURPOSE:** To examine knee biomechanics and muscle activation patterns during walking in those with and without CAI.

**METHODS:**
100 CAI patients (M=49, F=51; 22±3 yrs, 174±10 cm, 71±14 kg, 82±9% FAAM ADL, 62±13% FAAM Sports, 4.5±2.6 ankle sprains) and 100 controls (M=56, F=44; 23±3 yrs, 172±13 cm, 72±18 kg, 100% FAAM ADL & Sports, no previous sprains) performed five walking trials, while knee joint angles, moments, and EMG activation were measured. Functional analyses were used to compare variables between groups across the stance phase of gait (p<0.05). If functions and associated 95% confidence intervals did not cross zero, group differences existed.**RESULTS:** Figure 1. Compared to controls, CAI patients increased valgus angle during initial loading and reduced valgus angle during pre-swing. The valgus moment decreased during loading response and terminal stance. The CAI group reduced knee flexion angle during mid-stance, likely a result of a reduced knee extension moment tied to decreased vastus lateralis activation. Medial hamstring activation was decreased during initial loading and mid-stance.

**CONCLUSIONS:** CAI patients demonstrated knee flexion and knee extension patterns in a way that reduced knee flexion; likely a result of less knee extension moment and vastus lateralis and medial hamstring activation. Changes in knee joint mechanics may increase injury risk during functional movement. More data are needed to link these findings to injury risk.
Comparison Of Absolute Gait Parameters Between Breast Cancer Survivors And Healthy Controls During Forward And Backward Walking

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Older breast cancer survivors (BCS) report more falls and less stability than older adults with no cancer history. Spatio-temporal gait parameters are often used as indicators of fall risk in older adults. PURPOSE: To assess the differences in forward, backwards, and accelerated forward walking in BCS in comparison to a control group.

METHODS: 13 postmenopausal BCS (mean age: 58.5±8.5 years) and 8 control (mean age: 60.8±6.1 years) participated. Four BCS had surgery, chemo and radiation done. Gait was measured on the 16x4' Zeno walkway. Participants completed 5 trials each of forward, backward, and accelerated forward walking conditions. Participants had a lead and follow-up distance of 1m to capture steady-state gait. Gait speed, step length, step time, and stride width were used as dependent variables. A mean of five trials was used to run a Group X Condition ANOVA.

RESULTS: Significant main group effect indicated that BCS (59.63±1.38cm) had significantly shorter step length compared to healthy controls (64.42±1.76 cm) across all conditions (P<0.045). Significant condition main effect was observed for all the variables (all post hoc tests P<0.001). All participants walked significantly slowest during backwards condition (0.91±0.03ms) followed by forward (1.24±0.03ms) and accelerated forward (1.76±0.06ms) conditions. All participants walked with significantly shorter step length during backwards condition (48.43±1.74cm), followed by forward (46.38±1.01cm) and accelerated forward (37.20±2.84cm) conditions. All participants took significantly shorter step time during accelerated forward condition (0.42±0.01s) compared to forward (0.52±0.01s) and backward (0.54±0.02s) conditions. All participants walked with significantly wider stride during backwards condition (16.07±0.77cm) compared to forward (7.65±0.47cm) and accelerated forward (7.31±0.50cm) conditions. No significant interaction was observed. CONCLUSION: Shorter step length irrespective of forward or backwards walking could indicate a more conservative gait approach among BCS. Overall, spatio-temporal gait parameters among BCS seem to be similar compared to healthy controls. Whether these results hold true based on exposure to surgery and/or radiation and/or chemo therapy needs to be determined.

Concussion Recovery: Gait Characteristics In Collegiate Student-athletes

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BACKGROUND: Sports-related concussions have recently become one of the highest profile injuries in the athletic community. Concussion results from significant force to the brain that induces pathophysiological processes that affect its function. These effects can often present themselves through different combinations of physical, cognitive, emotional, and sleep symptoms. While neurocognitive computerized evaluations can provide useful information regarding self-report symptoms as well as quantitative measures of neurocognitive performance, they may not be sensitive to alterations in balance and gait which may last longer.

PURPOSE: To assess gait characteristics in concussed NCAA Division 1 collegiate student-athletes at various time periods following a concussion.

METHODS: 47 participants completed an assessment of gait at baseline (n=24), while symptomatic (n=13) and/or when cleared to return-to-play (n=10). The gait protocol (10m walk under single and dual task conditions) was assessed through the use of the Mobility Lab software using ADPM sensor system. Gait measures included cadence, gait speed, step length, step duration and double stance time. RESULTS: A 2 (cognitive load) x 3 (phase assessment) MANOVA was conducted. There was a significant overall cognitive load main effect (p<0.05), assessment phase main effect (p<0.05) and a cognitive load x assessment phase interaction (p<0.05). Univariate analysis showed there were significant differences for all variables when a cognitive load was added (p<0.05). There were no significant differences found for gait speed (p>0.05), but significant differences were found between assessment phase groups for double support (p<0.05), step duration (p<0.05) and cadence (p<0.05).

CONCLUSIONS: Time point in recovery and cognitive load affects gait patterns and will overall speed may not show differences in recover, underlying mechanisms of control still remain affected even when student-athletes are returned to play. This has implications for concussion recovery and susceptibility to injuries if not fully recovered.

Changes In Healthy Old Adults’ Gait Biomechanics Following Short-term Lower Extremity Power Training

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PURPOSE: Age-related slowing of walking speed predicts many clinical conditions later in life. A variety of exercise programs can increase old adults’ habitual and fast gait speed. However, the biomechanical mechanism of how old adults make use of the newly acquired physical abilities during gait is still unknown. Here, we examined the kinematic and kinetic mechanisms of how lower extremity power training increases healthy old adults’ gait speed.

METHODS: 12 males and 10 females (age 70-81 y) were randomly assigned to a control (n = 7) and training group (n = 15). The training intervention consisted of 16 sessions, administered over 8 weeks to improve lower extremity muscle power by
having participants explosively leg press progressively increasing loads of 30-40% of 1-repetition maximum (1RM). We measured participants’ leg muscle strength in five muscle groups and gait biomechanics before and after the training intervention. RESULTS: Training increased maximal leg press load by ~40% (P < 0.05) and maximal voluntary force in five groups of leg muscles by ~32% (P < 0.05) but not in the no-exercise control group. Training (12.3%) vs. control (7.4%) tended to increase habitual and fast gait speed (21.1 vs. 8.9%) more (all P < 0.05). In the training group only, these increases were correlated with increases in stride length (habitual: r² = 0.84, fast: r² = 0.89). Training made old adults’ gait more erect, as hip and knee extension increased in the stance phase of gait. Training increased ankle joint power by 3.3 J (control: -0.41, Group by Time interaction: P < 0.05), which correlated r = 0.58 and r = 0.67 with increases in habitual and fast gait speed without changes in hip and knee joint powers.

CONCLUSION: After the intervention, old adults walked with a more erect gait due to increases in hip and knee extension in the stance phase of gait. The small but significant increase in ankle joint but not in hip and knee joint power correlated with increases in gait speed. The present results provide the first mechanistic insights into how short-term lower extremity power training improves healthy old adults’ gait biomechanics.

Supported by JSPS KAKENHI Grant Number 16K21320.

2623 Board #143 June 2 9:30 AM - 11:00 AM
High Intensity Cycling Improves Spatiotemporal and Kinematic Gait Parameters in Parkinson’s disease Patients
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(No relationships reported)

Purpose: Gait dysfunction is a cardinal symptom of Parkinson’s disease (PD). Alterations in gait are more pronounced during dual-task conditions where a cognitive and motor task are performed simultaneously. We have demonstrated that high-intensity aerobic exercise programs improve gait function under single-task (ST) conditions, however its impact on gait function while dual-tasking (DT) is unknown. A fundamental gap exists in understanding how high intensity exercise may impact DT conditions, however its impact on gait function while dual-tasking (DT) is unknown. We have demonstrated that high-intensity cycling can improve gait function during dual-task conditions following an 8-week cycling program.

Methods: Eleven individuals with idiopathic PD were recruited to participate in an 8-wk stationary cycling intervention. Participant’s gait was analyzed before and after the intervention using the Computer Assisted Rehabilitation Environment (CAREN) virtual reality system to assess upper and lower extremity kinematics. Participants walked on a treadmill at a self-selected speed while performing three cognitive tasks: N-back, Serial 7’s and Verbal fluency.

Results: MDS-UPDRS scores significantly improved from pre to post testing (-4.72±5.54). Participants demonstrated significant increases in velocity (0.169±0.61 m/s;p=0.01), arm swing path length, hip joint work of motion (W/kg), and knee joint ROM during both ST and DT conditions after the cycling intervention when compared to baseline. The ST condition was significantly greater than DT conditions for all parameters. Change in path length during ST conditions from pre to post testing (0.08±0.135 m) was significantly greater than the N-Back (0.020±0.136 m), Serial 7’s (0.018±0.130 m), and Verbal fluency (-0.002±0.119 m) (p=0.005). Hip and knee ROM for single task were also found to be significantly greater (p=0.05) when compared to DT.

Conclusions: High-intensity cycling can improve gait dysfunction in PD. Changes occurred in both ST and DT conditions, with greater improvements seen under ST conditions. The increases found after the 8-wk cycling intervention suggest that high-intensity exercise elicits centrally mediated changes in the brain, allowing participants to allocate fewer cognitive resources to gait performance.

This study was supported by a grant through the National Institute of Health R01NS073717.

2624 Board #144 June 2 9:30 AM - 11:00 AM
The Effect of a Backpack Hip Strap on Energy Expenditure While Walking.
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(No relationships reported)

Previous studies have demonstrated that the energy cost of carrying a backpack increases as the mass of the load carried increases. Conflicting results have been found when research examined the effect of duration on energy expenditure while carrying a backpack. A potential confounding variable could be the design of the backpack, particularly the use of a backpack hip strap. PURPOSE: To examine the effect of backpack hip strap use on walking energy expenditure while carrying a loaded backpack.

METHODS: A crossover design was used in which fifteen young, healthy male subjects walked at a self-selected pace for two 10-minutes in two backpack loading conditions: with a hip strap (strapped) and without a hip strap (non-strapped). Oxygen consumption (VO2), rating of perceived exertion (RPE), respiratory exchange ratio (RER), and heart rate (HR) were monitored throughout each 10-minute trial. Change scores from the 4th to 10th minute were calculated for each variable. A t-test was used to evaluate the difference between conditions for each variable.

RESULTS: The change in VO2 (0.62 ± 0.40 vs. 0.33 ± 0.23, p = 0.04) and change in RPE (1 ± 0.25 vs. 2 ± 0.21, p &lt; 0.01) from the 4th to the 10th minute were different for the strapped versus non-strapped condition, respectfully. There was no difference in the change in RER (0.04 ± 0.01 vs. 0.03 ± 0.01, p &gt; 0.05) or HR (5.33 ± 0.93 vs. 4.07 ± 1.39, p &gt; 0.05) for the strapped versus unstrapped condition, respectfully.

CONCLUSIONS: Wearing a hip strap reduced the energy expenditure and perceived exertion in as little as 10 minutes of walking compared the non-strapped condition. Future work should consider the effect of a hip strap on these variables while hiking for extended periods.
Chronic ankle instability (CAI) patients often exhibit altered walking mechanics, due to strength and proprioceptive deficits associated with CAI. Reduced strength and proprioception function may decline a gait energetic efficiency, which can reduce shock absorption and power generation. It is unclear whether strength and proprioceptive training can affect walking energetics for CAI patients. PURPOSE: To examine the effect of a 6-week ankle and hip rehabilitation program on ankle, knee, and hip joint energetic patterns during walking in CAI patients. METHODS: 15 CAI patients (23 ± 2 yrs, 178 ± 18 cm, 76 ± 9 kg, 83 ± 7% FAAM ADL, 56 ± 10% FAAM Sports, 3 ± 1.1 MAV, 4.7 ± 2.0 ankle sprains) performed ankle and hip strength and proprioceptive exercises (i.e., theraband, wobble board, etc.) 3 times per week, for 6 weeks (this was the rehab group). 14 CAI patients (22 ± 2 yrs, 177 ± 9 cm, 75 ± 12 kg, 81 ± 9% FAAM ADL, 56 ± 12% FAAM Sports, 3 ± 1.2 MAV, 5.9 ± 3.3 sprains) performed no rehabilitative exercises (this was the control group). We measured ankle, knee, and hip joint power during walking for all patients before and after the exercises. Functional statistics (α = .05) were used to evaluate the influence of the rehab exercises on joint power for both groups across the entire stance phase of walking. RESULTS: Figure 1. The rehab intervention resulted in up to 0.07 W/kg more positive ankle power (concentric) between 19 and 26% of stance and up to 0.06 W/kg more positive knee power (concentric) between 40 and 48% of stance. No changes were detected in hip joint power during the stance phase of walking. CONCLUSION: Data suggest that the strength and proprioceptive training results in an improved gait energetic efficiency through the increased ankle and knee power generation during mid-stage. As greater muscular strength can lead to an increase in power absorption and generation, the intervention focusing on strength should be beneficial in improving walking energetics in a CAI population.
Accurately predicting maximal oxygen consumption (VO_2max) in healthy individuals as part of a fitness assessment is a common practice in some fitness and wellness centers where maximal testing is not practical. One system used to predict VO_2max is the Polar FT60 Fitness Test™ which predicts maximal oxygen consumption based on an individual’s resting heart rate and prior three month activity level. While these systems are somewhat popular, the question remains concerning their validity and accuracy in predicting VO_2max in healthy subjects. PURPOSE: To determine the validity of the Polar FT60 Fitness Test™ in accurately predicting VO_2max in healthy individuals.

**METHODOLOGY:** Thirty-one subjects volunteered for the study (males=13; females=18; age=27.61±5.46yrs; WT=71.50±15.00kg; HT=169.32±14.00cm; BMI=24.09±3.84kg/m²; BF%=20.58±10.00). Volunteers reported to the lab where their predicted maximal oxygen consumption was assessed using the Polar FT60 Fitness Test™ following manufacturer’s recommendation. Maximal oxygen consumption was then determined using a standard maximal treadmill protocol where VO_2max was assessed with a calibrated Parvo Medics’ TrueOne® 2400 metabolic system.

**RESULTS:** Results indicate that the Polar FT60 Fitness Test™ significantly overestimates maximal oxygen consumption by -9.75% (predicted VO_2max =49.77±10.76ml/kg/min; actual VO_2max =44.92±8.12ml/kg/min; p=0.001; 95% CI=2.188, 7.515). **CONCLUSION:** These results indicate that the Polar FT60 Fitness Test™ significantly overestimates maximal oxygen consumption in this population of healthy subjects.

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Historically, cyclists have relied upon blood lactate analysis and/or metabolic testing to determine their fitness level and training zones. However, these methods are now being challenged by Near Infrared Spectroscopy (NIRS). The BSX Insight is a wearable NIRS device that claims to predict lactate threshold by analyzing changes in muscle oxygenation. PURPOSE: To determine whether time of day and leg dominance influence estimated and/or actual maximal single leg hop (SLHmax) performance. METHODS: Seventeen (8 guards, 9 posts) competitive, male basketball players (171±1 y, 72.6±11.9 kg) completed a familiarization visit followed by two identical experimental trials. Subjects ate a consistent diet 24 h before each trial and consumed 500 ml water and a granola bar 3 h before each trial. The protocol began with a 10-min warm up, followed by four ~20-min quarters consisting of 13 basketball drills; involving sprinting, vertical jumping (VJ), shooting, dribbling, passing, pre-planned agility, reactive agility, and a basketball-specific cognitive task (recall of a mock scouting report and game plan). Heart rate (HR) was measured continuously. Subjects received the same volume of a carbohydrate-free, electrolyte beverage to maintain euvhydration during both trials. Paired samples t-tests and coefficient of variation (CV) were used to assess the reliability of each drill (between mean values of the two trials). **RESULTS:** There were no differences between trials in mean HR (160±11 bpm vs. 161±10 bpm, p=0.77). There were no differences in performance between trials for any of the drills (p > 0.05). Between-trial CV’s by drill were as follows: 15±VJ max height (11.5%) and mean height (6.8%), pre-planned agility (3.9%), passing accuracy (9.8%), dribbling speed (3.7%), mid-range shooting accuracy (13.1%), lay up accuracy (3.3%), reactive agility (7.0%), lane slides (3.5%), 3-point shooting accuracy (14.7%), sprints (4.3%), rebounding (7.9%), free throw accuracy (15.8%), and accuracy on the cognitive task (9.8%). Shooting accuracy was more reliable in the guards vs. posts; mid-range (9.0% vs. 15.4%), 3-point (8.5% vs. 19.4%), and free throw (9.4% vs. 18.7%). **Conclusion:** The reliability of the basketball drills in 14-19 y players ranged from 3 to 16% and varied by player position. Future research is needed to determine the validity (e.g., identifying different skill levels) and sensitivity (e.g., measuring the efficacy of nutritional interventions) of this novel basketball-specific protocol.
unlike other tests of lower limb performance, individuals were not able to accurately estimate those time of day differences in performance or the lack of differences in performance between dominant and non-dominant legs. Overall, it is interesting that for time of day and leg dominance, participants either did not perceive differences that were present or perceived differences that were not present.

**METHODS:** To compare HRV variables during steady-state exercise at the same intensity during treadmill (TM) and Cycle (C) exercise. To examine the repeatability of HRV during exercise, particularly with differing exercise modes.

**PURPOSE:** Little research has explored the repeatability of HRV during exercise, particularly with parasympathetic function. Future research is needed at higher intensities, when parasympathetic withdrawal has occurred, and sympathetic control of heart rate is the dominant factor.

**RESULTS:** Our findings indicate that the MSET is superior to the Bruce submaximal protocol. Following similar methodology, we sought to evaluate agreement between ECG and PPG estimated HR. HR monitors are considered accurate if the correlation coefficient (r) is >0.9 and root mean square error (RMSE) is <5 bpm at rest or <10 bpm during exercise.

**CONCLUSION:** No significant mean differences were noted on any HRV variable. Intraclass correlation coefficients were significant for SDNN (0.87), RMSSD (0.78), LF (0.83), HF (0.76), but not for LF/HF (0.38), LF/HF of 0.38 (0.38), LF (0.38) and the LF/HF ratio (0.43). Bland-Altman analysis showed good agreement for all HRV variables (P > 0.05).

**CONCLUSION:** Results suggest that HRV variables measured during steady-state exercise at moderate exercise intensity were repeatable, particularly those associated with parasympathetic function. Future research is needed at higher intensities, when parasympathetic withdrawal has occurred, and sympathetic control of heart rate is the dominant factor.

In order to prescribe training intensities based on maximal heart rate (MHR), it is important to determine the potential differences in MHR using a variety of different testing conditions. Systematic differences between MHR across testing and competition conditions are poorly defined. **PURPOSE:** To determine if MHR varies between laboratory testing, field testing, practice, games and an age-prediction equation in collegiate female hockey athletes. **METHODS:** MHR was measured in 16 NCAA Division 1 female hockey athletes during a progressive, graded maximal treadmill test (MHR\textsubscript{MAX}), on-ice fitness testing (MHR\textsubscript{FIELD}), one season of practices (MHR\textsubscript{PRED}), and games (MHR\textsubscript{GXT}) and estimated by an age prediction equation (208-0.7 x age; MHR\textsubscript{PRED}). Participants were excluded if they failed to obtain 2 out of 3 criteria during MHR\textsubscript{GXT}: (i) RER 1.1, 2 (plateau in VO\textsubscript{2} and 3) attainment of ≥ 90% of MHR\textsubscript{MAX}. MHR\textsubscript{MAX} were compared across different methods by Kruskall-Wallis tests and Pearson correlation coefficients were determined between the different methods.

**RESULTS:** MHR\textsubscript{MAX} (194.5 ± 6.0 bpm) was significantly higher than MHR\textsubscript{PRED} (192.3 ± 4.9 bpm, p = 0.037) and lower than MHR\textsubscript{MAX} (201.1 ± 8.3 bpm, p = 0.0018) and MHR\textsubscript{GXT} (201.1 ± 11.0 bpm, p = 0.01), but not significantly different from MHR\textsubscript{FIELD} (193.8 ± 9.0 bpm, p = 0.64). Significant correlations were found between MHR\textsubscript{GXT} and MHR\textsubscript{FIELD} (r = 0.79, p < 0.001) but not MHR\textsubscript{PRED} (r = 0.41, p = 0.13) or MHR\textsubscript{MAX} (r = 0.10, p = 0.70). MHR\textsubscript{PRED} was not correlated with any other methods (r = 0.15 to 0.22, < 0.05 for all). **CONCLUSIONS:** Among elite female hockey athletes, MHR\textsubscript{GXT} and MHR\textsubscript{FIELD} were significantly lower than practices and games. This suggests that MHR from competition may overestimate the heart rate that is representative of maximal aerobic capacity. Use of this value as a reference to prescribe training volume could result in unintentionally higher training loads with potentially increased risk of overtraining or injury.

A customized submaximal treadmill test for cycle ergometry was reported as a superior estimate of maximum oxygen uptake (VO\textsubscript{2max}) in comparison to the YMCA bike test. **PURPOSE:** Following similar methodology, we sought to evaluate agreement between a customized submaximal treadmill test (MSET) with the widely used Bruce submaximal protocol. **METHODS:** Participants (29 women and 21 men; age = 31.7 ± 11.4 y, BMI = 24.02 ± 3.03) performed a graded exercise test (GXT) with a subsequent exhaustive, square-wave bout for the verification of “true” VO\textsubscript{2max} in counterbalanced-order, subjects then completed submaximal protocols. The MSET consisted of two 3-min stages estimated at 35% and 70% of VO\textsubscript{2 max}, where VO\textsubscript{2max} was estimated with a linear regression equation utilizing gender, BMI, age, and self-reported physical activity. **RESULTS:** VO\textsubscript{2} from the GXT and verification bout were 47.2 ± 7.7 and 47.0 ± 7.7 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}, respectively (ICC = 0.99, CV = 2.0%, TE = 0.83 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}), with the highest value used as the “true” VO\textsubscript{2max} (47.7 ± 7.7 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}). Neither the Bruce (45.95 ± 6.97 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}) nor the MSET (47.3 ± 9.4 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}) differed from “true” VO\textsubscript{2max}. The MSET had a “very large” measurement agreement with “true” VO\textsubscript{2max} (ICC = 0.78, CV of 9.1%, TE = 4.07 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}). Bruce had a “large” measurement agreement with “true” VO\textsubscript{2max} (ICC = 0.62, CV of 10.0%, TE = 4.51 ml·kg\textsuperscript{-1}·min\textsuperscript{-1}). **CONCLUSIONS:** We conclude that the MSET is superior to the Bruce protocol because it yields a better measurement agreement for “true” VO\textsubscript{2max}, is more time efficient, and can be used to prescribe exercise.
PURPOSE: Using a verification phase test (VP) following a graded exercise test has been shown to be superior to secondary criteria to determine a "true" VO2max. It has not been determined if a sex difference in the optimal intensity for cycle ergometry VP testing exists. METHODS: 31 participants (16 females, age: 21±1.5 yrs, BMI: 23.2±3.3 kg/m²; 15 males, age: 22±1.5 yrs, BMI: 24.5±2.2 kg/m²) completed a ramp VO2max test, then on 4 subsequent days, in random order, complete VP tests at 80, 90, 100, and 105% of the peak wattage achieved during the initial ramp test. RESULTS: The VO2max values for each test (Ramp, 80, 90, 100, and 105%) for women were 2.36±0.35, 2.29±0.34, 2.34±0.33, 2.35±0.31, 2.32±0.32 L/min and for men were 3.65±0.66, 3.67±0.71, 3.67±0.67, 3.56±0.51, 3.49±0.48 L/min. For males VO2max at 105% was significantly lower than Ramp (P=0.02), 80% (P<0.01), and 90% (P=0.02). Also VO2max at 80% (P=0.07) and 90% (P=0.08) was marginally higher than at 100%. Females showed no significant differences between VO2max values for any VP or Ramp test. 10 of the 16 female subjects had their highest VO2max during the 100 or 105% VP while 12 of 15 male subjects had their highest from a VP at a submaximal wattage. When comparing all VPs a significant sex x test interaction (P=0.01) was observed. CONCLUSIONS: Submaximal VP intensities of 80% and 90% of max wattage achieved on the ramp test produce the highest VO2max values in males. In females the maximal and supramaximal intensities most frequently produced the highest VO2max whereas the 80% led to excessive time to exhaustion (9.23±4.99 min). In order to obtain the highest VO2max values in the most optimal test time we recommend using 90% of max wattage in males and 100% or 105% of max wattage in females.

PURPOSE: The applicability of verification phase (VP) testing as a means to confirm the attainment of a “true” VO2max in males with obesity is widely unknown due to only two previous published studies on this population. The aim of the present study was to assess the validity of verification phase testing on separate days in males with obesity and determine the optimal work rate at which the highest VO2max can be elicited. METHODS: Nine healthy males with obesity between the ages of 18 and 35 (age = 24.1 ± 6.1 years; body mass index [BMI] = 33.2 ± 4.2 kg/m²) performed a ramp-style VO2max test on the cycle ergometer followed by four randomly assigned constant power (CP) tests. All participants performed identical GXTs using either the Rudolph 2700 (high resistance) or the Daniels’ valves (low resistance) during the maximal phase. TTE was significantly longer when using the Daniels’ valve across all submaximal speeds. During the maximal phase, TTE was significantly longer when using the Daniels’ valve for all groups (6.0, 10.9, 6.2 and 9.8% for ETM, ETf, RAM and RAF, respectively, p<0.05). There were no other differences between valves in all groups for the submaximal or maximal portions of the GXT. CONCLUSION: These findings indicate that higher resistance two-way breathing valves alter the assessment of an individual’s VO2max and EE during submaximal exercise. Although breathing valve resistance altered TTE, VO2max was unchanged. Therefore, airflow resistance of a breathing valve must be considered when comparing physiological responses to a GXT in the applied and research settings.
**MEDICINE & SCIENCE IN SPORTS & EXERCISE**

### June 2 11:00 AM - 12:30 PM

#### Board #161

**Biomechanical Comparison Of Countermovement Jumps On Land And In Water: Age Effects**

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*No relationships reported*

The use of a reduced impact, aquatic environment for physical activity and rehabilitation in older adults has become a focus of recent literature. **PURPOSE**

The present study sought to evaluate the mechanical specificity of countermovement jumps performed on land and in water in older adults. **METHODS** Fifty-six young (22.0±3.9yrs) adults and twelve healthy older (57.3±4.4yr) adults were asked to perform maximal countermovement jumps on land and in chest-deep water. Kinetic and kinematic measures of jump performance were obtained using a tri-axial force platform and two dimensional videography, respectively. **RESULTS** As expected, peak (PP) and mean mechanical power (MP) outputs were greater (p<0.01) for jumps performed by young vs older adults (PP:732±4035W;MP:3049±1717W) and for jumps performed by all subjects in water (PP=9387±3981W;MP=3781±1864W) vs land. Compared to young adults, older adults experienced less of an increase in bodyweight normalized PP and MP for jumps performed in water vs land (p<0.05). Peak movement velocities in older adults tended to be slower, with older adults spending 55% greater time in body unweighting. Compared to land, unweighting time increased more in the water for older adults (Land:0.5±0.3s;Water:1.2±0.7s) than young adults (Land:0.4±0.1s;Water:0.7±0.2s). Across ages, amortization rate was 26% greater for jumps performed in water and, in comparison with younger adults, amortization time in older adults was 20% longer in duration. A 144% increase in peak dorsiflexion velocity for jumps performed in water (66.3±4°/s vs. 4.7±1°/s), suggests that loading strategy during amortization is likely unique from land-based jumping. **CONCLUSION** The aquatic environment produces jumping movements that are mechanically distinct from jumping movements performed on land. The results of the present study suggest that jumping in an aquatic environment may be beneficial in older adults training to improve mechanical power output and lower-extremity neuromuscular function.

**MEDICINE & SCIENCE IN SPORTS & EXERCISE**

### June 2 11:00 AM - 12:30 PM

#### Board #163

**Comparison of the Talk Test and Percent Heart Rate Reserve for Exercise Prescription**

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*No relationships reported*

Exercise intensity is traditionally prescribed using %HRmax, %HRpeak, %VO2max or %VO2R. Recently, the Talk Test (TT) has been proposed as an alternative method to guide exercise intensity. However, it is unknown if prescribing exercise intensity solely using the TT can provoke training responses that are comparable to traditional guidelines. **PURPOSE:** To compare the training responses consequent to training using either the TT or %HRpeak. **METHODS:** Forty-four subjects (17 males and 27 females: age=20.4±3.0 yrs; ht=170.5±9.7 cm; wt=71.9±13.6 kg) completed an incremental maximal cycle ergometer test, were stratified by VO2max and gender, and randomly assigned to training groups guided by either %HRpeak (n=20) or the TT (n=24). Both groups completed 40-minute training sessions 3 days per week for 10 weeks. In the HR group, exercise intensity was targeted at 40-59%HRpeak for weeks 1-4, 50-59%HRpeak for weeks 5-8, and 60-79%HRpeak for weeks 9-10. In the TT group, exercise intensity was targeted at the highest power output that still allowed for comfortable speech. Changes in VO2peak, peak power output (PPO – watts and watts/kg), ventilatory threshold (VT); and PO at VT were compared between groups using two-way ANOVA with repeated measures. **RESULTS:** There were significant (p<0.05) pre- vs. post increases in VO2peak (TT=+10.6%; HR=+11.5%), PO - watts (TT=+18.5%; HR=+14.1%), PO - watts/kg (TT=+19%; HR=+14%), VT (TT=+56.9%; HR=+32.7%), and PO at VT (TT=+39%; HR=+43%) in both groups as a result of training, with no significant differences (p>0.05) in the magnitude of improvement between groups. **CONCLUSION:** Guiding exercise prescription using the TT is a simple and effective method for prescribing exercise intensity and elicits improvements in exercise performance that are comparable to traditional %HRpeak guidelines.

**MEDICINE & SCIENCE IN SPORTS & EXERCISE**

### June 2 11:00 AM - 12:30 PM

#### Board #164

**Talk Test As A Marker For Maximal Lactate Steady State In Athletes**

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*No relationships reported*

The Talk Test (TT) is a simple surrogate of standard methods of exercise prescription. **Purpose:** To evaluate if the TT can identify Maximal Lactate Steady State (MLSS) in athletes. **Methods:** Well-trained triathletes (m=7, f=5) performed two incremental time trials (TT). Belt resistance of NMT results in reduction in time-trial performance compared to treadmill or road running, but the repeatability between NMT TT is not well-documented. **PURPOSE:** To evaluate if the TT can identify Maximal Lactate Steady State (MLSS) in athletics. **METHODS:** To evaluate if the TT can identify Maximal Lactate Steady State (MLSS) in athletics.

Both groups completed 40-minute training sessions 3 days per week for 10 weeks. In the HR group, exercise intensity was targeted at 40-59%HRpeak for weeks 1-4, 50-59%HRpeak for weeks 5-8, and 60-79%HRpeak for weeks 9-10. In the TT group, exercise intensity was targeted at the highest power output that still allowed for comfortable speech. Changes in VO2peak, peak power output (PPO – watts and watts/kg), ventilatory threshold (VT); and PO at VT were compared between groups using two-way ANOVA with repeated measures. **RESULTS:** There were significant (p<0.05) pre- vs. post increases in VO2peak (TT=+10.6%; HR=+11.5%), PO - watts (TT=+18.5%; HR=+14.1%), PO - watts/kg (TT=+19%; HR=+14%), VT (TT=+56.9%; HR=+32.7%), and PO at VT (TT=+39%; HR=+43%) in both groups as a result of training, with no significant differences (p>0.05) in the magnitude of improvement between groups. **CONCLUSION:** Guiding exercise prescription using the TT is a simple and effective method for prescribing exercise intensity and elicits improvements in exercise performance that are comparable to traditional %HRpeak guidelines.

**MEDICINE & SCIENCE IN SPORTS & EXERCISE**

### June 2 11:00 AM - 12:30 PM

#### Board #164

**Repeatability Of 5-km Time Trials On A Non-motorized Treadmill**


*No relationships reported*

Non-motorized treadmills (NMT) allow for continuous self-selection of pace during time trials (TT). Belt resistance of NMT results in reduction in time-trial performance versus treadmill or road running, but the repeatability between NMT TT is not well-documented. **PURPOSE:** This study examined variability across three, 5-km time trials on a NMT (Curve 3.0, Woodway Inc., Waukesha, WI). **METHODS:** Eleven male runners (30 ± 10 y) with no previous experience running on the NMT, were instructed to cover 5-km on the NMT as quickly as possible on 3 occasions. Time was not expressed, but runners were informed of distance at each km and when 0.3 km remained. RPE, velocity, and power were assessed averaged for each kilometer. **RESULTS:** There was no main effect (p = 0.48) for trial number based on completion time, but mean finishing time was 22 s slower during the TT2 versus TT1. Intraclass correlation was high for TT1-TT2 (ICC = 0.95), but improved for TT2-TT3 (ICC = 0.99). Bland-Altman plots reveal the 95% upper and lower levels of agreement were -116 to 63 s. Main effects were found for time but not trial on RPE, velocity, or power based on trial when data was broken down into 1-km intervals. **CONCLUSION:** Despite a lack of statistical significance between time trials, there was a trend in the data for runners to start TT2 with a more cautionary pace for the first 2-km. Multiple participants anecdotally reported posterior leg muscle fatigue that they were unaccustomed to experiencing during road or motorized treadmill running, possibly explain the pacing modification. When NMT are used for performance testing of 5-km distance, we suggest a familiarization TT be initiated before experimental treatment sessions.
The push-up is a classic exercise that is used to strengthen the upper body. It is popular because it is a body weight exercise which can be modified to accommodate different ability levels. The push-up is also used to assess muscular endurance during fitness testing. Though several standardized protocols have been established, there are still execution related issues that have not been fully examined to date, which may affect interpretation of testing and training outcomes. PURPOSE: To study the effects of cadence on performance and electromyographic (EMG) activity of the pectoralis major and triceps brachii during a push-up exercise to failure in young and healthy college males. METHODS: Thirteen subjects (age = 22.5 ± 3.4 years) recruited for this study. Height, weight and body composition were measured. Subjects completed one set of push-ups to failure at the following cadence during 5 randomly assigned sessions: (1) 120 beats per minute (bpm), (2) 60 bpm, (3) 40 bpm, (4) 30 bpm, (5) self-selected pace (SSP). EMG activity of the right pectoralis major and right triceps brachii were recorded during each session. Repeated measures ANOVA were used to determine differences between sessions. RESULTS: Subjects completed 35.15 ± (17.70) push-ups at the self-selected pace, 23.15 ± (13.99) at the 30 bpm, 25.23 ± (12.83) at 40 bpm, 28.31 ± (12.89) at 60 bpm and 31.31 ± (15.04) at 120 bpm. The total number of completed repetitions was significantly different between sessions. SSP, which equated to self-selected pace, was different from both the 30 and 60 bpm (p < 0.05). Push-ups performed at 120 bpm was greater than 30 bpm (p = .019). Push-ups performed at 60 bpm was greater than 40 bpm (p = .001). There were no differences in the EMG activity of the pectoralis major or triceps brachii between the 5 cadence sessions. CONCLUSIONS: Young and healthy college-age subjects performed more push-ups to failure at a self-selected pace compared to slower cadences without differences in EMG activity in the pectoralis major or triceps brachii. Self-selected pace appears to be optimal in terms of push-up performance compared to slower cadences and supports self-selected for testing purposes. However, additional work is necessary to investigate higher cadences, additional muscles, and energy costs at different speeds.
Using visual cues such as colors along with the standardized numerical and verbal descriptors in OMNI scales may be more appealing to an exercise cohort to measure perceived exertion accurately. Purpose: To examine the concurrent and construct validity of a newly developed 10-point OMNI Ratings of Perceived Exertion (RPE) Colored Scale (OMNI-Color) in young adult women and men. Methods: 40 subjects (age (yrs): 22.75 ± 1.79; weight (kg): 60.05 ± 10.67; height (cm): 167.12 ± 5.87) participated in a cross-sectional, perceptual estimation paradigm to assess exertional perception via two exercise protocols: a load-incremented cycle ergometer protocol (n = 20) and a progressive graded treadmill protocol (n = 20). Equal number of participants of each gender were recruited for each study and all participants undertook the respective protocols on two separate trials, one week apart. Oxygen uptake (VO2; ml·kg·1·min−1), heart rate (HR; beats·min−1) and RPE were recorded at each exercise stage. RPE was estimated with the OMNI-Color and either the OMNI Adult Walk/Run Scale (OMNI-WS) or the Adult OMNI Scale of Perceived Exertion for Cycle Ergometer Exercise (OMNI-Cycle) in a counterbalanced and randomized manner for respective studies. Correlations between the scales were used to examine the construct validity. Concurrent validity was evaluated with correlations between the RPE values of OMNI-Color, and both VO2 and HR. Results: Linear regression analyses showed that the RPE derived from the OMNI-Color distributed as a positive linear function for both VO2 and HR (r = 0.97 to 0.99, p < 0.05) for total cohort. In the cycle ergometer protocol, RPE derived from the OMNI-Color distributed as a linear function of the OMNI-Cycle (r = 0.996 to 0.998, p < 0.01) for both genders. In the progressive graded treadmill protocol, RPE derived from the OMNI-Color distributed as a linear function of the OMNI-WS (r = 0.998 to 0.999, p < 0.05) for both genders. Independent sample t-tests found no significant differences between OMNI-Color and OMNI-Cycle or OMNI-WS. Conclusion: Both concurrent and construct validity were established for the OMNI-Color. OMNI-Color may be used as an alternative scale to measure RPE during exercise, regardless of modality. Future research can further explore the scale’s validity and applicability to other populations.

Self-paced VO2max tests (SPV) are a fairly recent development in cardiorespiratory testing. SPV’s have been considered valid for measuring VO2max, however, other measurements such as ventilatory threshold (VT) are also important when completing such cardiorespiratory testing and have not been adequately studied. It has been suggested that VT cannot be measured during SPV. PURPOSE: The purpose of this study was to determine whether the first VT (VT1) and second VT (VT2) could be identified during an SPV and how it compared to VT1 and VT2 determined during a Bruce protocol. It was hypothesized that VT1 and VT2 could be determined during SPV and would not be different than the VT1 and VT2 identified during the Bruce protocol.

METHODS: 10 healthy, recreationally active subjects (9 male, 1 female, 25.4 ± 9.0 years) completed SPV and Bruce protocols on the same treadmill in random order. Gas sampling was processed as 15 breath moving averages. VT1 and VT2 were determined by identifying breaks in the VE, VE/VO2, P50, VE/VO2 and P50CO2 versus time slopes as well as the VE versus VCO2 slope. The researcher analyzing VT was not involved in testing and was blind to the protocol. VT1 and VT2 was expressed as a percentage of the maximal VO2 (%VO2max) attained during the respective protocol. Paired t-tests were used to identify differences between protocols for VO2max, VT1 and VT2. RESULTS: VO2max was not different between Bruce and SPV protocols (55.5 ± 5.5 vs 56.6 ± 4.5 ml·kg·1·min−1, respectively, p = 0.15). Five tests (4 during SPV) produced atypical slopes and VT2 identification was difficult. VT1 occurred at a higher %VO2max in SPV (41.1 ± 8.1 SPV vs 32.2 ± 7.4 Bruce, p = 0.005) as did VT2 (86.4 ± 7.5 SPV vs 67.8 ± 8.9 Bruce, p = 0.001). CONCLUSIONS: SPV allowed subjects to alter their pace and their ventilatory responses making it more difficult to identify VT. Higher VT in SPV is in contrast to recent research. The magnitude of difference in VT may be due to both the difficulty in identifying VT in SPV and also the potential for SPV to allow subjects to alter their metabolic requirements and postpone anaerobiosis. Measurement of blood lactate throughout testing is needed to aid in the validation of VT in SPV.

Recent scientific studies have examined the connection between physical fitness tests and NHL draft success (Bur, 2008). Others examined correlation of physiological lab test results and measures such as plus/minus score and skating speed in collegiate hockey players (Peyer, 2011). PURPOSE: To determine if laboratory physiological test results correlate to on ice measures obtained from a wearable sensor including accelerations, heart rate and breathing rate. METHODS: Seven NCAA division III hockey players consented to procedures approved by Adrian College Human Subjects Committee. Lab tests including the Wingate, treadmill running VO2max and lactate threshold were performed four times periodically throughout the five-month hockey season. The Wingate was used to determine mean power (MP), peak power (PP), and anaerobic fatigue (AF) values. Treadmill VO2max tests were performed using procedures previously validated (Peyer, 2011), which provided VO2max and time on treadmill variables. Aside from VO2max and lactate threshold, V2 Lac (lactate levels at end of VO2Max test) and V2 Lac P1 (levels one minute after test) were also determined. On-ice measures were obtained from wearable sensors (Zephyr, MD), which consisted of a triaxial accelerometer, as well as HR and breathing rate (BR) monitor. Accelerations were used to calculate Mechanical Intensity (MI), which reflected cumulative and instantaneous accelerations and Load (ML), which reflected cumulative accelerations over time. HR and BR were used to calculate instantaneous physiological intensity (PI) and physiological load (PL) an accumulation of these physiological values over the session. Statistical analyses were performed using SPSS 21.0 (IBM, NY) RESULTS: The strongest correlations were observed between Wingate variables AF and MI (0.60, p < 0.001), PP and MI (0.54, p< 0.001), AF and ML (0.58, p < 0.001). Strong inverse correlations were observed between ML and both V2 Lac (-0.512, p<0.001) and V2 Lac P1 (0.544, p<0.001). CONCLUSION: There are positive correlations between laboratory measures of anaerobic fitness and on-ice accelerations. Further,
lower lactate accumulation following a VO2max test is associated with the ability to generate higher cumulative accelerations during on-ice sessions among NCAA DIII hockey players.

**PURPOSE:** The purpose of this study was to compare on-ice physiological measures to pre- and post-season off-ice physiological laboratory tests to determine i) the relationship between off-ice tests and on-ice performance and ii) changes over the course of a season among collegiate ice-hockey players. **METHODS:** Seven NCAA D III male ice hockey players (age 22 ±0.5, weight 87.89kg ±6.1kg, height 185.4cm ±3.4 cm) participated in procedures approved by the Adrian College Human Subjects Committee. Laboratory tests including the Wingate anaerobic test, treadmill VO2max, and lactate threshold tests, were performed at the beginning and end of the 5 month hockey season. Peak power output (PP), mean power output (MP), and anaerobic fatigue (AF) were assessed by the Wingate test. VO2max, previously validated among ice hockey players, was used to obtain VO2peak values and time on treadmill. Lactate levels were also measured at the end of the VO2max test (V2 Lact) and one minute after the completion of the test (V2 Lact P1). Subjects wore a Zephyr bioharness (Zephyr, MD) to measure on-ice physiological exertions during all practices and games. The sensor measured triaxial accelerations, breathing rate, and heart rate. Statistics were performed using SPSS 21.0 (IBM, NY). Season-long measures were divided into quartiles to correspond to laboratory testing. Data from the sensors from the first and last quartiles was compared to pre- and post-season lab tests. **RESULTS:** There were no significant differences from pre- to post-season among any laboratory tests. In contrast, there were significant decreases in average on-ice accelerations at 10, 20, 30 and 60 seconds (p<.05). There were non-significant changes in average accelerations over 20 minutes, while average accelerations over 45 minutes significantly increased (p<.05). **CONCLUSION:** The increase in average accelerations over 45 minutes from pre- to post-season suggest an increase in on-ice aerobic fitness. The decrease in average accelerations during anaerobic measures at 10 to 60 seconds suggest decreased anaerobic capacity of the subjects that were not identified by Wingate tests. Wearable sensors may provide additional information to laboratory testing for the assessment of physiological changes across a season among collegiate hockey players.

**Body Weight-supported Treadmill And Standard Treadmill Exercise**

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**No relationships reported.**

Treadmills that partially support body weight are used in some rehabilitation settings. Cardiorespiratory responses to this type of exercise have been reported in very few published studies.

**PURPOSE:** To determine the cardiorespiratory response to graded exercise on a standard treadmill (ST) and body weight-supported treadmill (BWST). **METHODS:** In random order, 20-36 yr old adults (n = 6 males, 4 females) performed BWST and ST trials. Identical exercise sessions were performed on each treadmill except 25% of body weight was supported by the BWST. On each treadmill a two-minute warm up was performed at 2 mph and 0% grade, followed by 6 minutes of exercise at 3% grade at each of the following treadmill velocities: 3, 4.5, and 6 mph. Expired respiratory gases were analyzed each minute. Steady state heart rate, VO2, VCO2, and RER were calculated as the average value during the final three minutes of each exercise stage. Blood pressure and RPE were recorded during the final minute of each stage. A 2x3 repeated measures ANOVA was used to determine significant differences at the p<.05 level, and the LSD method for post hoc analyses. **RESULTS:** There was a significant difference (p<.05) in absolute VO2 between ST and BWST at 4.5 mph (2.14±.39 v 1.42±.27 l·min⁻¹) and 5 mph (2.75±.58 v 1.79±.41 l·min⁻¹). VO2peak was significantly different (p<.05) at each exercise intensity between treadmills (ST v BWST: 16.0±1.1 v 13.6±1.2; 31.2±2.0 v 20.6±2.4; 39.8±1.9 v 25.8±2.9 ml·kg⁻¹·min⁻¹). There was a significant difference (p<.05) in RER between ST and BWST at 4.5 mph (1.0±.1 v 1.2±.1; 1.3±.1 v 1.2±.1 ml·kg⁻¹·min⁻¹). There was a significant difference (p<.05) in RER between ST and BWST at 4.5 mph (1.3±.1 v 1.2±.1 l·min⁻¹). There was a significant difference (p<.05) in RER between ST and BWST at 4.5 mph (1.2±.1 v 1.1±.1 l·min⁻¹). There was a significant difference (p<.05) in SBP on the ST (144±20 v 126±25 v 175±22 mmHg) and BWST (128±11 v 143±13 v 155±16 mmHg) at each exercise intensity. There were no significant differences in DBP at any point during exercise. There was a significant difference (p<.05) in RPE on the ST at 6 mph (15±1.5, 4.5±1.2 l·min⁻¹, and 1.3±0.9). **CONCLUSION:** There appears to be a lower cardiorespiratory response during body weight-supported exercise and traditional treadmill exercise.

**Agreement Between Electromyographic Fatigue And Ventilatory Thresholds During Taekwondo Specific Test**

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**No relationships reported.**

**PURPOSE:** The aim of the present study is to compare electromyographic fatigue and ventilatory thresholds during taekwondo specific test. **METHODS:** 10 male taekwondo athletes (20± 2yrs, body mass 67.5±6.3kg, height 176±9cm) participated in the study. The University ethics committee approved the study (opinion #765.698). At first visit, anthropometric assessment and TKDet were performed. TKDet were constituted by 1-min progressive stages of kicking sequences, and kicking interval started from 4.6s and reduced 0.4s every minute until participant’s fatigue. Expired gases were measured continuously with portable analyzer VO2max (MediGasR, Saint Louis, USA). Ventilatory thresholds were determined with the ventilatory equivalents method. Vo2peak was measured with the wireless EMG system connected to a pair of surface electrodes placed in the rectus femoris, according to SENIAM recommendations. EMG signal was recorded continuously during the tests with a frequency of 2000 Hz. EMG was filtered by third order Butterworth band-pass filter. RMS values were calculated during every non-sustaining posing windows with 1s duration. EMG thresholds were detected by both power regression (two inflections - three segments line). Parametric data were described by mean and standard deviation, 95% confidence interval of mean and compared with Paired T-test (effect size Cohen’s d). Non-parametric data were described by median and interquartile range, 95% confidence interval of median and compared with Wilcoxon test (effect size z<1.6). The coefficient of variation error of measurement were reported to describe data variability, and intraclass correlation coefficient was calculated to determine the agreement. P < 0.05 was adopted for all tests. **RESULTS:** Detailed results were presented in table 1.
CONCLUSIONS: Although the VO2 values are similar, these methods may not be interchangeable to determine training zones. Supported by CAPES, CNPq, and FAPERJ.

Table 1. Comparison of heart-rate/resistance exercise test and electromyographic fatigue and ventilatory thresholds (n=15)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Mean (SD)</th>
<th>Mean (SD)</th>
<th>CV%</th>
<th>SWD%</th>
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<tr>
<td>VO2</td>
<td>22.4</td>
<td>18.5</td>
<td>17.7</td>
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<td>6.6</td>
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<tr>
<td>RFD/kg</td>
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<td>8.2</td>
<td>8.3</td>
<td>11.0</td>
<td>7.9</td>
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<tr>
<td>RSImod</td>
<td>22.4</td>
<td>20.4</td>
<td>19.7</td>
<td>7.7</td>
<td>5.8</td>
</tr>
</tbody>
</table>

- **Mean (SD)**: Mean and standard deviation of VO2, RFD/kg, and RSImod for each group.
- **CV%**: Coefficient of variation for VO2, RFD/kg, and RSImod.
- **SWD%**: Standard deviation of the mean for VO2, RFD/kg, and RSImod.

Reactive strength index modified (RSImod) has gained awareness as a means of assessing and monitoring explosive movement performance among athletes. RSImod utilizes time-to-take-off (TT) and vertical jump height (VJ) to assess the explosive power of an athlete. Despite its wide spread use, the degree of improvement in RSImod necessary to mark a real improvement versus random variation has not been well established. PURPOSE: To determine reliability and smallest worthwhile difference (SWD) in RSImod in college athletes. METHODS: Seventy-three NCAA Division-I male (n = 59) and female (n = 16) athletes volunteered to participate. Two countermovement VJ trials were recorded from dual force plates with data processed using METLAB. To control arm movement, hands grasp a PVC tube placed across shoulders behind the neck. VJ height was calculated from flight time. TT was estimated as the duration from the start of the jump (first negative deflection of 10N below the force record associated with the countermovement) to take-off from the force plate. RSImod was calculated as the VJ height divided by TT. Peak force (PF/kg) and power (PP/kg) relative to body mass was determined force recording rates. Rate of force development (RFD) was determined from peak force per unit time during the vertical movement and the peak (PRFD) was recorded. RESULTS: TT, PF/kg, PP/kg, and RFD were not significantly different between trials. Interclass correlation coefficients ranged from 0.83 for PRFD to 0.92 for PF/kg. Men had significantly higher RSImod (0.01 ± 0.00) and PP/kg (55.3 ± 14.4 N/kg) than women (0.34 ± 0.08 and 46.2 ± 6.7 N/kg), but TT was significantly shorter in women (0.79 ± 0.13 s) than men (0.96 ± 0.10). RFD/kg was not significantly different between men (170.0 ± 50.8 N/kg) and women (99.9 ± 39.7 N/kg). CV% ranged from 3.4% for PF/kg to 18.3% for RFD/kg with RSImod being 7.9%. SDW% ranged from 10.8% for PF/kg to 59.5% for PRFD, with RSImod being 22.4%. CV% and SWD% for RSImod were 7.7% and 21.9%. CONCLUSIONS: Given the variation and relatively high SWD% and the between trial difference in RSImod, the novelty of the test protocol may warrant familiarization sessions prior to actual measurement to insure more consistent values among trials despite ICC values that appear acceptable.

Assessment of barbell velocity during resistance training is an effective tool to gauge progress in strength and power and to manage intra-session fatigue. The criterion measurements of velocity are 3D motion capture or force plate systems; however, the cost of these implementations is extraordinary and impractical. Therefore, linear position transducers (LPTs) are commonly used for velocity calculation. Specifically, the TENDO Weighlifting Analyzer System (TWAS), which costs >$1,000 is widely used. However, the Open Barbell System (OBS) LPT was recently developed for a cost of <$300.

**PURPOSE:** To investigate if average concentric velocity calculations during the barbell bar squat via the TWAS and OBS were valid compared to the Optotak Certus 3D (OC3D) motion capture system. METHODS: Twenty-Five males (Age: 25±3yrs, Body Mass: 90.1±14.7kg, Body Fat Percentage: 12.9±4.5%) performed a one- repetition maximum (IRM) back squat followed by one set of maximum repetitions at 70% of the established IRM. Average velocity (AV) was calculated on every IRM attempt and every repetition at 70% of IRM with the OC3D, TWAS, and OBS. For OC3D, AV was calculated from the observed y-coordinates (i.e. vertical position) via post-process coding in the MATLAB program. Both LPTs were attached to the right side of the barbell via Velcro strap, and AV was displayed immediately upon completion of the lift for the LPTs. Independent samples t-tests between each LPT and OC3D were used to compare AVs between devices. To assess agreement between LPTs and OC3D, intraclass correlation coefficients (ICCs) and 95% confidence intervals (CI) were calculated. Significance was set at p<0.05.

**RESULTS:** The number of usable samples from all IRM squat attempts and repetitions at 70% of IRM were as follows: OC3D-522, TWAS-573, and OBS-558. There was no difference for AV between OC3D vs. TWAS (p=0.54) or OC3D vs. OBS (p=0.48). Regarding ICCs the OBS had an ICC of 0.936 in comparison to OC3D with a 95% CI of 0.914-0.952; while TWAS had an ICC of 0.870 compared to OC3D with a 95% CI of 0.830-0.899. CONCLUSION: Our results indicate that ICC values and CIs associated with the OBS show better validity in comparison to the criterion OC3D for AV than does TWAS. Therefore, the OBS is an effective low-cost option to assess AV during resistance training.

The portable metabolic analyzer (MA) has been commonly utilized in assessing sport- or physical activity related energy expenditure. However, little is known about the validity of the portable MA. **PURPOSE:** To determine the accuracy of oxygen consumption (VO2) and carbon dioxide (VCO2) production measured by the portable MA, Oxycon Mobile 5.0 (OM) using the Parvo Medic TrueOne 2400 metabolic cart (MC) as a criterion measurement. METHODS: A total of 19 participants (age: 19-45 yrs) completed the same exercise protocols during the two separate visits. The metabolic analyzers (i.e. OM and MC) were randomly assigned for the visit. The exercise protocol included 15 mins for resting (laying down), 5 mins for sitting, standing, 3 mph, 4 mph, 5 mph, 6 mph running, and 2.5 mph cool down with a minute break between each activity. Measures of VO2 and VCO2 from OM were statistically compared to the values from the MA. Pearson correlation was calculated to identify the measurement relationship between the MA and the MC. Mean absolute percentage error (MAPE) was calculated to examine the measurement error of OM. Cohen’s D was calculated to investigate the effect size of the measurement difference. **RESULTS:** The strong overall agreements of VO2 and VCO2 between the OM [r=0.94 (p<0.01) and MC [r=0.96 (p<0.01)] were observed. For each stage of the exercise protocol, Pearson r of VO2 and VCO2 measurement between the OM and MC were 0.33 and 0.34 for resting, 0.26 and 0.31 for sitting, 0.28 and 0.33 for standing, 0.57 and 0.30 for 3mph, 0.68 and 0.53 for 4mph, 0.74 and 0.63 for 5mph, 0.78 and 0.76 for 6mph, 0.70 and 0.47 for 2.5mph cool down. Calculated MAPEs of VO2 and VCO2 for each stage are as follow: 19.22%, 13.06% for resting, 14.49%, 7.53% for sitting, 6.32%, 0.19% for standing, 10.78%, 8.70% for 3mph running, 7.49%, 5.23% for 4mph running, 4.23%, 1.22% for 5mph running, 3.87%, 0.47% for 6mph running, 3.34%, 4.34% for 2.5mph cool down. Effect size for VO2 and VCO2 were 0.78 and 0.43 for resting, 0.54 and 0.23 for sitting, 0.27 and 0.01 for standing, 0.44 and 0.33 for 3mph, 0.34 and 0.22 for 4mph, and 0.74 and 0.63 for 5mph running.
for 4mph, 0.19 and 0.04 for 5mph, 0.19 and 0.02 for 6mph, 0.11 and 0.11 for 2.5mph cool down. CONCLUSIONS: VO₂ and VCO₂ measured in walking and running (running 3, 4, 5, 6mph) were more valid than the light physical activities (i.e., laying down, sitting, and standing).

The push-up (PPU) is an explosive upper-body test performed on a force plate and has recently replaced the bench press test in high school football combine such as the U.S. Army National Combine and Under Armour All-American Combine. PURPOSES: Compare the PPU test performed from the knees versus the toes across all age groups. Two-way ANOVAs (position x age) were performed, while intraclass correlation coefficients (ICC), standard errors of measurement (SEM), coefficients of variation (CV), and minimum detectable changes (MDC) were calculated. RESULTS: PF, pRFD, and PP were greater from the knees for the 10-11 and 12-15 yr groups, whereas AP was greater (p < 0.05) from the knees for all age groups. PF and pRFD were greater (p ≤ 0.05) in 12-15 yr than 6-9 and 10-11 yr from the knees and the toes. Table 1 shows the mean values and test-retest reliability metrics. CONCLUSIONS: PF, pRFD, AP, and PP were greater from the knees than the toes, and the oldest age group (12-15 yr) demonstrated the highest PF and pRFD values. However, the only consistently reliable measure was PF when the PPU test was performed from the knees in 10 to 15-year-olds. pRFD was also reliable from the toes in young male athletes.

Muscular endurance resistance training (MERT) has been shown to improve the onset of blood lactate accumulation (OBLA). It has been speculated that improvements in OBLA following MERT is related to metabolic adaptations associated with continued exposure to increased blood lactate concentrations. PURPOSE: The purpose of this study was to investigate metabolic responses during each training session of a 4 week MERT program in aerobically trained males. METHODS: 17 males, ages 18-45, participated in this study. Subjects were randomly assigned to either an experimental (EX) or control (CON) group, 9 EX and 8 CON. Baseline measures included VO₂max and OBLA using a cycle ergometer, and 1 repetition maximum (IRM) for: leg press (LP), leg curl (LC), and leg extension (LE). The EX group performed MERT 4 sets of 12-15 repetitions at 50% of IRM for LP, LC, and LE for 4 weeks with 2 sessions per week. Resistance was increased after 4 sessions to accommodate any potential strength gains. Pre and post blood lactate concentrations were measured for each MERT session. Both groups were instructed to maintain current aerobic training throughout the study with participants returning to the lab to repeat baseline measures. T-tests were used to determine if significant between group differences existed using delta scores (post-pre). RESULTS: No significant differences in baseline measurements were observed (p>0.05). No significant group differences were observed for VO₂max, OBLA, LP, and LE. However, significant group differences were observed for LC (kgs) (EX 9.2±1.5 vs. CON -0.14±1.5). The average blood lactate response (mM) for the first 4 MERT sessions ranged from 7.0±0.7 to 13.8±1.7 and the last 4 sessions ranged 8.23±0.95 to 13.8±0.76. CONCLUSIONS: 4 weeks of MERT did not significantly improve VO₂max, OBLA, LP, and LE but did improve LC. Although subjects performed all MERT at the same percentage of IRM a large range of lactate responses were observed between subjects. The range in lactate responses suggest that the relative intensity of the exercise and metabolic responses were not the same between subjects. It may be more appropriate to assign training load with MERT based on lactate response to ensure similar metabolic responses between subjects.

Physical activity tracking wearables have emerged as a popular method for consumers to assess their daily activity, calories expended and heart rate. However, less is known if these health measures are valid at various levels of exercise intensity.

PURPOSE: To examine heart rate (HR) and energy expenditure (EE) validity of three popular wrist-worn activity monitors at different exercise intensities.

METHODS: 62 participants (36 females, 46.8% non-white) wore the Apple Watch (AW), Fitbit Charge HR (FCHR) and Garmin Forerunner 225 (GF). Validity was assessed by 2 criterion devices: HR chest strap and a metabolic cart. Participants completed a 10-min seated baseline; separate 4-min stages of light, moderate and vigorous-intensity treadmill exercises; and a 10-min seated recovery. Data from devices were compared to each criterion via two-way RM-ANOV A and Bland-Altman analysis. Differences were expressed in mean absolute percentage error (MAPE).

RESULTS: AW - HR MAPE between 7.87-24.38%. HR not significantly different at the start (p = .13), baseline (p = .76) or vigorous intensity (p = .84). Lower HR readings during light (p = .05), moderate (p < .01) and recovery (p < .01). EE MAPE between 14.07-210.84%. Measured higher EE at all stages (p < .01). FCHR - HR MAPE between 23.38-16.99%. HR not significantly different at start (p = .43) or moderate intensity (p = .34). Lower HR readings during baseline, vigorous and recovery (p < .001) and higher HR in light (p < .001). EE MAPE between 16.85-84.98%. Measured higher EE at baseline (p < .05), light (p < .001) and moderate (p < .001). GF - HR MAPE between 7.87-24.38%. HR not significantly different
at vigorous intensity (p < .35). Measured higher HR readings start, baseline, light, moderate (p < .001) and recovery (p < .05). EE MAPE between 30.77-155.05%. Measured higher EE at all stages (p < .001).

CONCLUSION: This study provides one of the first validation assessments for the Fitbit Charge HR, Apple Watch and Garmin Forerunner 225. An advantage and novel approach of the study is the examination of HR and EE at specific PA intensities. Establishing validity of wearables is of particular interest as these devices are being used in weight-loss interventions and could impact findings. Future research should investigate why differences exist between exercise intensities and the devices exist.

INTRODUCTION: While hip accelerometer has traditionally been considered the gold standard in the measurement of physical activity, wrist-worn devices have gained popularity in both research and consumer markets. The relationships between these measurements are not well characterized.

PURPOSE: To compare acceleration measurements between hip- and wrist-worn devices in young (EFY) and middle-aged (MA) children and women.

METHODS: 37 healthy, non-smoking, Y (18-39 years; 10M,10F) and MA (40-65 years; 8M,9F) adults participated in this one-visit, observational study. Participants wore a triaxial accelerometer on their non-dominant wrist and corresponding hip during a series of 14 well-defined, but varied-intensity common activities. Three-way mixed repeated measures ANOVAs (age by sex by device location) were used to assess cohort differences in accelerations for each activity, with movement speed as a covariate when appropriate (e.g. self-selected walking velocity). Significance was set at p ≤ 0.005 to adjust for multiple comparisons.

RESULTS: After correcting for self-selected walking speed, over-ground walking accelerations were approximately 50% greater in women compared to men in both age groups (p = 0.004, effect size, d = 1.2) despite no difference in hip accelerations (p = 0.15). Accelerations for other activities did not differ by sex (p > 0.03). MA adults demonstrated greater accelerations than Y adults (p = 0.005; d = 0.82) with wiping but no other tasks (p > 0.05). Wrist accelerations were often measured to be greater than hip but not consistently so.

CONCLUSIONS: Hip and wrist accelerations demonstrated few sex and age differences and were not consistently related to each other. The sex difference in wrist accelerations suggests lifestyle physical activity may be underestimated in women using wrist accelerometry. The inconsistent relationship between hip and wrist accelerations suggests previous hip cut points cannot be reliably used for wrist assessments.

RESEARCH SUPPORT: In part by the Physical Therapy & Rehabilitation Department, University of Iowa; NIH Grant U1M AR06338; and the U.S. Army.

DISCLAIMER: The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or reflecting the views of the Army or the Department of Defense.

PURPOSE: The purpose of this study was to ascertain the degree of tracking of physical fitness between SG and GG was observed in girls. The overall physical fitness was significantly higher in SG than in CG (p < .001).

CONCLUSIONS: These results suggest that characteristics of physical fitness at the age of 12 were strongly influenced by the overall physical fitness at the age of 5 in both boys and girls. Analysis of anti-tracking results did not show a big effect. In particular, it was remarkable in boys. Supported by Grant-in-Aid for Scientific Research (B) (No.16H03271) from Ministry of Education, Culture, Sports, Science and Technology in Japan.

INTRODUCTION: Possibility of Anti-tracking In part by the Physical Therapy & Rehabilitation Department, University of Iowa; NIH Grant U1M AR06338; and the U.S. Army.

CONCLUSIONS: These results suggest that players are required to complete more high intensity bouts in a shorter time period (37.8±14.0 min vs. 51.9±17.8 min) however average total distance was less under the new IHF rules. Supported by NSSFC and Xinniao Project through key project 13BTY049 and 2016R04593.

A variety of activity trackers with evolving technology are commercially available, yet it remains uncertain the influence body size has on these devices’ accuracy (as previous activity trackers have been), which would compromise their generalizability. PURPOSE: To examine the accuracy of consumer-grade activity trackers in quantifying steps and moderate-to-vigorous physical activity (MVPA) engagement in free-living conditions in a diverse sample of body mass index (BMI) categories.

METHODS: Sixty individuals (21.1 ± 1.5 years, 2.3 ± 0.2 ft stride length) across three BMI categories (“Normal” [n = 25]: 20-24.9 kg/m²; “Overweight” [n = 25]: 25-29.9 kg/m²; “Obese” [n = 13]: ≥30 kg/m²) wore four activity trackers during one 24-hour day (wear time 12.7 ± 1.9 hours). On the dominant side of the body, the Fitbit Charge HR (Charge) and Jawbone UP3 (UP3) were worn on the wrist and the Fitbit One (ONE) on the waist, with the NL1000 activity tracker (NL; serving as the criterion device) worn on the dominant side of the wrist. Mixed-within-between ANOVA analyses were performed to examine differences in steps and MVPA for the activity tracker across three BMI categories. RESULTS: There were no differences in steps or MVPA for the individual devices across BMI categories. In the Normal group, the UP3 (6667 ± 3366 steps) and ONE (7400 ± 8135 steps) underestimated steps (p > .005), compared to the NL (8135 ± 3562 steps). Similarly, in the Overweight group, the UP3 (8799 ± 3986 steps) and ONE (9019 ± 3841 steps) underestimated steps (NL 9312 ± 3986 steps, both p < .05). In the Obese group the Charge overestimated...
Smart watches have greatly evolved since their first release. With advancements in technology, many smart watches can now estimate aerobic capacity. These watches are user-friendly and affordable but there are no current investigations that have reported accuracy of aerobic capacity. PURPOSE: The purpose of this study was to compare actual VO2max values (AMax) to predicted VO2max values obtained from the Garmin Forerunner 230 (230Max) and 235 and V800 Polar smart watch (PMax). The Garmin watches predict VO2max based upon heart rate values obtained during a 10 min, self-paced outdoor run. The Polar watch predicts VO2max based upon resting heart rate variability. METHODS: Eighteen females (BMI=24.9 ± 3.3 kg/m², age=24.7 ± 3.8, AMax=42.9 ± 4.8 ml/kg/min) and 24 males (BMI=26.6 ± 3.8 kg/m², age=24.2 ± 4.1, AMax=49.5 ± 5.6 ml/kg/min) participated in this study. PMax values for each individual were obtained following a 10 min supine rest and were based upon the different training ranges that can be programmed into the watch. Participants then completed a treadmill VO2max test. Within 48 hours of completing the treadmill VO2max test, individuals completed a 10 min, self-paced outdoor run using both Garmin smart watches. Paired sample T-tests were used to determine if there were differences between AMax and predicted VO2max values of each watch. RESULTS: There were significant differences between AMax and PMax (2.5 ± 6.8 ml/kg/min, p=0.029), 230Max (0.3 ± 3.4 ml/kg/min, p=0.002) and 235Max (-1.1 ± 4.0 ml/kg/min, p=0.026) in females. In males there were significant differences between AMax values and PMax values for each individual were obtained following a 10 min supine rest and were based upon the different training ranges that can be programmed into the watch. There were significant differences between AMax and PMax (2.5 ± 6.8 ml/kg/min, p=0.029), 230Max (0.3 ± 3.4 ml/kg/min, p=0.002) and 235Max (-1.1 ± 4.0 ml/kg/min, p=0.002). CONCLUSION: In females, predicted VO2max values were significantly different from AMax values and the ranges differed from a mean of 2.5 ml/kg/min to an underestimation of 1.1 ml/kg/min. In males, predicted VO2max values were significantly different from AMax values and the watches consistently overestimated VO2max range (-1.1 to -6.0 ml/kg/min). Caution should be taken when using these predicted values for exercise prescription especially in men.

The use of optical sensing technology has provided exercise watches with the ability to assess heart rate without the need of a chest strap. The Garmin Forerunner 230 (G230) and 235 (G235) are identical watches with the exception that the G235 uses a chest strap to measure heart rate (HR) and the G235 measures HR via an optical sensor built into the watch. The use of a chest strap to measure exercise HR is a proven and reliable technology whereas the use of an optical sensor to measure exercise HR is still a developing technology. Both watches provide an estimate of VO2max (PMax) based upon distance run and HR measured during a self-paced run. Average HR (AHR), maximum HR (MHR), cadence, and kcals are also recorded. PURPOSE: The purpose of this study was to compare actual VO2max values (AMax) to predicted VO2max values obtained from the Garmin Forerunner 230 (230Max) and 235 and V800 Polar smart watch (PMax). The Garmin watches predict VO2max based upon heart rate values obtained during a 10 min, self-paced outdoor run. The Polar watch predicts VO2max based upon resting heart rate variability. METHODS: Eighteen females (BMI=24.9 ± 3.3 kg/m², age=24.7 ± 3.8, AMax=42.9 ± 4.8 ml/kg/min) and 24 males (BMI=26.6 ± 3.8 kg/m², age=24.2 ± 4.1, AMax=49.5 ± 5.6 ml/kg/min) participated in this study. PMax values for each individual were obtained following a 10 min supine rest and were based upon the different training ranges that can be programmed into the watch. Participants then completed a treadmill VO2max test. Within 48 hours of completing the treadmill VO2max test, individuals completed a 10 min, self-paced outdoor run using both Garmin smart watches. Paired sample T-tests were used to determine if there were differences between AMax and predicted VO2max values of each watch. RESULTS: There were significant differences between AMax and PMax (2.5 ± 6.8 ml/kg/min, p=0.029), 230Max (0.3 ± 3.4 ml/kg/min, p=0.002) and 235Max (-1.1 ± 4.0 ml/kg/min, p=0.002). CONCLUSION: In females, predicted VO2max values were significantly different from AMax values and the ranges differed from a mean of 2.5 ml/kg/min to an underestimation of 1.1 ml/kg/min. In males, predicted VO2max values were significantly different from AMax values and the watches consistently overestimated VO2max range (-1.1 to -6.0 ml/kg/min). Caution should be taken when using these predicted values for exercise prescription especially in men.

Garmin Forerunner 230 And 235

Comparison Of Vo2Max Values Obtained From The Garmin Forerunner 230 And 235

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(No relationships reported)

Accuracy of Garmin and Polar Smart Watches to Predict VO2max

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(No relationships reported)

Accuracy of Wearable Devices for Determining Physiological Measures during Different Physical Activities

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(No relationships reported)

Polar T-31. Values were compared to those from a six-lead ECG and metabolic measurements by accelerometer-based physical activity monitors is unknown. PURPOSE: We suggest that non-GPS distance measurements by commercial products may be useful for monitoring overall, cumulative volume for health and fitness purposes. However, these measurements fall short of GPS when high accuracy is needed, as in training programs designed to enhance performance. These findings cannot be generalized to all accelerometer devices.

The validity and agreement of running distance measurements by a commercially-available physical activity monitor to those of a personal GPS device during self-paced running.

METHODS: Twenty-four recreational runners (n = 12 females) wore a personal GPS (Garmin Forerunner 10, GPS) and commercially-available physical activity monitor (MOVbund accelerometer, MB) on the dominant wrist during three separate outdoor training runs. Participants followed their normal training schedules, such that the pace and duration of each run was voluntarily determined by the participant. The association between MB and GPS distance measurements was determined using Pearson’s correlation analysis. The 95% limits of agreement between MB and GPS were calculated according to the method of Bland and Altman. Specifically, the upper and lower limits of agreement were calculated as the mean of the differences (d) between GPS and MB ± (1.96 x the standard deviation of the differences), expressed as: d ± 1.96s.

RESULTS: There was a significant, positive association of a large effect size between measurements of distance by GPS and the commercially-available physical activity monitor (MB) (r = 0.763, p < 0.001). However, the calculated limits of agreement (-1.946 to 2.025km) between GPS and accelerometer measurements suggest that individual MB measurements may be up to 2km above or below GPS. CONCLUSION: We suggest that non-GPS distance measurements by commercially-available physical activity monitors may be useful for monitoring overall, cumulative volume for health and fitness purposes. However, these measurements fall short of GPS when high accuracy is needed, as in training programs designed to enhance performance. These findings cannot be generalized to all accelerometer devices.

PurposE: Wearable technology is ACSM’s number one 2016-2017 fitness trend. The accuracy of these devices has yet to be firmly established. The objective of the study was to determine the validity of wearable devices’ assessment of step count, heart rate (HR) and caloric expenditure (KCAL) during various physical activities. METHODS: Thirty college students (19 female, 11 male) engaged in 3 activity sessions (sweeping with a broom and dustpan, climbing stairs, and walking 1/4 mile) while wearing an Apple Watch Sport, Fitbit Charge HR, Accusplit Hip Pedometer, and Polar T-31. Values were compared to those from devices that were objectively recorded using a tally counter. Subjects also completed a treadmill graded exercise test during which HR and KCAL were reported by an Apple Watch Sport, Fitbit Charge HR, and Polar T-31. Values were compared to those from a six-lead ECG and metabolic analyzer. HR was recorded at rest and during each stage. KCAL was determined at the end of the protocol.

RESULTS: Correlations between objective step counts and from the devices were:

<table>
<thead>
<tr>
<th>Device</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple Watch</td>
<td>0.855</td>
</tr>
<tr>
<td>Fitbit Charge HR</td>
<td>0.848</td>
</tr>
<tr>
<td>Accusplit Hip Pedometer</td>
<td>0.763</td>
</tr>
<tr>
<td>Polar T-31</td>
<td>0.750</td>
</tr>
</tbody>
</table>

The 95% limits of agreement between MB and GPS ± (1.96 x the standard deviation of the differences), expressed as: d ± 1.96s.

RESULTS: There was a significant, positive association of a large effect size between measurements of distance by GPS and the commercially-available physical activity monitor (MB) (r = 0.763, p < 0.001). However, the calculated limits of agreement (-1.946 to 2.025km) between GPS and accelerometer measurements suggest that individual MB measurements may be up to 2km above or below GPS. CONCLUSION: We suggest that non-GPS distance measurements by commercially-available physical activity monitors may be useful for monitoring overall, cumulative volume for health and fitness purposes. However, these measurements fall short of GPS when high accuracy is needed, as in training programs designed to enhance performance. These findings cannot be generalized to all accelerometer devices.
was accurate across all activities. The most accurate devices for activities were: walking (Apple Watch, r = 0.84); stair climbing (iPhone, r = 0.90); sweeping (Fitbit, r = 0.70). During the treadmill test, correlations between HR assessed via ECG and devices were: Apple Watch (r = 0.76 to 0.99), Polar T31 (r = 0.72 to 0.94), and Fitbit (r = 0.19 to 0.98). Heart rate accuracy across the session was highest in the Apple Watch. KCAL from neither the Apple Watch (r = 0.63) nor Fitbit (r = 0.48) had a high correlation value to that from the metabolic analyzer.

CONCLUSIONS: Fitness-related values provided by wearable devices had varying levels of accuracy when compared to objective step counts, HR and KCAL assessed by calibrated scientific equipment. Accuracy of step counts varied by activity and was higher across activities in the iPhone. HR reported from wearable devices, similarly, had varying levels of accuracy, with the Apple Watch being most accurate across a graded exercise test. Fitness-related information from wearables that are not medical devices should be considered as a valuable and used for motivation. Further validation of these devices should include a variety of physical activity modalities.

2671 Board #191
June 2 9:30 AM - 11:00 AM
Validity Of The DiagnostixTM 2100 And Fitbit Charge HRTM In Assessing Heart Rate
Paige Hardeckopf, Charles Fountaine. University of Minnesota Duluth, Duluth, MN. (Sponsor: John R. Keener, FACSM)
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The importance of exercise intensity is an important factor when maximizing the health benefits that result from exercise. New innovations in consumer based activity trackers and electronic healthcare monitoring devices have been able to quantify the level of exercise intensity based on heart rate (HR) values. However, there is limited research assessing the validity of these devices. PURPOSE: To assess the validity of the Fitbit Charge HR (FB) and ACSC Diagnostix 2100 Fingertip Pulse Oximeter (PO) in assessing heart rate during exercise in comparison to the heart rate from an electrocardiogram (ECG).

METHODS: Healthy college students (n=30, 18 females) performed 1 min of standing rest, 10 min of the standard Bruce Protocol test on a treadmill, and a 2 min cool-down walk. Each participant simultaneously wore the FB on the right wrist, the PO on the right index finger, and had 10 electrodes placed on their chest for the 12-lead EKG. HR was recorded from each device every minute. Absolute differences between the 3 HR monitors were compared using repeated measures ANOVA. Pearson r correlation coefficients and Standard Error of Estimate (SEE) were calculated to determine the relationships between each HR monitor vs. EKG. RESULTS: Repeated measures ANOVA indicated a significant difference in HR between the 3 monitors, F(2,58) = 16.876, p = 0.001. Post hoc tests indicated a significant difference between EKG and FB (132.1 ± 13 vs. 120.5 ± 13.7 bpm, p = 0.001), and EKG and PO (132.1 ± 13 vs. 121.9 ± 15.5 bpm, p = 0.001). The correlation between the EKG and FB was r=0.64, p=0.001, SEE 10.2 bpm, whereas the correlation between EKG and PO was r=0.63, p=0.001, SEE 10.27 bpm. CONCLUSIONS: Large absolute differences and modest correlation values do not indicate a strong agreement between the FB or PO vs. EKG. Therefore, the extent of each device’s validity to monitor HR is questionable when compared to the gold standard EKG.

2672 Board #192
June 2 9:30 AM - 11:00 AM
Validity of the Fitbit® Distance Traveled Feature Among Multiple Speed Trials
Christina J. Marton. Gustavus Adolphus College, Saint Peter, MN.
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A science review by Delago (2014) suggested that the distance-traveled feature on Fitbit® was an accurate measurement. However, as speed increased the accuracy of the Fitbit® decreased meaning the faster the pace, the greater the error for each speed measured. Whereas a systematic review conducted by Evenson et al. (2015) reported only one study that measured the distance-traveled feature. This study concluded that the Fitbit® over-estimated at lower speeds and underestimated at faster speeds. PURPOSE: To examine whether the fitness device, Fitbit® Charge, provides an accurate measurement of the distance-traveled feature at various speeds and to expand on the research regarding the distance-traveled feature. METHODS: Twenty-eight healthy students from a Division III college participated in this study. A repeated measure ANOVA experimental design compared the Fitbit® distance-traveled output under three dependent variable speeds of 2.5mph (76.1m/min), 4.5mph (120.7m/min), and 6mph (160.9m/min) to a Quinton MedTrack ST35 treadmill distance-traveled measurement. All participants completed six minute trial for each of two different speeds on a treadmill while wearing the Fitbit® Charge. Following each six-minute trial, the distance-traveled was compared between the treadmill and the Fitbit® output. A repeated measure ANOVA analysis was used to test for significant differences (p < 0.05) among the three speeds between the Fitbit® and the treadmill. RESULTS: Results did not detect significant differences in distance-traveled between the Fitbit® Charge compared to the treadmill at 2.5mph (F(1,27) = 0.67, p = 0.42), 4.5mph (F(1,27) = 2.45, p = 0.13), or 6mph (F(1,27) = 0.43, p = 0.51). CONCLUSION: It seems reasonable to conclude that the distance-traveled feature on the Fitbit® Charge is valid when compared to treadmill output at these three speeds. Future research could look at a wider range of speeds to ensure further accuracy. IRB# 1516-0099
not equivalent at the ±10% equivalence zone. A Bland Altman plot was constructed to visualize the MDA data using 95% limits of agreement that are between -121.1 and 200.4. More details below the mean of the proportion bias that self-report overestimated activity.

**Conclusions:** This study provides some support for the use of the IPAQ, but confirms the common observation in self-report instruments with participants tendency to overestimate their participation in MDA and underestimate sedentary time. The use of measurement error modeling and calibration methods may be needed to address this error in future studies.

**2677**  **Board #197**  **June 2 9:30 AM - 11:00 AM**  **Assessing Physiological Function During a High-Altitude Hike Using Real-time Monitoring**

Nicholas Fox¹, John E. Davis², Allison Brown³, Nicole Deel¹, Alexander Montoya¹, Monroe Moleksy¹, Eric Achatz², Michael Miller¹, Jeremy Rettinger¹, Elaine Reno², Luke Yaeger¹, Ann Wislowski³, Andrew Subduthi, FACSM⁴, Robert Roach, FACSM⁴, ¹Alma College, Alma, MI. ²CU School of Medicine, Aurora, CO. ³Altitude Research Center CU School of Medicine, Aurora, CO. ⁴Funding: (No relationships reported)

Assessing the physiological responses to exercise at high altitude in real time or using cloud-based data storage has important implications for remote monitoring of human health and well-being in challenging environments. **Purpose:** To determine the feasibility of using real-time monitoring to assess the cardiovascular responses to a simulated climb for military operations. **Methods:** Seventy-four male (age = 21.9 ± 2.2 yrs, height = 1.78 ± 0.02 m, weight = 78.2 ± 9.7 kg) sea level (SL) residents volunteered to participate in this study after giving informed consent and completing the Army Physical Fitness Test. Subjects were flown from SL to high altitude (HA) and completed a 5.9-km hike with a 35-pound sackpack that began at 2329 m and finished at 3840 m the morning after arrival at HA. They were instructed to complete the course as fast as possible. Heart rate (directly from ECG), breathing rate and depth, and oxygen saturation were assessed using a wrist worn monitor (Carre Technologies inc., Hexoskin). In 73 out of 74 of the subjects, the Hexoskin was effective at collecting all of the hike data. For analysis, the 5.9 km course was divided into four equal segments (Segment 1 = 0–250 m, 2 = 250–500 m, 3 = 500–750 m, 4 = 750–1000 m) based on step count. Elevation gain for each of the segments was determined from topographical maps (Segment 1 = 123 m, 2 = 178, 3 = 142 m, and 4 = 262 m). Average and maximal heart rates were calculated for each of the segments. **Results:** Average heart rates were 140.1 ± 1.81 bpm, 161.9 ± 5.82 bpm, 159.2 ± 6.4 bpm, and 161.5 ± 6.22 bpm respectively for the four segments corresponding to 74.5%, 86.1%, 84.6%, and 85.9% of estimated heart rate max. The heart rates reflected the elevation gain except for Segment 1 which had the greatest elevation gain but similar heart rates to Segment 2. Differences between segments suggest that the relative contribution of the segments was 74% (all stops occurred in Segment 4) which resulted in an overall lower average. **Conclusions:** These results suggest that real-time monitoring for multiple variables simultaneously (heart rate, ECG, step count) in the field is a viable means of assessing physiological function and simulating a military operation with a 610 m elevation gain results in relatively high heart rates that generally reflect elevation gain.

**2678**  **Board #198**  **June 2 9:30 AM - 11:00 AM**  **Accuracy of Smart Phone Application to Monitor Heart Rate**

A. Page Glave, Jennifer J. Didier, Mary L. Williams, Christina Waters, Emily Ferrers, Megan Cole. Sam Houston State University, Huntsville, TX. Email: aglave@shsu.edu (No relationships reported)

Smart phones applications to monitor heart rate are very popular. The application examined in this study has millions of installs, with one application boasting 35 million plus users (application store info). However, there is limited research available on the validity of these applications. An earlier study found a camera-based application to be accurate (McCurley, et al., 2013), but the study examined a single smart-phone platform. **Purpose:** The purpose of this study was to examine the accuracy of a popular heart rate application on two smart phone platforms while resting and during moderate exercise. **Methods:** The same heart rate monitor application was chosen for two different technology platforms. The application was required to be free and allow multiple heart rate readings per day. Participants were split into two groups based on technology platform. Both groups were monitored using electrocardiograph (ECG) and the smart phone application used pre-exercise and during an exercise session on an elliptical machine. Measurements were recorded every minute. Data were analyzed using correlations and t-tests between platforms. All data were analyzed for both seated and exercise heart rate averages. **Results:** For technology platform 1, heart rate while seated was 82.5 ± 14.2 bpm and for platform 2 was r = 0.60 (21% missing data). For platform 1, heart rate during exercise correlation for the application was r = 0.30 (44% missing data) and for platform 2 was r = 0.20 (6% missing data). There was not a significant difference in heart rate while seated, t-test (-1.33), p = .197 nor exercise heart rate, t-test (-1.54, p = .142 with comparing means of the two platforms. **Conclusions:** Smart phone applications to monitor heart rate appear to be fairly accurate, particularly at rest. Although these should not be used as a replacement for constant heart rate monitoring tools, they may be useful to allow home monitoring or a quick check of heart rate.
Low-cost, consumer-grade, wearable physical activity monitors are increasingly popular for personal use and may provide a more accurate measure of physical activity than subjective methods (e.g., self-report) while being less expensive than research-grade accelerometers. Because of their popularity in individuals wishing to monitor their personal physical activity behavior and their potential merits in a research setting, assessments of the validity of these devices is warranted. **PURPOSE:** To assess the validity of a novel, low-cost, wearable physical activity monitor (Movband 3) relative to established measures physical activity intensity during treadmill exercise.

**METHODS:** Participants (N = 19) completed four, ten-minute treadmill stages (1.5, 3.0, 4.0, 6.0 MPH) while wearing the Movband 3 on their wrist and the previously-validated Actigraph GT1M monitor around their waist. During each treadmill stage, relative oxygen consumption (VO2 ml/kg/min) and heart rate (beats/min) were recorded via indirect calorimetry and telemetry monitoring, respectively. The relationship between Movband counts and Actigraph counts, VO2, and heart rate were then assessed via Pearson’s correlation analyses. The relationship between miles traveled as reported via the Movband and actual miles traveled on the treadmill was assessed via correlation and tests of agreement as established by Bland and Altman. 

**RESULTS:** There were large, positive effect sizes for the associations between Movband counts and Actigraph counts (r = 0.72), VO2 (r = 0.59), and heart rate (r = 0.63). There was also a large, positive association between Movband miles and actual miles traveled (r = 0.97). These correlations would support the validity of the Movband. However, the difference (Δ) betweenMovband miles and actual miles was greater than a null hypothesis of zero (Δ = 0.3 ± 0.4 miles, r = 0.4, p < 0.001) and there was a significant positive association between Δ and the mean of the Movband and treadmill miles (β = 0.54, p < 0.001). This indicates a lack of agreement.

**CONCLUSIONS:** There was evidence to support the validity of the Movband 3 for the assessment of physical activity intensity in a laboratory setting. However, while this device is associated with measures of exercise intensity it does not provide an accurate measure of miles traveled.

**2680**

**Board #200**

**June 2 11:00 AM - 12:30 PM**

**Differentiating Swelling and Hypertrophy Following Repeated Bouts of Resistance Exercise**

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**No relationships reported**

Previous studies have examined the swelling response following a single bout of exercise; however, no study has looked at the muscle swelling response across several bouts of resistance exercise.

**PURPOSE:** To examine the muscle swelling response over an 8-day period consisting of four separate traditional resistance exercise bouts.

**METHODS:** Nine untrained males visited the lab on nine occasions. Visit 1 consisted of one repetition maximum (IRM) testing. Participants then visited the lab for eight consecutive days separated by 24 hrs. During visits 2, 4, 6, and 9 participants performed 4 sets of 10 repetitions of biceps curls (or time matched rest on control arm) at 70% of their 1RM. Muscle thickness (MTH) was measured at 50, 60 and 70% of the distance from the acromion process to the lateral epicondyle before and after exercise.

**RESULTS:** During Visits 3, 5, 7, and 8 there were measures of MTH taken but no exercise. 

**RESULTS:** There was an interaction (p<0.003) for MTH at all sites. MTH at the 50% site increased from 3.1 (0.2) to 3.4 (0.2) cm immediately following the first exercise bout, returning back near baseline by visit 4 pre [3.2 (0.2) cm]. Similar increases were noted immediately post exercise on visit 4 [3.5 (0.1) cm], 6 [3.4 (0.1) cm], and 9 [3.5 (0.2) cm]. MTH at the 60% site increased from 3.3 (0.3) to 3.7 (0.3) cm following the first exercise bout, decreasing near baseline by visit 4 pre [3.8 (0.3) cm]. Similar increases were noted immediately post exercise on visit 4 [4.2 (0.4) cm], 6 [4.2 (0.3) cm], and 9 [4.2 (0.3) cm]. The control arm displayed a slight baseline shift (non-significant at most time points p>0.05). Differences between the exercise and control arm were only observed immediately post exercise, except at the 50% site during visit 6.

**CONCLUSIONS:** Resting levels of MTH do not appear to change appreciably beyond what occurs following the first naïve bout of resistance exercise. We suggest that naïve resistance exercise appears to produce a baseline shift in MTH, which may represent the threshold needed to be surpassed in order to assume real muscle growth has occurred.
We know that muscle tissue size is inversely associated with the amount of intramuscular fat (Akima et al. 2015). In prolonged bed-rest, atrophy of lower-limb muscle occurs, implying that an increase of intramuscular fat may occur in parallel. Successful countermeasures, such as resistance training, may also affect the amount of intramuscular fat. Given that muscles atrophy at different rates in diuse (Belavý et al. 2009), the adaptation in intramuscular adipose tissues may also muscle specific.

**PURPOSE:** The purpose of this study was to quantify the effect of exercise during 8-week bed-rest on intramuscular fat and muscle tissue in individual thigh muscle groups.

**METHODS:** Twenty-one men were randomized to either 8-week bed-rest with resistance exercise (TR-group, n = 13) or no exercise (CTR-group, n = 8). The training was performed 3 days a week and consisted of bilateral leg press, single and double leg heel raise, and back and foot sole raise. Axial images of the mid-thigh were taken before and after the bed-rest using magnetic resonance imaging. Intramuscular fat cross-sectional area (CSA) and muscle CSA were measured in quadriceps femoris (QF), adductors (AD) and hamstrings (HM). We calculated the percent change of intramuscular fat CSA between before and after the bed-rest. **RESULTS:** After bed-rest, muscle tissue CSA in CTR was significantly decreased compared to before bed-rest in all muscle groups (p < 0.05), whereas muscle tissue CSA did not change in the TR-group. Intramuscular fat CSA in individual muscles did not change after bed-rest in either group (QF: TR 7.3 ± 20.6 % vs. CTR -30.1 ± 31.4 %, AD: CTR -3.8 ± 19.7 % vs. TR -34.2 ± 26.1 %, HM: CTR -9.6 ± 26.8 % vs. TR -33.6 ± 30.1 %). However, for intramuscular fat of all muscle groups pooled a significant difference between the groups was observed with a reduction of intramuscular fat in the TR group (CTR 1.0 ± 13.9 % vs. TR -36.2 ± 28.2 %, p ≤ 0.05) and deoxyhemoglobin (p > 0.05). No changes were observed in EMG assessed muscle activation between bouts (p ≥ 0.28) and NIRS assessments of tissue saturation (p > 0.05) and deoxyhemoglobin (p > 0.05). **CONCLUSIONS:** CT was significantly impacted by EIMD. CT has been shown to be a strong predictor of endurance exercise performance—thus the previously observed decrements in endurance performance following EIMD may be attributed to a decline in CT. Interestingly, EIMD affected IACT to a much greater extent than CT (p < 0.05). IACT is thought to represent a finite energy store, likely anaerobic in nature, that can be used to perform exercise above CT. Our findings indicate EIMD significantly reduces this energy store—potentially through impairments in excitation-contraction coupling.

Cancer is a major public health problem in the U.S. and the world. In 2013 there were an estimated 1,660,290 new cases of cancer in the U.S. Severe weight and muscle loss in cancer (cancer cachexia [CC]) is accepted as a common effect of many cancers, and is directly responsible for 20-40% of cancer-related deaths. The mechanisms that control the development of CC are not well understood. In order for muscle wasting to occur, there must be either a decrease in myogenic factors or an increase in catabolic factors. Most investigations of CC focus on the post-cachectic state and do not examine the progression of the condition. **PURPOSE:** The purpose of this study is to determine the roles of classical myogenic factors (Pax7, MyoD and Myogenin; markers of satellite cell content and regulators of myocyte proliferation and differentiation, respectively), and catabolic factors (Atrogin and MuRF; E3 ubiquitin ligases regulating ubiquitin-mediated protein degradation) in the onset of CC. **METHODS:** C57BL6/J mice at 8 wks of age, and tumor allowed to develop for 1, 2, 3, or 4 wks, gastrocnemius muscle weights were measured to assess CC. MyoD, Myogenin, Atrogin, MuRF, and Pax7 were analyzed using RT-PCR for all 5 groups (1, 2, 3, 4 wk LLC and PBS). Data were analyzed by one-way ANOVA, Student-Newman-Keuls test was used to determine differences among means, significance was set at P<0.05. **RESULTS:** Gastrocnemius muscle weights were only lower than PBS control at 4 wk post tumor-implantation. Pax7 was ~30% lower at all timepoints following tumor implantation. MyoD and Myogenin were ~50% lower in wks 1 and 2 post-tumor implantation, and returned to baseline for wks 3 and 4. Atrogin was ~3.5-fold greater in wk 4, while MuRF was ~2.3-fold higher in wk 3 and ~3.8-fold in wk 4 post-tumor implantation. **CONCLUSIONS:** Our data suggest a reduction in satellite cell content shortly after tumor implantation and an early reduction in markers of myogenic differentiation and proliferation though muscle loss is not evident until 4 wk post tumor implantation; while MuRF and atrogin mediated protein degradation does not seem to be altered until later in tumor progression. Supported by Arkansas Bioscience Institute.
Sleep deprivation (SD) increase catabolic hormone concentrations and decrease growth factors, which may impair the muscle regeneration. PURPOSE: Evaluate the influence of SD on the muscle regeneration, cellular proliferation and muscular insulin-like growth factor-1 (IGF-1) concentration after cryolesioning in rats. METHODS: Forty male rats, Wistar, 3 month, were distributed into 4 groups: Control (CTL), submitted to SD for 96 h, CTL plus sleep recovery period (CTL+R), submitted to SD for 96 h plus 96 h of sleep recovery (SD96+R). Previously, the animals were submitted to cryolesioning of Tibialis anterior (TA) from left leg. After 3 days of recuperation, SD96 and SD96+R groups were sleep deprived for 96 h by modified multiple platform method, following of sleep recovery for 96 h to SD96+R group. TA of both legs were excised (intact and injured) to histopathologic analysis (with HE, 40x), PCNA (western blot) and muscular IGF-1 (ELISA) analysis. The data were analyzed by one way ANOVA. RESULTS: The concentration of IGF-1 in intact leg was reduced in SD96 compared to CTL (3.56±0.27 vs 8.16±1.05 ng/dL respectively; P<0.05), and the expression was reestablished in SD96+R group (7.76±0.90 ng/dL). In injured leg, the concentration of IGF-1 increased in all groups, but with less magnitude in SD96 compared to CTL (1.42±0.25 vs 3.85±1.249 respectively; P<0.001) and SD96+R (1.65±0.20 vs 2.307±0.182 AU respectively; P<0.001). PCNA protein not change with SD, but injury increased its concentration proportionally in all groups when compared to intact leg (CTL - 1.85±0.22; vs 0.46±0.35 AU respectively; SD96 - 2.4±0.6 vs 0.62±0.12 AU respectively; CTL+R - 1.68±0.35 vs 0.55±0.08 AU respectively; P<0.05). The qualitative histopathologic analysis showed a delay in process of muscle regeneration, with higher amounts of fibrous tissue, inflammatory process and muscle atrophy in SD96+R group compared to CTL+R. CONCLUSION: SD reduced muscular IGF-1 concentration and delayed the muscle regeneration stimulated by cryolesioning in TA of rats. Supported by CEPID/SONO-FAPESP (#98/14303-3), CNPq, CAPES, and FAPESP (#2011/15962-7; 2013/00152-5).

**Effects Of Sleep Deprivation And Sleep Recovery On Muscular IGF-1 And Muscle Regeneration**

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**Reliability and Comparison of Measurements of the Tibialis Posterior Cross-Sectional Area Via Ultrasound Imaging**

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unique morphological and architectural adaptations over time may influence athletic performance and/or potential risks of musculoskeletal injuries; however, future studies are needed to test these hypotheses.

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2690  
June 2, 2017 11:00 AM - 12:30 PM  
**Muscle Volume Is A Critical Determinant Of Rowing Performance In Olympic Rovers**

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**BACKGROUND:** Rowing races challenge rowers to combine high sprint and endurance capacity. Muscle morphology is an important determinant of sprint and endurance capacities and as such may also be a critical determinant of rowing performance.

**PURPOSE:** To determine how much of the rowing performance of Olympic rowers is explained by sprint and endurance capacity and by muscle morphology.

**METHODS:** 18 elite rowers (12 male, 6 female and 17 competed in different disciplines at the 2016 Olympics) performed a maximal incremental rowing test to obtain VO_{max}, reflecting the endurance capacity. Sprint capacity was assessed by a 30-second Wingate cycling test and maximal isometric knee extension torque. Morphology of m. vastus lateralis (volume, physiological cross-sectional area (PCSA), fascicle length and pennation angle) was derived from a 3D ultrasound reconstructed voxel array. 13 rowers completed a 2000m time trial on a rowing ergometer to assess rowing performance. Coefficients of determination were obtained from multiple and single regression analyses.

**RESULTS:** Rowing performance was largely explained by absolute maximal oxygen uptake combined with peak power output obtained during the Wingate test (R^2=0.98, p<0.001). Muscle volume largely explained rowing performance (R^2=0.85, p<0.001) and was strongly related to Wingate peak power output (r=0.82, p<0.001). VO_{max} (r=0.65, p<0.001) and maximal isometric knee extension torque (r=0.60, p<0.001). Less variance in rowing performance was explained by PCSA (R^2=0.68, p<0.001) and fascicle length (r=0.43, p<0.05) and none by pennation angle (r=0.30, p=0.774).

**CONCLUSION:** Rowing performance of Olympic rowers is excellently explained by VO_{max} and Wingate peak power output (R^2=0.98). Muscle volume, of all morphological properties, is the most important determinant of rowing ergometer performance, and endurance and sprint capacity in Olympic rowers.

Funding: Technologiestichting STW

2691  
June 2, 2017 11:00 AM - 12:30 PM  
**Effects Of Time-of-day Specific Resistance Training On Muscle Strength And Muscular Il-6-associated Signaling In Male Rats**

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**PURPOSE:** Muscle mass and strength play an important role in athletic sports and health promotion. Although resistance training (RT) is known to be effective for muscle mass improvement, the optimal daily timing of RT and feeding has not yet been determined. The purposes of the present study are to investigate the best daily timing of RT for the muscle hypertrophy in male rats.

**METHODS:** In study I, SD rats were divided into Control (C, non-exercise), Early (E, beginning of active phase, 8:00) and Late (L, end of active phase, 17:00). Rats of exercise groups (E and L) were asked to perform RT by climbing for 10 weeks in beginning and end of active phase respectively. Climbing strength and weight of flexor hallus longus (FHL) and flexor digitorum profundus (FDP) was determined after 10 weeks training. In study II, rats were divided into E (Early) and L (Late) groups and were performed an acute RT by climbing. FDP muscle samples were obtained 2, 6 and 24 hours after RT.

**RESULTS:** In study I, we observed that 10 weeks RT improve muscle strength, muscle mass and myofiber cross sectional area (CSA), but these training effects do not show any significant difference between E and L groups. In study II, acute RT in the evening induced more plasma testosterone/cortisol and IL-6, and muscular IL-6 associated signaling such as phosphorylation of STAT1 and STAT3 compared to training in the morning.

**CONCLUSIONS:** we suggest that resistance exercise-induced IL-6 signal in skeletal muscle is not the main source of 10 weeks resistance training adaptation.

2692  
June 2, 2017 11:00 AM - 12:30 PM  
**Characterization of Protein Metabolism in Undifferentiated and Differentiated Murine Muscle Tissue**

Jessica M. Cardin, J. William Deaver, Colleen L. O’Reilly, Stephen F. Crouse, FACSMM, James D. Fluckey, Texas A&M University, College Station, TX. (Sponsor: Stephen F. Crouse, FACSMM)

(No relationships reported)

The emergence of cell culture experiments has greatly expanded the understanding of skeletal muscle physiology. However, there is a paucity of data regarding the behaviors of cells grown in culture at various stages in vivo. This preliminary set of studies was designed to assess alterations of anabolic responses between undifferentiated and differentiated muscle tissue.

**Purpose:** Determine if there is a disparity in fractional synthesis rates (FSR) between C2C12 myoblasts and myotubes.

**Methods:** C2C12 cells were plated at 200,000 cells per T25 flask and 600,000 cells per T75 flask with 5 mL and 12 mL DMEM (respectively) supplemented with 20% Fetal Bovine Serum and 1% gentamycin. Cells were cultured in an environment at held at a constant 37°C and 5% CO₂. Once cells reached confluence, media was changed to 2DMEM supplemented with 2% horse serum 1% gentamycin, 5% HEPES, 0.75% transferrin, and 0.75% insulin. Myoblasts were plated after the 4th passage. Deuterium oxide was applied 24 hours prior to harvest of the cells at a level of 4%. Media containing deuterium oxide was reserved for analysis. Cells were washed with multiple applications of PBS. Norris buffer was then applied to the flasks at 100 ul. for T-25s and 300 ul. for T-75s. Flasks were then placed on ice for 5 minutes. Cells were harvested and deposited into centrifuge vials. Vials were spun at 14,000 x G for 30 minutes to separate cytosolic and myofibrillar fractions. The supernatant (containing the cytosolic fraction) from the vial was decanted into another vial and saved for analysis. 2H-alanine and plasma enrichment was determined by GC-MS and FSR was calculated by.

**Results:** Preliminary data demonstrates that differentiated murine myotubes have ~76% FSR of the undifferentiated murine myoblasts (P < 0.005).

**Conclusion:** Future investigators must be aware of the ratio of undifferentiated cells and differentiated myotubes as this ratio could confound results as myoblasts are still present even at later stages of differentiation.

2693  
June 2, 2017 11:00 AM - 12:30 PM  
**Partial or Complete Unloading of Skeletal Muscle Leads to Specific Alterations of Anabolic Signal Transduction**

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(No relationships reported)

Consequences of disuse atrophy of skeletal muscle observed during spaceflight on astronaut health and performance are a focal point of space research. Decrements of both muscle mass and protein synthesis rates have been observed with exposure to varying muscle loading environments (1G > partial loading > 0G), and most of the reduced muscle mass can be attributed to diminished rates of synthesis. However, specific mechanistic-dependent reductions of protein synthesis are not well defined. **PURPOSE:** To determine whether or not alterations of anabolic signal transduction was responsible for the changes previously observed in fractional synthesis rates with specific gravitational loading paradigms. **METHODS:** Female BALB/cByJ which were normalized by bodyweight and assigned to normal cage ambulation (1G), partial weight bearing suspension titrated to approximately 33% bodyweight (G/3), partial weight bearing titrated to 16% bodyweight (G/6) and full unloading of hind limbs (0G) in specially designed cages. All mice were subjected to that loading environment for 21d prior to tissue harvest, and monitored daily. Immunoblotting of the proteoconcin (n=23) was carried out to analyze alterations of anabolic signal transduction. Although numerous signaling intermediates were assessed, the focus of this abstract will be on ribosomal protein S6 kinase (p70-S6K). This important protein has served as a marker of protein synthesis signal transduction as well as the anabolic capacity in skeletal muscle. **RESULTS:** Regardless of loading paradigm, no differences were detected among groups for the activation of p70-S6K (as indicated by the phospho: total protein content). Total protein content, however, was ~27% lower than control in 0G and G/6 (P=0.008) with G/3 not being different from control (P=0.05). **CONCLUSION:** In combination with previous data (unpublished
Phase angle, determined from resistance and reactance via bioelectrical impedance analysis (BIA), provides an indication of cellular function and hydration. Ultrasound-derived echo intensity (EI) is often used to evaluate the relative variation in the muscle function and pathology using a comprehensive set of phenotyping measures. This study aimed to show that fascial gliding occurs during transcutaneous vacuum treatment and to investigate whether the transcutaneous vacuum treatment improved fascial gliding function of the vastus lateralis muscle using ultrasound. METHODS: Seven volunteers (age: 21-60) participated in this study. Transcutaneous vacuum treatment (vacuum and rolling) was applied to both left and right vastus lateralis muscle. Deep fascial motion when the knee joint was moved passively from 0 to 45 degree was measured by B-mode ultrasound before and after treatment. RESULTS: Motion of deep fascia (mm 5D, mm) before treatment was 32.4 ± 4.0; Ichikawa et al., 2015). Measurement after transcutaneous vacuum treatment was 32.2 ± 7.39, the same as the motion after treatment was 32.8 ± 7.57, the same as the result of the previous study (28.5 ± 4.3). Motion of deep fascia after transcutaneous vacuum treatment was 32.2 ± 7.39, the same as the motion after myofascial release treatment of the previous study (32.4 ± 4.0; Ichikawa et al., 2015). There was no interaction between either side (left or right). However, the treatment effect was significant, and motion after treatment was longer than motion before treatment (32.8 ± 7.57, same as the result of the previous study). CONCLUSIONS: In this study, the effects of transcutaneous vacuum treatment on improvement of fascial gliding function, and fascial gliding during transcutaneous vacuum were demonstrated. Transcutaneous vacuum provided mild myofascial stimulation without requiring articular movement. We concluded that transcutaneous vacuum treatment effectively improved fascial gliding function and increased range of joint motion and flexibility of muscle and fascia.
**RESULTS:** Exercise intervention did not show a change in bodyweights of the BL10 mice. However, these mice showed significant improvement in hindlimb (HL) but not forelimb (FL) grip strength in comparison to non-exercised group. Analysis of the serum showed that the creatine kinase (CK) levels in the VW group significantly increased compared to the non-treated group. All three exercise interventions showed significant decreases in body weight at 25wk of age in mdx mice. Dystrophin deficient mdx mice showed different effects on muscle function depending on the exercise regimen. DT exercise was significantly detrimental to HL grip strength, while VW exercise showed significant improvement on HL grip strength over time. Evaluation of cardiac function (% ejection fraction and fraction shortening) showed that HT and VW but not DT interventions showed significant improvement. Analysis of CK levels showed that the VW group significantly increased compared to the non-treated group. **CONCLUSIONS:** Our study demonstrates that type of exercise intervention significantly affects dystrophin deficient skeletal and cardiac muscle function. Our study highlights that mild but not strenuous (DH) exercise regimens show benefits in DMD muscle therefore caution must be taken when prescribing exercise regimens to DMD patients.

**PURPOSE:** Exercise modality, it has not been tested using neuromuscular electrical stimulation (NMES) after anterior cruciate ligament (ACL) reconstruction. NMES has been shown to augment muscle regeneration after ACL-R but the effect of NMES on muscle regeneration after ACL-R has not been tested using NMES. **METHODS:** Critical torque (CT) is an integrative measure/concept that represents the “critical” or upper boundary of steady-state work that can be performed without leading to exhaustive fatigue. While this concept has been observed across multiple voluntary exercise modalities, it has not been tested using neuromuscular electrical stimulation (NMES). **PURPOSE:** The purpose of this study was to determine if NMES exercise results in hypoboric work-duration pattern that plateaus at the end of exercise and 2) determine if NMES exercise performed below CT results in no fatigue. **METHODS:** Participants (n = 9) were tested. Following familiarization, participants completed 2 identical testing sessions each consisting of four separate 5-minute NMES bouts separated by 20 minutes of rest. The NMES protocol consisted of 3-seconds of stimulation, followed by 2-seconds of rest, for 60 total isometric contractions. Current and pulse duration (200-μs) were held constant among all tests. Initially 100 Hz NMES was used. During the second test a frequency that elicited a torque value below the end test torque during the 100 Hz test (under CT) was used. The third and fourth tests were at 50 Hz and 25 Hz, applied in a random order. The second testing session was performed 3-7 days later. **RESULTS:** End-test torque (CTT) was calculated as the mean of the last 6 contractions expressed relative to peak torque. Torque values did not differ over the final 6 contractions within each exercise bout—100 Hz (p = 0.49), 50 Hz (p = 0.15), 25 Hz (p = 0.31), and under CT (p = 0.15). Torque declined from 93 ± 18% to 22 ± 7% of peak torque at 100 Hz, from 60 ± 24% to 22 ± 8% at 50 Hz, and from 29 ± 13% to 20 ± 6% at 25 Hz. These CTT values did not differ from each other (p > 0.05). Initial torque and CTT for the under CT bout did not differ (12 ± 8 vs 11 ± 5% of peak torque; p = 0.48), but CTT was lower than the CTT values from the 100, 50, and 25 Hz bouts (p < 0.05). **CONCLUSIONS:** Intermittent isometric NMES results in a hypобobic work-duration relationship similar to what is observed during voluntary isometric exercise. NMES exercise above CT declined to a similar torque value regardless of stimulation frequency, while exercise under CT showed no declines in torque. These findings suggest the NMES exercise protocol can be used to determine CT.

**PURPOSE:** Variants of the myostatin gene (MSTN) have been shown to have an influence on muscle hypertrophy phenotypes in a wide range of mammalian species. Recently, a thoroughbred horse with a C-A allele at the g.66939373C/T single nucleotide polymorphism (SNP) has been reported to be suited to short distance racing. In this study, we examined the effect of the MSTN SNP on muscle fiber properties in young horses during a training period. **METHODS:** To investigate the effect of the MSTN SNP on muscle fiber before training, several mRNA expressions were relatively quantified in biopsy samples from the middle gluteal muscle of 24 untrained male thoroughbred horses (1.5-year old); C/C: n = 8, C/T: n = 8, T/T: n = 8) using real-time RT-PCR analysis. Furthermore, the remaining muscle samples were used for immunohistochemical analysis to determine the number of satellite cells (SC), as well as the population and area of each fiber type. All measurements were reevaluated in biopsy samples of the same horses after a 5-month period of conventional training. **RESULTS:** As compared to values before training, although there were no significant differences, cross sectional areas of all muscle fiber types increased (12-17%) in all SNP groups after training. Although the expressions of MSTN mRNA decreased in all SNP groups, a significant decrease was found in only the C/C group after training. However, the expressions of mRNA related to SCs activation and proliferation (HGF, Pax7, MyoD, and Myogenin) were identical among all SNP groups before training. While, expression of VEGFα, PGC1α, and SDHα mRNAs, which relate to the biogenesis of mitochondria and capillaries, was significantly higher (54-82%) in the T/T group than the C/C group after training. **CONCLUSIONS:** It is suggested that hypertrophy of muscle fiber is directly associated with a decrease in MSTN mRNA expression in the C/C group, and that increased expressions of VEGFα, PGC1α, and SDHα in the T/T group might be indirectly caused by the MSTN SNP. These results indicate that the C/C and T/T groups with the MSTN SNP have an advantage in short and long distance races, respectively.

**PURPOSE:** Exercise modality, it has not been tested using neuromuscular electrical stimulation (NMES) after anterior cruciate ligament (ACL) reconstruction. NMES has been shown to augment muscle regeneration after ACL-R but the effect of NMES on muscle regeneration after ACL-R has not been tested using NMES. **METHODS:** Critical torque (CT) is an integrative measure/concept that represents the “critical” or upper boundary of steady-state work that can be performed without leading to exhaustive fatigue. While this concept has been observed across multiple voluntary exercise modalities, it has not been tested using neuromuscular electrical stimulation (NMES). **PURPOSE:** The purpose of this study was to determine if NMES exercise results in hypoboric work-duration pattern that plateaus at the end of exercise and 2) determine if NMES exercise performed below CT results in no fatigue. **METHODS:** Participants (n = 9) were tested. Following familiarization, participants completed 2 identical testing sessions each consisting of four separate 5-minute NMES bouts separated by 20 minutes of rest. The NMES protocol consisted of 3-seconds of stimulation, followed by 2-seconds of rest, for 60 total isometric contractions. Current and pulse duration (200-μs) were held constant among all tests. Initially 100 Hz NMES was used. During the second test a frequency that elicited a torque value below the end test torque during the 100 Hz test (under CT) was used. The third and fourth tests were at 50 Hz and 25 Hz, applied in a random order. The second testing session was performed 3-7 days later. **RESULTS:** End-test torque (CTT) was calculated as the mean of the last 6 contractions expressed relative to peak torque. Torque values did not differ over the final 6 contractions within each exercise bout—100 Hz (p = 0.49), 50 Hz (p = 0.15), 25 Hz (p = 0.31), and under CT (p = 0.15). Torque declined from 93 ± 18% to 22 ± 7% of peak torque at 100 Hz, from 60 ± 24% to 22 ± 8% at 50 Hz, and from 29 ± 13% to 20 ± 6% at 25 Hz. These CTT values did not differ from each other (p > 0.05). Initial torque and CTT for the under CT bout did not differ (12 ± 8 vs 11 ± 5% of peak torque; p = 0.48), but CTT was lower than the CTT values from the 100, 50, and 25 Hz bouts (p < 0.05). **CONCLUSIONS:** Intermittent isometric NMES results in a hypобobic work-duration relationship similar to what is observed during voluntary isometric exercise. NMES exercise above CT declined to a similar torque value regardless of stimulation frequency, while exercise under CT showed no declines in torque. These findings suggest the NMES exercise protocol can be used to determine CT.

**PURPOSE:** Estimation of Critical Torque Using Neuromuscular Electrical Stimulation of the Quadriceps in Humans. **PURPOSE:** The purpose of this study was to determine if NMES exercise results in hypoboric work-duration pattern that plateaus at the end of exercise and 2) determine if NMES exercise performed below CT results in no fatigue. **METHODS:** Participants (n = 9) were tested. Following familiarization, participants...
obtained from 37 recreational athletes (25±4 yrs, 181±7 cm, 83.5±15 kg) after 12 weeks (wks) of regular rehabilitation following ACL-R (quadriceps tendon autograft, n=22 or semitendinosus tendon autograft, n=15) and again after 12 wks with 2×/wk either conventional (CON/ECC, n=16) or CON/ECC+ (n=21) supervised leg press training (random assignment). Immunohistochemical analyses were used to determine myosin heavy chain (MyHC) I, II and hybrid fibers to quantify fiber type specific satellite cells (SCs, Pax7+/ and active SCs (Pax7+/MyoD+). Magnetic resonance imaging was performed to measure quadriceps cross sectional area (CSA). RESULTS: After 12 wks of one-legged quadriceps strength training CSA was significantly (p<0.000) increased with a significantly (p<0.003) greater increase after CON/ECC+ compared to CON (81.7±13.1 to 96.3±14.7 cm² vs. 78.5±12.1 to 87.0±11.8 cm²). MyHC I fiber number significantly (p=0.002) increased only after CON/ECC+ (35.7±17.1 to 41.7±15.8 %). The change was significantly (p<0.02) different from CON/ECC (36.6±13.0 to 35.1±10.4 %). MyHC I hybrid fibers showed a significant (p<0.001) similar decrease after CON/ECC+ (7.1±6.5 to 4.0±4.5 %) and CON/ECC (7.7±4.9 to 4.3±3.6 %). MyHC II fiber number did not change significantly. While no significant change in SC content was observed (SCs related to MyHC I or II fibers 0.15±0.08 and 0.14±0.07 before, 0.14±0.09 and 0.14±0.07/fiber after training), the number of active SCs per biopsy section was significantly (p=0.007) greater after training (2.42±2.09 vs. 1.08±1.38) without significant difference between the training regimes. No significant differences occurred with regard to the different autografts.

CONCLUSION: Strength-training induced muscle regeneration after ACL-R lead to an increase in activated SCs and a decrease in MyHC I hybrid fibers. After CON/ECC+ the gain in muscle mass was greatest and was accompanied by a significant increase in MyHC I fibers.

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2702 Board #222
June 2 11:00 AM - 12:30 PM
Thigh Muscle Cross-sectional Area by pQCT: Precision of Two Software Programs
Samuel R. Buchanan1, Christopher Poole2, Daniel Schiffr1, Debra Bemben, FACSM1, Michael Bemben, FACSM1, The University of Oklahoma, Norman, OK. 1Southern Methodist University, Dallas, TX. 2Bone Diagnostic Inc., Spring Branch, TX. (Sponsor: Dr. Debra Bemben, FACSM)

Scans performed by pQCT produce images with voxels, each with a density value that is the average of all the tissue densities contained within the voxel. Software programs differentiate between bone and soft tissues within the human limb using contour/peel modes and threshold range settings. Subtle calculation differences of voxel partial volumes by software may lead to variations in tissue density and area values. PURPOSE: The purpose of the investigation was to compare the precision of two software programs, Stratec v6.00 (STC) and ImageJ (IMJ), for thigh muscle cross-sectional area (mCSA) in college age men. METHODS: pQCT scans (XCT 3000, Stratec) performed at the 50th femur site for 10 male subjects (18-30 years) on 3 different days, were used to measure femur mCSA using STC and IMJ. Loops were created within STC with thresholds set at -100, 40, and 710 to separate and calculate air, subcutaneous fat, bone, and muscle. Contmodes 3 and 31 were used to delineate bone from muscle. Filter F01F06U01 was used to smooth the image, incorporating intramuscular fat (IMAT) into mCSA. IMAT thresholds and filters for IMAT were similarly set. Intraclass correlation coefficients (ICC), coefficient of variation (%CV), and least significant change (LSC) were calculated across trials to determine the precision for each method. The relationship between the two methods was determined by Pearson’s r. RESULTS: The ICCs for STR and IMJ were 0.995 and 0.996, respectively. CV’s were 2.5% for STR and 2.44% for IMJ. The LSCs for STR and IMJ were 10.955 cm² and 10.833 cm², respectively. High positive correlations (r=0.999, p<0.001) were found between methods. Repeated measures ANOVA showed significant differences between STR and IMJ, with IMJ having a significantly higher mCSA than STR (p=0.032). There was a significant trial effect with trial 1 being higher than trial 3 (p=0.05). CONCLUSION: The two software programs had similar precision values for mCSA, however, there was a small but significant mean difference between STR and IMJ. The higher trial 1 mean compared to trial 3 for both methods may be attributed to technical error. Both programs appear equally capable of deriving mCSA with IMAT included. ImageJ may be advantageous, as it does not require expertise for loop creation or user-created equations to derive mCSA, both being possible sources for human error.

2703 Board #223
June 2 11:00 AM - 12:30 PM
Regional Differences in Musculoskeletal Adaptation Following 16-Weeks of High-Intensity Functional Training.
Wade Hoffstetter, Paul Serafini, Gerald Mangine, Yuri Feito, FACSM. Kennesaw State University, Kennesaw, GA. (Sponsor: Yuri Feito, FACSM)

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(No relationships reported)

High-Intensity Functional Training (HIFT) continues to gain traction in the fitness world; however, many questions remain about its effect in musculoskeletal adaptations. PURPOSE: We sought to investigate what musculoskeletal regions of interest (ROI) were affected following a 16-week HIFT program among a group of recreationally active adults. METHODS: Nine men (34.2±9.12 yrs, 1.78±0.05 m, 91.5±17.7 kg) and 17 women (36.7±8.4 yrs, 1.63±0.07 m, 68.5±12.8 kg) completed 16-weeks (2 – 5 sessions · wk⁻¹) of HIFT. Prior to training (PRE; < 2 weeks), measures of bone mineral density (BMD), bone mineral content (BMC), and lean mass (LM) were collected in the arm, leg, and axial (skeletal muscle only) regions via dual-energy X-ray absorptiometry. Post-testing (POST) measurements were collected within two weeks following the conclusion of the 16-wk training program. RESULTS: Analysis of variance with repeated measures revealed a significant ROI × time interaction for LM (F = 436.967, p < 0.001, r² = 0.95), where greater improvements were observed in the legs (133.2%) compared to the arms (50.9%). A tendency was noted for changes in BMC across ROIs (F = 2.86, p = 0.067, r² = 0.11), where improvements occurred in the legs (1.6%, p = 0.002) but not the arms (0.14%, p = 0.689) or axial region (-0.48%, p = 0.167). CONCLUSION: Our data suggests that a 16-wk HIFT intervention focusing on general physical preparedness is particularly beneficial for stimulating adaptations in lower limb BMC and lean mass.

2704 Board #224
June 2 11:00 AM - 12:30 PM
Effects of Doxorubicin Treatment and Exercise on Skeletal Muscle Function and Myogenic Regulatory Factors
Michael J. Capps, Nicole R. Wood, Raquel B. Busekurs, Reid Hayward, David S. Hydock. University of Northern Colorado, Greeley, CO.

(No relationships reported)

Doxorubicin (DOX) is used to treat a wide range of cancers, but its use is limited due to its toxicities. DOX treatment causes myotoxicity leading to skeletal muscle dysfunction and impairments in activities of daily living for cancer patients. Maintenance and repair of skeletal muscle involves myogenic regulator factor (MRF) signaling, and evidence suggests that DOX inhibits MRF expression. Exercise, however, attenuates many of the toxicities associated with DOX treatment, and including exercise with DOX treatment may have a positive effect on MRF expression. PURPOSE: To determine the effects of exercise and DOX treatment on skeletal muscle function and MRF expression. METHODS: Male rats were randomly assigned to sedentary+saline (SS), sedentary+DOX (SD), treadmill+DOX (TMD), resistance training+DOX (RSD), or combined endurance and resistance training+DOX (COMD). DOX groups received 1 mg/kg DOX daily for 12 consecutive days and SS received 0.9% NaCl at an equivalent volume as a placebo. TMD then trained on a motorized treadmill 5 days per week for 2 weeks, RSD animals were then housed in cages where food and water were progressively raised to force a bipedal stance for 2 weeks, and COMD rats were then housed in raised cages and treadmill trained for 2 weeks. Sedentary rats were restricted to normal cage activity during this time period. Twenty-four hours after the activity intervention, grip strength (GS) was measured, and the soleus was extracted and analyzed for expression of the primary MRFs MyoD and Myf5 using Western blotting. RESULTS: SS had a 29% lower GS than SS (p <0.05), but this significant GS decline was not observed in TMD, RESD, or COMD (-10%, -5%, -2% vs. SS, respectively, p>0.05). MyoD expression was 61% lower in SD compared to SS, but none of the activity interventions attenuated this decline (-56%, -65%, -65% vs. SS in TMD, RSD, and COMD, respectively, p<0.05 for all comparisons). A similar Myf5 decline was observed with SD, TMD, RSD, and COMD expressing 44%, 40%, 65%, and 56% lower Myf5 than SS, respectively (p<0.05). CONCLUSION: Activity interventions protected against the DOX-induced reduction in GS, but this does not appear to be the result of changes in MRF expression suggesting that exercise-induced protection against DOX myotoxicity may not be due to mitigating decreases in primary MRF expression.
Regional Differences in Bone Mineral Density in Male Collegiate Runners with Different Foot-strike Patterns

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Email: kevin.ryan@marquette.edu
(No relationships reported)

There are two main running foot-strike patterns; heel striking (HEEL) and mid-foot striking (MID). Given that people who run with different gait patterns likely experience different loading profiles, it would be of interest to analyze regional differences in bone mineral density (BMD) in order to characterize foot-strike specific injury risk. PURPOSE: To investigate the differences in hip and foot BMD of male collegiate runners with different foot-strike patterns. METHODS: Thirty NCAA D1 athletes were recruited for the study (Age: 20±1 yrs; Height: 179 ± 5 cm; Weight: 70 ± 6 kg; Body Fat: 10.8 ± 4.0%). Ground Reaction Force (GRF) data was collected with an instrumented treadmill while the subjects ran at two different paces; threshold pace (TPP=70 min/mile) and long-slow distance pace (LSD=6.58 min/mile). Femurs and foot bones of the left (L) and right (R) leg were scanned with dual-energy x-ray absorptiometry (DXA). Foot-strike patterns were categorized based on the presence of an initial impact transient in the GRF profile and confirmed with video analysis. DXA absorptiometry (DXA). Foot-strike patterns were categorized based on the presence of an initial impact transient in the GRF profile and confirmed with video analysis. DXA absorptiometry (DXA).

<table>
<thead>
<tr>
<th>Foot-Strike Pattern</th>
<th>Leg Side</th>
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<tr>
<td></td>
<td>Left</td>
<td>0.641±0.095</td>
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<td>Right</td>
<td>0.640±0.098</td>
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CONCLUSION: Although foot-strike pattern and leg side both appear to affect BMD of the first metatarsal, the exact nature of this effect is not known.

RESULTS: Individuals with SI joint dysfunction exhibited fewer muscle synergies than healthy controls (mean EV for the 5th PC (range): SI = 0.89 (0.74-1.02), control = 1.04 (0.9-1.10). The first PC for the ensemble EMG for controls included a contribution from contralateral GM and LD (Pearson r with 1st PC of ensemble EMG: right GM = -0.20, left LD = -0.22, left GM = 0.29, right LD = -0.25), whereas this synergy was absent from left LD to right GM for individuals with SI joint dysfunction (right GM = -0.11, left LD = 0.05, left GM = 0.36, right LD = 0.37). CONCLUSION: Individuals with SI joint dysfunction exhibit fewer synergies than healthy controls when walking. Our results support the hypothesis that individuals with SI joint dysfunction do not exhibit a synergy between contralateral gluteus maximus and latissimus dorsi when walking.

Tibial stress fractures are a substantial issue among active duty military personnel. Previous research found that walking with heavy loads increased joint moments and contact forces to a greater degree than the relative increase in load. However, the effect of added load on tibial bending remains unclear. PURPOSE: Determine the relationship between added load and tibial bending moment (M_bend) while walking with heavy loads. METHODS: 26 active duty male volunteers (20.7 ± 3.3 yrs; 1.77 ± 0.87 m; 85.3 ± 13.9 kg) walked on a treadmill for 10 minutes unloaded and with each of five vest-borne loads (15, 25, 35, 45 and 55 kg) while force and motion data were collected. PCQT scans were used to obtain volunteers’ mid-distal tibial geometry (38% from distal end). A musculoskeletal model was used to estimate muscle forces necessary to match joint moments. At the instant of peak tibia axial force (75.5 ± 1.9% of stance phase), M_bend at the mid-distal tibia were calculated as the product of joint reaction and muscle forces and their respective moment arms and summed to create a total moment. Vest-borne loads were expressed as a percentage of body mass. RESULTS: M_bend caused by muscle were consistently greater in magnitude and opposite in direction from moments caused by joint reaction forces. Total moments caused bending in the concave posterior direction placing the anterior tibia in tension. Moments were correlated with added loads when normalized to body mass (Figure 1) as well as when moments were expressed as increases relative to the unloaded condition (all p < .01). For each 10% increase in added load, M_bend increased 8.3% relative to unloaded walking. CONCLUSION: At this injury prone site on the tibia, the increase in bending moment with added loads was linear and slightly less than proportional to the loads added.
PURPOSE: To compare peak patellofemoral and ACL/PCL forces among varying lunging techniques involving lunges with a long and short stride both on flat ground and up to a 4 inch platform. METHODS: Sixteen male and female subjects (mean bodyweight 67.6kg, 1.75 m height; 28.9 years old) using bodyweight only performed a forward lunge with a long stride (shank vertical at bottom position) and a short stride (1/2 the long stride distance) on flat ground and up to a 4 inch platform. Force platform and video data were collected and input into a biomechanical model, and peak patellofemoral and ACL/PCL were calculated as a function of knee angle. A One-Way Repeated measures ANOVA assessed significant differences among lunging techniques (p<0.05). RESULTS: Peak patellofemoral force occurred between 79°-96° knee angles and was significantly greater (p<0.001) with a short stride lunge on flat ground (1668±479N) and up to a 4 inch platform (1553±580N) compared to lunging with a long stride lunge on flat ground (1193±512N) and up to a 4 inch platform (1061±523N), but no significant differences in peak patellofemoral force were found between the two short stride lunges (p=0.99) and between the two long stride lunges (p=0.99). Peak ACL force occurred between 7°-12° knee angles and was not significantly different (p>0.20) among any of the lunging techniques. Peak ACL force occurred between 62°-83° knee angles and was significantly greater (p<0.001) with a long stride lunge on flat ground (554±220N) and up to a 4 inch platform (609±265N) compared to lunging with a long stride lunge on flat ground (402±114N) and up to a 4 inch platform (458±145N), but no significant differences in peak ACL force were found between the two short stride lunges (p=0.99) and between the two long stride lunges (p=0.99). Peak ACL force was significantly greater (p<0.001, r² = 0.96) and was significantly greater (p<0.001) with a short stride lunge on flat ground (1668±479N) and up to a 4 inch platform (1553±580N) compared to lunging with a long stride lunge on flat ground (1193±512N) and up to a 4 inch platform (1061±523N), but no significant differences in peak patellofemoral force were found between the two short stride lunges (p=0.99) and between the two long stride lunges (p=0.99). Peak ACL force occurred between 7°-12° knee angles and was not significantly different (p>0.20) among any of the lunging techniques. Peak ACL force occurred between 62°-83° knee angles and was significantly greater (p<0.001) with a long stride lunge on flat ground (554±220N) and up to a 4 inch platform (609±265N) compared to lunging with a long stride lunge on flat ground (402±114N) and up to a 4 inch platform (458±145N), but no significant differences in peak ACL force were found between the two short stride lunges (p=0.99) and between the two long stride lungues (p=0.99). CONCLUSIONS: Lunge technique variations did affect peak patellofemoral and cruciate ligament forces. Compared to a long stride lunge, lunging with a short stride, which caused the knees to translate forward approximately 8 cm beyond the knees at bottom lunge position, resulted in greater peak patellofemoral force but less PCL force. Lunging technique variations did not affect peak ACL force. There were no patellofemoral or PCL differences in peak force between the two long stride lungues or between the two short stride lungues.

PURPOSE: To investigate the bilateral correlations between peak Ground Reaction Forces and Bone Mineral Density in Male Collegiate Runners

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No relationships reported.

Overuse injuries are prevalent in distance runners due to the repetitive nature of the sport. Some runners exhibit speed dependent asymmetries in their running mechanics, which may play into the fact that these injuries often occur unilaterally. Analyzing correlations between ground reaction forces (GRF) and bone mineral density (BMD) may help elucidate whether injuries are more related to running leg.
were extracted from the TP and LSD condition. Femoral neck BMD (g/cm²) values for right and left leg were extracted from the DXA scans. Bivariate correlations were used to analyze the influence of femoral neck BMD and peak GRF at the two running speeds. Separate correlation analyses were run for the left and right leg. RESULTS: During the LSD condition, peak GRF and BMD data were correlated only for the right leg (Right: r = 0.539, p = 0.03; Left: r = 0.412, p = 0.127). Similarly, peak GRF and BMD were correlated only for the right leg during the TP condition (Right: r = 0.53, p = 0.06; Left: r = 0.506, p = 0.054). CONCLUSIONS: Peak stance-phase GRF of the right leg were positively correlated with BMD of the right femoral neck, regardless of running speed. The fact that significant correlations between peak GRF and BMD data were only observed on one side suggests that side-to-side differences could influence the risk of sustaining unilateral overuse injuries in runners.

2712 Board #232 June 2 9:30 AM - 11:00 AM
Motor Units Discriminated From High-density, Surface Electromyography Require Careful Scrutiny.
Leah A. Davis¹, Awad Almuklass¹, Landon Hamilton², Taian Vieira³, Alberto Botter², Roger M. Enoka¹. ¹University of Colorado Boulder, Boulder, CO; ²Politecnico di Torino, Torino, Italy.
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PURPOSE: To examine if the KAT training leads to neural adaption and improved motor performance. KAT training with haptic feedback could be a valuable teaching tool for improving kinesthetic awareness.

METHODS: Participants (n=33) were randomly assigned to a KAT training group or a control group. Both groups were instructed to complete 30 repetitions of a knee extension isometric exercise. The KAT training group performed the exercise in a virtual environment with haptic feedback, while the control group performed the exercise without haptic feedback. Posture control was assessed using a motion capture system in two conditions: a traditional test and a test with real-time haptic feedback. Results: The KAT training group demonstrated significantly better posture control in both conditions compared to the control group (p<0.05).

CONCLUSION: KAT training with haptic feedback can improve posture control, and thus, kinesthetic awareness. This study highlights the potential of KAT training as a tool for improving kinesthetic awareness in athletes.

2713 Board #233 June 2 9:30 AM - 11:00 AM
Blood Flow Restricted Exercise Alters Motor Unit Recruitment And Firing Rate
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Purpose: Despite suggestions that low-intensity (LI) blood flow restricted exercise (BFRE) may be as effective as high intensity (HI) resistance exercise for the purpose of enhancing the recruitment of type II motor units (MU); individual MU acute response to LI BFRE has never been observed and/or reported. Recently, the decomposition of the surface electromyographic (EMG) signal introduced new analysis methods to assess single MU properties. Through these methods we aimed to observe LI BFRE effects on the behavior of the individual MUs.

METHODS: Eight men (26.0 ± 3.8 yrs) performed 5 sets of 15 reps of knee extensions at 20% 1RM (with and without BFRE). BFRE condition was set at 60% of the individual absolute arterial occlusion value. Torque was determined during pre- and post-exercise maximal voluntary contractions (MVC). Surface EMG activity was recorded from the vastus lateralis (VL) at pre- and post-exercise time point measurements. In each of these time points, isometric voluntary contractions were performed, matching trapezoidal target-force trajectories at 40% pre-MVC. Resulting surface EMG signals were decomposed and MU recruitment threshold, firing rates and MU action potential (MAP) amplitudes were further analyzed.

RESULTS: Torque only decreased after the LI BFRE condition (-20.5%; p<0.05). In the regression lines between MU recruitment threshold and firing rate, LI BFRE induced higher decrements in the linear slope coefficient (-165.1% ± 120.4, p<0.05) when compared to LI condition (-44.4 ± 33.1, p<0.05). Also, the MU firing rate vs. MAP amplitude relationship had a higher linear dependency (R² = 0.53) to higher firing rates than for the LI condition. MAP amplitude values after the BFRE condition, reinforcing the evidence that new MUs with higher MAP amplitude are recruited and MUs with similar MAP amplitudes are activated at higher firing rates.

Conclusion: LI BFRE induced a significant change in the MU recruitment pattern, with higher-threshold and lower-firing rate MUs being recruited earlier to compensate muscle failure. Moreover, these findings suggest strong evidences about an elevated firing rate in similar MAP amplitude after LI BFRE condition.

Acknowledgements: The authors would like to express their gratitude to Dr. Paola Contessa (Delfys Inc., Natick, USA), for all the invaluable assistance, comments and support.

2714 Board #234 June 2 9:30 AM - 11:00 AM
The Effect of Real-Time Haptic Feedback on Kinesthetic Awareness and Motor Skill Performance
Jo T. Shattuck, Mateusz Mittek, John Ransone, FACSM. University of Nebraska, Lincoln, NE.
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PURPOSE: Kinesthetic awareness is an individuals’ knowledge of their own body position and movements in space. Sensory integration is the process of combining inputs from proprioceptive receptors in muscles, mechanoreceptors in skin, and visual motor/visual spatial systems is critical to motor skill acquisition. We proposed that kinesthetic awareness training (KAT): the addition of haptic feedback in real time, to introduce secondary discriminatory system information into kinesthetic processing. We hypothesized that input will reinforce propoceptive skills by merging a non-native input with native proprioceptive and visual system information, and subsequently cause an increase in accuracy in a single session of motor skill practice.

METHODS: We assessed torso angle, a crucial control element that are common to many multi-joint, complex actions. Three subjects (19.7 ± 0.58 yrs) performed static and dynamic torso control movements with and without real-time haptic feedback. A wearable mini motion-capture-feedback device with embedded accelerometer, magnetometer, gyroscope and proximity sensors recorded continual positional data in 8 axes. The device provided haptic feedback (vibrations via tiny motor ) when the target parameters were achieved. After 5 repetitions of practice, alternating sets with and without real-time haptic feedback were measured, (2 sets of 5 and 10 repetitions). RESULTS: We analyzed posture control in 2 conditions in the beginning and end of a training session. An ANOVA was performed on normalized differences from the target means was significant in the initial training sets, (p <0.01, F=4.2), and not significant in the final sets, (p = 0.09, 4.0). The results suggest a significant learning effect with KAT training after 30 repetitions. CONCLUSION: The results of this study suggests KAT training with haptic feedback could be a valuable teaching tool for improving somatosensory proprioception and kinesthetic awareness. Further investigations should examine if the KAT training leads to neural adaptation and improved motor performance.

2715 Board #235 June 2 9:30 AM - 11:00 AM
A 6-week Strength Training Increases Muscle Size in Patients with Chronic Ankle Instability: MRI Analysis
Hyeri Gonzales¹, S. Jun Son¹, Hyunsoo Kim², Kade Eppich³, Neil K. Bangertre, Matthew K. Seeley, J. Ty Hopkins, FACSM. ¹Brigham Young University, Provo, UT. ²West Chester University, West Chester, PA. (Sponsor: J. Ty Hopkins, FACSM)
Email: Hyeri.gonzales@gmail.com

Patients with chronic ankle instability (CAI) have shown strength deficits in ankle and hip musculature. Little is known whether strength deficits are associated with muscle size in this patient population, and if strengthening can improve muscle size.

PURPOSE: To examine if the effect of a 6-week ankle and hip strength program on peroneus longus (PL) and gluteus medius (GM) muscle size in CAI patients.

METHODS: 14 CAI subjects in a strength group (22±1 yrs, 173±9 cm, 73±12 kg, 82±8% FAAM ADL, 58±13% FAAM Sports, 3.7±1.5 ankle sprains) completed a series of 5 ankle and hip strength exercises (isometric, concentric, and eccentric contraction with theraband) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 5.9±3.3 ankle sprains). A Siemens Trio MRI scanner with a large flex coil was used to acquire images using a 3D multi-slice spiral gradient echo sequence with TE: 7.48 ms, TR: 17 ms, slice thickness: 5 mm. Images were acquired

Abstracts were prepared by the authors and printed as submitted.

FRI, JUNE 2, 2017
at pre- and post-intervention. Axial cross-sectional area (CSA) from each muscle was segmented using Analyze 12.0 software. PL muscle belly was consistently defined at 15±6 slices (7.5 cm) from the superior head of the fibula. GM muscle belly was defined at 15±6 slices (7.5 cm) from the superior greater trochanter of the femur. ANCOVA analyses (covariate: pre-intervention value) were used to detect group × time differences.

RESULTS: ANCOVA analyses confirmed between-group differences in PL (F (1,25)=36.327, p < .001) and GM CSA (F(1,25)=13.389, p < .05) over time. The strength training resulted in a 5% increase in CSA (pre: 47.7±7.8 cm², post: 47.7±7.8 cm²; p > .05) in the control group. CONCLUSIONS: Relative to the control group, a 6-week strength program is effective in increasing muscular strength, which can have positive effects on movement and dynamic stability during functional movement.

**2716**

**Board #236**

**June 2 9:30 AM - 11:00 AM**

**Influence of Body Position on Maximum Ankle Torque under Volitional Fatigue Conditions**

Taeimin Moon¹, Yongung Kwon², Chris Karaffa¹, Stella Matthews¹, Jai K. Jung², D.S. Blaise Williams III, FACSM.¹

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²Youngstown State University, Youngstown, OH.

Email: taemoon86@gmail.com

(No relationships reported)

Many studies have investigated the reliability of measuring isometric ankle strength using isokinetic dynamometer. However, hip position and body position may influence the participant’s ability to generate torque during the test. **Purpose:** To investigate the effect of body position on isometric ankle plantarflexion (PF) and dorsiflexion (DF) - strength measurement in pre and post-fatigued conditions. **Methods:** Fifteen healthy subjects (age:20.5±1.5 yrs) participated. Subjects required a total 2 of visits with a week period between visits. Subjects were initially assigned one of two test positions (seated and supine). The order of test positions were randomized and counterbalanced. Subjects performed the Bruce protocol on a treadmill until they reached volitional exhaustion. Before and after the Bruce protocol, subjects performed a total of 3 maximum voluntary isometric contractions (MVIC) in PF and DF directions. Data were analyzed using peak torque in each direction from the 3 trials of the MVIC. Separate two-way analysis of variance with repeated measures was used to assess the effect of fatigue (pre-fatigue and post-fatigue) and test position (seated and supine) for PF and DF. **Results:** There were significant differences between both pre and post-fatigue (PF; pre: 103.1 ± 17.2 Nm vs post: 82.4 ± 14.4 Nm, p-value<0.001; DF; pre: 21.7 ±6.4 vs post: 18.3 ± 6.3, p-value<0.001) and supine and seated positions (PF; supine: 84.7 ±15.6 Nm vs seated: 101.5 ± 18.8 Nm, p-value<0.001; DF; supine: 17.9 ±5.4 vs seated: 22.7 ± 5.6, p-value=0.026) for PF and DF torques. There was no significant interaction between time and position for any variables. **Conclusions:** Body position affected isometric ankle PF and DF strength but fatigability was not influenced by body position. Specifically, subjects were able to produce more torque in the seated position compared to supine position. This may be due to the subjects ability to stabilize the back and hip against the seat back. Further, this suggests that these two positions should not be interchanged when testing individuals in pre- and post-fatigue situations.

**2717**

**Board #237**

**June 2 9:30 AM - 11:00 AM**

**Strength and Proprioceptive Training Increases Muscle Size in Patients with Chronic Ankle Instability: MRI Analysis**

Kade E. Eppich¹, S. Jun Son¹, Hyunsoo Kim², Hyeri Gonzales¹, Neal K. Bangertér¹, Matthew K. Seeley¹, J. Ty Hopkins, FACSM.¹, ²Brigham Young University, Provo, UT. ¹West Chester University, West Chester, Pa. (Sponsor: J. Ty Hopkins, FACSM)

Email: kade.eppich@gmail.com

(No relationships reported)

Chronic ankle instability (CAI) is related to strength deficits in ankle and hip musculature. Rehabilitation training improves muscular strength, but it is unclear whether strength gain results from an increase in muscle size or neuromuscular efficiency. **Purpose:** To examine the effect of a 6-week ankle and hip strength and proprioceptive program on peroneus longus (PL) and gluteus medius (GM) muscle size in patients with CAI. **Methods:** 15 CAI subjects in a rehab group (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 4.7±2 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22±2 yrs, 179±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 5.9±3.2 ankle sprains). A Siemens Trio MRI scanner with a large flex coil was used to acquire images using a 3D multi-slice spiral gradient echo sequence with TE: 7.48 ms, TR: 17 ms, slice thickness: 5 mm. Images were acquired at pre- and post-intervention. Axial cross-sectional area (CSA) from each muscle was segmented using Analyze 12.0 software. PL muscle belly was consistently defined at 15±6 slices (7.5 cm) from the superior head of the fibula. GM muscle belly was defined at 15±6 slices (7.5 cm) from the superior greater trochanter of the femur. ANCOVA analyses (covariate: pre-intervention value) were used to detect group × time differences.

**RESULTS:** ANCOVA analyses confirmed between-group differences in PL (F (1,25)=36.327, p < .001) and GM CSA (F(1,25)=13.389, p < .05) over time. The rehabilitation intervention resulted in a 3.9% increase in PL (pre=5.9±1.5 cm², post=6.1±1.5 cm²; p < .05) and a 5.1% increase in GM CSA (pre=42±7.1 cm², post=44±7.7 cm²; p < .05). No significant changes were detected in PL (0.7% reduction; pre=6.96±1.7 cm², post=6.91±1.6 cm²; p > .05) and GM CSA (0.6% increase; pre=47.5±7.9 cm², post=47.7±7.8 cm²; p > .05) in the control group. **Conclusions:** Relative to the control group, a 6-week strength and proprioceptive program is effective in increasing muscle size of ankle and hip musculature. As muscle size is proportional to muscular strength, increased muscle size might have a positive impact on dynamic functions at the ankle and hip.

**2718**

**Board #238**

**June 2 9:30 AM - 11:00 AM**

**Sex-Specific Responses to Fatiguing Exercise Can Be Explained by Electromechanical Efficiency**

Ethan C. Hill, 68583-0806, Terry J. Housh, FACSM, Cory M. Smith, Josh L. Keller, Richard J. Schmidt, Glen O. Johnson, FACSM. University of Nebraska - Lincoln, Lincoln, NE. (Sponsor: Dr. Terry J. Housh, FACSM)

Email: ethan.hill@unl.edu

(No relationships reported)

**Purpose:** It is well known that muscle fatigue is manifested uniquely between men and women. Electromechanical efficiency has been used to examine various aspects of muscle function, but has not been applied to examine sex-specific fatigue responses. Therefore, the purpose of the present study was to examine electromechanical efficiency between men and women during a fatiguing task. **Methods:** Twenty-two resistance-trained men and women performed 50 submaximal (65% of concentric peak torque), concentric muscle actions of the dominant forearm flexors at 60°/s. Concentric peak torque was determined prior to and immediately after the fatiguing protocol. Surface electromyographic and mechanomyographic signals were simultaneously recorded from the biceps brachii muscle and electromechanical efficiency was calculated as the ratio of mechanomyographic amplitude to electromyographic amplitude. An independent samples t-test was used to compare the percent decreases in concentric peak torque between the men and women. Polynomial regression analyses were used to examine the composite patterns of responses for electromechanical efficiency for the men and women. In addition, to allow for the comparison of slope coefficients, composite electromechanical efficiency values were natural log transformed and fitted with a linear model. **Results:** Concentric peak torque decreased to a greater extent in the men (30.5%) compared to the women (22.1%). In addition, electromechanical efficiency decreased for both the men (quadratic, p = 0.016, r = -0.919) and women (quadratic, p = 0.006, r = -0.605), but the natural log transformed slope coefficients indicated that the decrease was greater for the men (-0.026) than the women (-0.009). **Conclusion:** Like concentric peak torque, electromechanical efficiency decreased for both the men and women, but the decrease was greater for the men. These findings indicated that men exhibited decreased electromechanical efficiency compared to their female counterparts which may have contributed to the greater decrease in concentric peak torque for the men. Thus, electromechanical efficiency may provide additional insight regarding the potential mechanisms mediating sex-specific responses to fatiguing exercise.

**2719**

**Board #239**

**June 2 9:30 AM - 11:00 AM**

**MMAX Normalisation of Voluntary EMG Removes the Confounding Influences of Electrode Location and Body Fat.**

Marcel B. Lanza, Tom B. Balshaw, Jonathan P. Folland, FACSM. Loughborough University, Loughborough, United Kingdom.

Email: marcel.lanza@gmail.com

(No relationships reported)

The evolved maximal M-wave (Mmax peak-to-peak [P-P]) is frequently used to normalise surface electromyography (sEMG) during voluntary contractions. However, it is unknown if Mmax normalisation: (i) accounts for the variation in electrode position over a muscle, potentially removing the need for precise and yet imperfect electrode placement between measurement sessions; and (ii) removes the documented influence of body fat on sEMG amplitude during voluntary contractions.
**PURPOSE:** The first aim of the study was to assess the influence of electrode positioning on sEMG measurements, using multiple recording sites over the vastus lateralis (VL), during voluntary contractions (MVCs) and evoked MMAX and examine if any site differences in these parameters were proportional. The second aim was to investigate if MMAX normalization removes the confounding influence of body fat, quantified by skin-muscle distance (SMD), on sEMG during MVCs.

**METHOD:** Young healthy males completed both experiments. Experiment 1 (n=10; 22 ± 2 y; 1.78 ± 0.07 m; 73.6 ± 6 kg) involved simultaneous sEMG measurements from 8 different VL sites during knee extension isometric MVCs and twitch contractions. Experiment 2 (n=41; 24 ± 2 y; 1.76 ± 6 m; 69 ± 6 kg) involved the same contractions with sEMG recordings from one location over the VL, vastus medialis and rectus femoris, and measurements of SMD at each sEMG site using B-mode ultrasonography.

**RESULTS:** Experiment 1 demonstrated that absolute sEMG at maximal voluntary torque (EMGmax) differed between the VL recording sites and increased values at more proximal sites (P < 0.030). However, when EMGmax was normalised to MMAX, P-P between sites no differences were found (P = 0.929). Experiment 2 showed positioning between test sessions and variable body composition between participants.

**CONCLUSION:** MMAX normalization is recommended to overcome the issues of both sensor re-unknown.

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**PURPOSE:** To compare hip and knee muscle activity between sliding and standard lunges.

**METHODS:** 28 participants were recruited from a local university community, with 14 participants randomised to the sliding (SL) group and 14 to the standard reverse lunges (RL) group. The SL participants performed a combination of standard reverse lunges and side lunges (SL). METHODS: Sixteen healthy active subjects performed 3 types of RL with SL: slide board (SB), foot sliders (FS), and standard reverse lunges (ST). After skin preparation, surface electrodes were placed over the muscle bellies of the gluteus maximus (GMX), ipsi- and contra-lateral gluteus medii (GM, cGM), vastus lateralis (VL), and vastus medialis (VM). Muscle activity of the weight bearing leg was measured at 1000 Hz with a wireless EMG system. Lungen were performed at a standardized tempo (44 bpm) and subject specific standardized length. Maximum voluntary isometric contractions (MVIC) were used to normalize peak EMG (gEMG) and average EMG (aEMG) to percent MVC for 4 lunges of each subject all conditions. One-way repeated measures ANOVAS (α = 0.05) were used to determine differences between the 3 lunge types for SL and RL.

**RESULTS:** RL gEMG was greater for ST (22 ± 21%) versus FS (17 ± 17%); p < 0.002. RL VM aEMG was greater for SB (30 ± 12%) versus FS (24 ± 14%); p < 0.05, and greater for ST (23 ± 15%) versus SB (19 ± 12%); p < 0.05. LGM aEMG was greater for ST (19 ± 13%) versus SB (15 ± 12%) and FS (16 ± 10%); p < 0.001 and 0.035. SL VM aEMG was greater for ST (135 ± 14%) versus SB (26 ± 11%); p < 0.05 and 0.004. SL GM aEMG was greater for ST (79 ± 44%) versus SB (52 ± 32%) and FS (50 ± 37%); p < 0.019 and 0.003. SL cGM aEMG was greater for ST (79 ± 41%) versus SB (59 ± 34%); p < 0.027. SL VM eEMG was greater for ST (92 ± 46%) versus SB (63 ± 28%) and FS (60 ± 18%); p < 0.031 and 0.1. CONCLUSION: Hip and knee muscle activity is similar for SL with minor differences in cEMG and VM based on lunge type. Standard SL had consistently greater peak and average muscle activity compared to sliding lunges. Sliding SL may require different neural control which could be important in rehabilitation settings.

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**PURPOSE:** The first aim of the study was to assess the influence of electrode positioning on sEMG measurements, using multiple recording sites over the vastus lateralis (VL), during voluntary contractions (MVCs) and evoked MMAX and examine if any site differences in these parameters were proportional. The second aim was to investigate if MMAX normalization removes the confounding influence of body fat, quantified by skin-muscle distance (SMD), on sEMG during MVCs.

**METHOD:** Young healthy males completed both experiments. Experiment 1 (n=10; 22 ± 2 y; 1.78 ± 0.07 m; 73.6 ± 6 kg) involved simultaneous sEMG measurements from 8 different VL sites during knee extension isometric MVCs and twitch contractions. Experiment 2 (n=41; 24 ± 2 y; 1.76 ± 6 m; 69 ± 6 kg) involved the same contractions with sEMG recordings from one location over the VL, vastus medialis and rectus femoris, and measurements of SMD at each sEMG site using B-mode ultrasonography.

**RESULTS:** Experiment 1 demonstrated that absolute sEMG at maximal voluntary torque (EMGmax) differed between the VL recording sites and increased values at more proximal sites (P < 0.030). However, when EMGmax was normalised to MMAX, P-P between sites no differences were found (P = 0.929). Experiment 2 showed that absolute EMGmax was negatively related to SMD (P = 0.001, r = -0.786) but when EMGmax was normalised by MMAX P-P the relationship with SMD was not significant (r = 0.17, P = 0.966).

**CONCLUSION:** The present study suggests voluntary sEMG and MMAX P-P amplitude vary proportionally across the surface of the VL muscle and that normalising voluntary sEMG to MMAX P-P removes the confounding influence of body fat. Therefore, MMAX P-P normalisation is recommended to overcome the issues of both sensor re-unknown.

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Effects of Marijuana Use on Lower Extremity Isokinetic Strength and Core Endurance
Brian C. García, Grace Rhodhouse, Jonathon Lisano, Laura K. Stewart, Jeremy D. Smith. University of Northern Colorado, Greeley, CO (No relationships reported)

Marijuana use among athletes is becoming more widely reported, particularly as more states legalize the drug. Anecdotally, supporters suggest that marijuana aids in recovery and improves performance. Unfortunately, the effect of marijuana use on muscle function is not currently understood. Purpose: To determine whether muscle strength and endurance are altered by marijuana use. Methods: All participants were physically active, defined by at least 150 minutes of moderate-intensity exercise per week via the I-PAQ Short Format, and were either marijuana users (MU, n = 10, mass = 81.4 ± 14.4 kg; ht = 1.78 ± 0.06 m; age = 25 yrs ± 6 yrs) or non-marijuana users (NU, n =15, mass = 73.5 ± 13.5 kg; ht = 1.80 ± 0.08 m; age = 25 yrs ± 6 yrs). Marijuana use habits were quantified through the Marijuana Use Measure. MU were described as those consuming marijuana products at least once a week for the past 6 months and NU were described as not having used any form of marijuana in the past 12 months. Hip (90° s−1), knee (30° s−1), and ankle (30° s−1) isokinetic strength was assessed in the dominant leg of each participant using a Biodex dynamometer. Leg dominance was determined by asking which leg the person would choose to kick a ball with for maximum velocity and distance. Core endurance (back extension, left side plank, right side plank, and trunk flexion) was also assessed by holding the position until failure. The time it took to reach failure for each condition for each participant was recorded. All conditions were randomized across participants and groups to avoid any order effects. A single factor MANOVA (α < 0.05) was used to determine differences between groups. Results: There were no statistically significant differences between groups for any strength or core endurance measures (F < 0.67; DF = 10, 15; F < 0.70; p > 0.68). Conclusion: Marijuana use in a healthy, young, active population does not appear to enhance or suppress core endurance or lower extremity strength. It is possible that exercise may be mediating potential detrimental effects of marijuana use. Future research should also focus on inactive populations using marijuana to assess if exercise is providing a protective effect.

Comparison of Electromyographic Responses Across Handle Types During Seated Row Exercise
Tyler F. Meckes1, Sam Meske1, Daniel G. Drury, FACSM2, Swapan Mookerjee1, ‘Bloomsburg University, Bloomsburg, PA. 1Gettysburg College, Gettysburg, PA. (Sponsor: Daniel G. Drury, FACSM) (No relationships reported)

Handle design and wrist position can affect the muscular performance during resistance exercises. Purpose: This study compared the electromyographic (EMG) responses during seated row exercise in the Latissimus Dorsi (LD), Biceps Brachii (BB), and Flexor Carpi Radialis (FCR) using a cylindrical handle versus a MAG® handle. Methods: Ten men (aged 21.1 ± 1.4 yrs) with prior resistance training experience (6.3 ± 1.9 yrs) performed the exercise protocol on a cable machine. Participants completed a one-repetition maximal lift (1-RM) followed by one set at 85% 1-RM until failure, using both handle types in randomized order. Root mean square EMG (EMGRMS) recordings from the BB, LD, and FCR were normalized to the 1-RM values. Results: Two-way repeated measures ANOVA was used to analyze differences between handle types and EMG activity. EMGRMS (±% ) are presented in the table below:

<table>
<thead>
<tr>
<th>Handle Type</th>
<th>EMGRMS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder</td>
<td>MAG(R)</td>
</tr>
<tr>
<td>Biceps Brachii</td>
<td>66.6 ± 8.9</td>
</tr>
<tr>
<td>Latissimus Dorsi</td>
<td>86.6 ± 13.3</td>
</tr>
<tr>
<td>Flexor Carpi Radialis</td>
<td>57.9 ± 4.1</td>
</tr>
</tbody>
</table>

* Sign. Diffs. (p < 0.001)

The 1-RM lifts were significantly greater (p < 0.003) with the MAG® handle (115.2 ± 17.4 kg) versus the cylindrical handle (102.5 ± 17.1 kg). HROM of the shoulder and elbow were not significantly different between handles for the total number of repetitions completed (cylindrical 11.9 ± 3.67; MAG® 11.2 ± 2.4). Conclusions: These findings showed significantly higher maximal lifts and greater EMG activity in the BB using the MAG® handle. Possible mechanisms for these differences may be related to actin and myosin overlap of the forearm flexors, grip comfort and differences in handle contact surface area.

Acute Effects of Unilateral Static Stretching On Handgrip Strength in the Stretched and Non-Stretched Limb
Jacob D. Jelmini, Andrew Cornwell, Nazareth Khodiguian, Jennifer Thayer. California State University, Los Angeles, Los Angeles, CA. Email: jjelmin2@calstatela.edu (No relationships reported)

Scientific Abstract: Previous research has demonstrated that an acute bout of static stretching can reduce force and power output from the muscles undergoing the stretching treatment. Although the mechanism for this effect remains unclear, evidence has been presented for a neural inhibition and a decrease in muscle tendinous stiffness. To further investigate the presence of a neural inhibitory mechanism, the current study focused on the impact of stretching just one limb on both the stretched limb and the contralateral non-stretched limb. It was reasoned that any decrease in force output from the non-stretched side could only be accounted for by neural inhibition as no mechanical adaptation would have occurred.
PURPOSE: To observe the effects of an acute bout of unilateral static stretching on handgrip strength and to discern whether a neural cross-over inhibitory effect is present to cause a decrease in force output and associated electrical activity from the non-stretched limb. METHODS: Thirty participants (15 males, 15 females) performed maximum voluntary unilateral handgrip contractions of both limbs before and after stretching the finger flexors of the strength-dominant side only. Each trial was assessed for peak force and associated muscle activity (EMG), as well as rate of force generation. RESULTS: Peak force (p = 0.002) and associated EMG (p = 0.000) decreased by 4.2% and 6.5% respectively in the stretched limb only. However, rate of force generation was significantly impaired in both the stretched (-15.2%; p = 0.000) and non-stretched limbs (-9.4%; p = 0.006) one-minute post-stretch, and remained similarly depressed for both limbs 15 minutes later. CONCLUSION: We conclude, therefore, that acute stretching negatively impacts rate of force generation more than peak force. Moreover, a reduced rate of force generation from the non-stretched limb indicates the presence of a cross-over inhibitory effect through the nervous system, which provides additional evidence for a neural mechanism.

E-36 Free Communication/Poster - Physical Activity and Health in Adults
Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2728 Board #248 June 2 11:00 AM - 12:30 PM
The Epidemiological Evidence of Cardiometabolic Disease Risk Factors in College-Aged Subjects: A Cross-Sectional Investigation
Michael J. Carper1, Hillary Dickey2, Derek A. Crawford3, Jessica Heinz4, Pittsburg State University, Pittsburg, KS; University of Oklahoma, Norman, OK. Email: mcarper@pittstate.edu
(No relationships reported)

PURPOSE: The purpose of this 5-year cross-sectional investigation was to collect basic body composition and fitness data on college-aged males and females to determine national recommended guidelines for college-aged students throughout the college years.

METHODS: A total of 3,388 college aged males (n = 1919) and females (n = 1469) age 18 - 25yrs participated in this investigation. Subjects performed the following tests: height; weight; body composition; muscular strength and endurance; cardiopulmonary function; flexibility; waist and hip circumferences; and resting blood pressure.

RESULTS: Females demonstrated a significant increase, from 18-19 yrs to 20-25 yrs, in sit-and-reach (14.5 to 13.9 in), total push-ups (15.2 to 13.3), handgrip strength (80.5 to 83.3 cm and hip (95.1 to 98.9 cm) measurements, fat mass (9.19 to 24.5 kg), BMI (24.4 to 25.8 kg/m²), diastolic blood pressure (75.8 to 77.4 mmHg), waist-to-hip ratio (0.48 to 0.51), and total overweight and obese status (33.9 to 39.1%). These subjects demonstrated a significant decrease, from 16-19yrs to 20-25yrs, respectively, in sit-and-reach (15.4 to 14.6 in) and total push-ups (15.2 to 13.3). Males demonstrated a significant increase, from 18-19yrs to 20-25 yrs, respectively, in weight (80.8 to 85.3 kg), % body fat (15.1 to 17.6 %), waist-to-hip ratio (0.88 to 0.90), waist (85.9 to 89.4 cm) and hip measurements (97.3 to 99.7 cm), waist-to-height ratio (0.48 to 0.50), fat mass (13.3 to 17.1 kg), BMI (25.1 to 26.3), total overweight and obese status (38 to 48.5%), diastolic blood pressure (76.7 to 79.3 mmHg), and right (49.1 to 51.1 kg) and left (46.8 to 48.3 kg) grip strength. These subjects demonstrated a significant decrease, from 18-19yrs to 20-25yrs, in sit-and-reach (14.5 to 13.9 in), total sit-ups (52.7 to 50.9), and total push-ups (33.6 to 32.1). All data was analyzed using independent sample t-tests (SPSS, v. 23; p < 0.05).

CONCLUSIONS: We have demonstrated that there is a continuous decline in basic health and fitness outcomes in college-aged students that may lead to the development of co-morbid conditions and the development of cardiometabolic diseases such as diabetes, hypertension, and cardiovascular disease.

2729 Board #249 June 2 11:00 AM - 12:30 PM
Physical Activity and Perceived Stress Among Student Physical Therapists
Eric Arguello. University of North Texas Health Science Center, Fort Worth, TX. (No relationships reported)

Physical activity is often suggested for managing stress. However, it is not known if there is a relationship between perceived stress and physical activity among student physical therapists.

Purpose: To determine the percentage of student physical therapists that meet the national recommended guidelines for aerobic and muscle strengthening physical activity and to describe the relationship between physical activity, perceived stress levels, and time spent in sedentary activities.

Methods: Doctor of Physical Therapy Students (n=113) were grouped according to their year in the academic program as Grad I’s, Grad II’s, and Grad III’s. Perceived Stress Scale and Exercise Activities Scale were combined in a questionnaire to describe student physical therapist’s perceived stress levels and to determine the average amount of aerobic and muscle strengthening physical activity performed on a weekly basis. Sedentary activities questions were also included in the questionnaire. Data were analyzed for mean perceived stress levels, percentages of student who met the exercise guidelines and the mean time spent in sedentary activities.

Results: Perceived stress was lower for the Grad III’s (9.1 ± 4.2) compared to Grad I’s (15.1 ± 6.1; p < .05) and Grad II’s (18.7 ± 8.4; p < .05). Perceived stress was lower for the Grad I’s compared to Grad II’s (p < .05). Perceived stress was higher in Grad I’s among all physical therapy students. Aerobic physical activity guidelines were met by 65% of Grad I’s, 54% of Grad II’s, and 93% of Grad III’s. Muscle strengthening activity guidelines were met by 33% of Grad I’s, 25% of Grad II’s, and 85% of Grad III’s. Time spent in sedentary activities was lower for Grad III’s (867 ± 765 min) compared to Grad I’s (2884 ± 1531.1 min, p < .05) and Grad II’s (3741.5 ± 2092.3 p < .05). There was a negative correlation between perceived stress and meeting the aerobic (rpb = -0.326, n = 113, p < .001) and muscle strengthening (rpb = -0.326, n = 113, p < .001) physical activity guidelines for all cohorts.

Conclusion: Student physical therapists in this Doctor of Physical Therapy program experiencing higher levels of perceived stress also demonstrate overall decreased physical activity and increased sedentary levels. In addition, perceived stress and activity levels appear to fluctuate during their education.

2730 Board #250 June 2 11:00 AM - 12:30 PM
Association of Physical Activity and Sedentary Behavior with Hyperuricemia
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PURPOSE: The purpose of this study was to identify the associations of sedentary behavior and physical activity level with hyperuricemia in South Korean men and women. METHODS: This study includes 161,064 healthy men and women with completed health examination between March 2011 and December 2013. Physical activity level and sitting time were assessed by a validated Korean version of International Physical Activity Questionnaire Short Form (IPAQ-SF). The presence of hyperuricemia was determined by examining serum uric acid (SUA) concentration (≥7mg/dL). Multivariable logistic regression analysis was conducted to investigate the associations of sedentary behavior and physical activity level with hyperuricemia. RESULTS: Participants who spent ≥10 hours/day was more likely to have hyperuricemia than participants spending <5 hours/day (Odds Ratio [OR]=1.10, 95% confidence interval [CI]=1.05-1.16) after adjusting for age, sex and risk factors of hyperuricemia. Participating in health enhanced physical activity (HEPA) defined as ‘vigorous-intensity activity on at least 3 days achieving a minimum Total physical activity of at least 1500 MET minutes/week or 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum Total physical activity of at least 3000 MET minutes/week’ was associated with decreased prevalence of hyperuricemia, compared to in men, women who ‘do not meet physical activity criteria’ (OR=0.92, 95% CI= 0.87-0.96). In gender stratified analyses, sitting time ≥10 hours/day was associated with increased prevalence of hyperuricemia (OR=1.09, 95% CI= 1.04-1.15) compared to sitting time <5 hours/day, and participating in HEPA was associated with decreased prevalence of hyperuricemia (OR=0.91, 95% CI= 0.87-0.96) compared to the minimal activity in men. However, it was not significantly associated with prevalence of hyperuricemia in women (sitting time, OR=1.27, 95% CI= 0.97-1.67; HEPA, OR=0.91, 95% CI= 0.77-1.39).

CONCLUSIONS: This study identified that the prevalence of hyperuricemia was associated by decreased physical activity and prolonged sedentary behavior, especially in men. Thus, participating in regular physical activity and reducing sedentary time are recommended to reduce the prevalence of hyperuricemia.

2731 Board #251 June 2 11:00 AM - 12:30 PM
Associations Between Impaired Fasting Glucose, Hypertriglyceridemia, and Hyperinsulinemia In Us Adults: 2007-2012 Nhanes
James R. Churilla, FACSM, Michael R. Richardson. University of North Florida, Jacksonville, FL. Email: j.churilla@unf.edu (No relationships reported)

PURPOSE: Examine the gender stratified associations between combinations of impaired fasting glucose and hypertriglyceridemia and the odds of hyperinsulinemia using a nationally representative sample of U.S. adults. METHODS: Study sample included male (n=3109) and female (n=3433) adult (≥ 20 years of age) participants in the 2007-2012 National Health and Nutrition Examination Survey. Hyperinsulinemia

Abstracts were prepared by the authors and printed as submitted.
was defined using the 75th percentile of fasting insulin as the cutoff value. Logistic regression analysis was used to examine the associations among impaired fasting glucose, hypertriglyceridemia, and hyperinsulinemia. Logistic regression models were adjusted for age, race, moderate-intensity physical activity (MPA), and waist circumference (WC). RESULTS: Demographic adjusted analyses revealed significantly greater odds of hyperinsulinemia in euglycemic men (OR 3.09, 95% CI 1.96-4.83) and women (OR 3.13, 95% CI 2.12-4.63) with hypertriglyceridemia (P=0.001 for both). Additionally, women with impaired fasting glucose and normal triglycerides had significantly greater odds of hyperinsulinemia (OR 5.62, 95% CI 3.61-8.75, P<0.001). A similar relationship was not revealed in men (OR 1.09, 95% CI 0.23-5.13, P=0.92). Following adjustments for MPA and WC, the odds of hyperinsulinemia in euglycemic men (OR 2.42, 95% CI 1.45-4.05) and women (OR 1.49, 95% CI 1.01-2.18) with hypertriglyceridemia were attenuated, but remained statistically significant (P=0.05 for both). Hence, the odds of hyperinsulinemia in women with impaired fasting glucose and normal triglycerides were no longer statistically significant (P=0.12). CONCLUSION: Our findings revealed greater odds of hyperinsulinemia in euglycemic men and women with hypertriglyceridemia regardless of MPA or WC.

2732  Board #252  June 2 11:00 AM - 12:30 PM  Association Of Resistance Exercise With The Incidence Of Hypercholesterolemia In Men

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(No relationships reported)

Hypercholesterolemia is a significant risk factor for cardiovascular disease. Although the beneficial effects of aerobic exercise (AE) are well-documented, evidence for the effects of resistance exercise (RE) on the development of hypercholesterolemia is still scarce. PURPOSE: To examine the association of RE, independent of and combined with AE, with the risk of developing hypercholesterolemia in men.

METHODS: Men, aged 18-83 years (mean age 46), who received comprehensive preventive examinations at the Cooper Clinic in Dallas, Texas, were included in this study. Baseline RE, AE, and meeting the 2008 US Physical Activity Guidelines (RE ≥2 days/week; AE ≥500 MET-minutes/week) were determined by self-reported frequency and minutes of exercise. Hypercholesterolemia was defined as total cholesterol of ≥240 mg/dL or physician-diagnosed hypercholesterolemia during follow-up examinations. Hazard ratios (HRs) and 95% confidence intervals (CIs) were calculated using Cox proportional hazards regression.

RESULTS: Among 7,317 participants, 1,430 men (20%) developed hypercholesterolemia during a median follow-up of 4 years. Individuals meeting the RE guidelines had a 13% lower risk of developing hypercholesterolemia (HR 0.87; 95% CI 0.77 to 0.96) after adjustment for potential confounders and AE. In addition, after full adjustment, less than 1 hour/week and 2 sessions/week of RE were associated with 32% and 31% lower risks of hypercholesterolemia (HR 0.68; 95% CI 0.54 to 0.88), respectively, compared to no RE. Less than 1 hour/week and 2 sessions/week of RE were associated with 32% and 31% lower risks of hypercholesterolemia (HR 0.69; 95% CI 0.54 to 0.88), respectively, compared to no RE. Addition, after full adjustment, less than 1 hour/week and 2 sessions/week of RE were associated with 32% and 31% lower risks of hypercholesterolemia (HR 0.68; 95% CI 0.54 to 0.88), respectively, compared to no RE. Additionally, women with impaired fasting glucose and normal triglycerides had significantly greater odds of hyperinsulinemia (OR 5.62, 95% CI 3.61-8.75, P<0.001). A similar relationship was not revealed in men (OR 1.09, 95% CI 0.23-5.13, P=0.92). Following adjustments for MPA and WC, the odds of hyperinsulinemia in euglycemic men (OR 2.42, 95% CI 1.45-4.05) and women (OR 1.49, 95% CI 1.01-2.18) with hypertriglyceridemia were attenuated, but remained statistically significant (P=0.05 for both). Hence, the odds of hyperinsulinemia in women with impaired fasting glucose and normal triglycerides were no longer statistically significant (P=0.12). CONCLUSION: Our findings revealed greater odds of hyperinsulinemia in euglycemic men and women with hypertriglyceridemia regardless of MPA or WC.

2733  Board #253  June 2 11:00 AM - 12:30 PM  Health Behaviors and Dietary Supplement Use among Military Personnel: A Latent Class Analysis

Xiaying Zheng¹, Josh B. Kazmaier¹, Tzucheg Kao², Krauss Stephen², Diana Jeffery³, Patricia A. Deuster, FACSM⁴. ¹University of Maryland, College Park, MD. ²Uniformed Services University, Bethesda, MD. ³Defense Health Agency, DoD, Falls Church, VA. Email: xyzheng86@gmail.com  
(No relationships reported)

Dietary supplements (DS) are commonly used to increase muscle mass and/or lose weight, even though many are ineffective and linked to adverse events. DS use is particularly common among military personnel and athletes, correlating with both health-promoting and risky/deleterious behaviors. Latent class analysis (LCA) identifies and classifies people into separate groups based on combinations of categorical responses. PURPOSE: To extend the current literature focused on individual behaviors among DS use and health behaviors, the present study used LCA to: (1) characterize military personnel with respect to health behaviors related to the performance triad, and (2) describe differences in body building (BB) and weight loss (WL) DS use across the classes constructed in (1). METHOD: Data from the 2011 DoD Health Related Behaviors Survey of Active Duty Military Personnel for 39,877 service members were assessed. Variables related to diet, activity and sleep were used in a sample weighted LCA to identify a best-fitting model and number of classes, and then relate class membership to BB and WL use. RESULTS: The best-fitting model identified four latent classes: 1) Balanced: balanced performance class (30%), characterized by healthy diet, high-to-moderate activity, and adequate sleep; 2) Active: highly active class (31%), characterized by poor diet, very high activity, and low-to-moderate sleep; 3) Unhealthy: weak performance class (34%), characterized by poor diet, low activity, and moderate-poor sleep; and 4) Inconsistent: careless responding class (5%), characterized by extreme and inconsistent responses. BB and WL supplements were most prevalent in the Active class (BB: 38%; WL: 37%) and least prevalent in the Unhealthy class (BB: 22%; WL: 28%). Females were less likely to use BB (17% female vs. 37% male) but more likely to use WL (23% female vs. 20% male) supplements. Class membership and WL/BB use also varied by military service branch. CONCLUSION: Among military personnel, BB and WL use are related to distinct patterns of positive and deleterious health behaviors. Educational DS campaigns should be tailored towards these latent classes of health behaviors. BB and WL use may be more common among individuals who engage in otherwise healthy behaviors than among those who engage in deleterious behaviors.

2734  Board #254  June 2 11:00 AM - 12:30 PM  Characterizing the Relationship between Physical Activity and Osteoporosis in the Greater Philadelphia Hispanic Population

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The Hispanic population in the United States has increased 9-fold since 1960, and currently accounts for 20% of the total population. While the incidence of osteoporosis in this population is similar to the national average, the literature exploring the connection between physical activity and osteoporosis incidence in Hispanic Americans is limited. PURPOSE: To determine the relationship between physical activity and osteoporosis in the Philadelphia Hispanic population. METHODS: 49 postmenopausal Hispanic women were recruited from community centers in the greater Philadelphia area. Surveys obtained self-reported osteoporosis status, which was used to separate women into healthy and osteoporosis groups. Both groups were queried regarding their physical activity level and type in childhood, adulthood, and late adulthood. Subject characteristics, fractures, nutrition, and socioeconomic status were also obtained. RESULTS: Groups (healthy n=25, osteoporosis n=24) were similar in height, weight, and age of menopause, but the osteoporosis group (67.6±10.0 yr) was older than the healthy group (73.8±6.2 yr). The osteoporosis group reported more meals containing starch, but fewer meals containing meat, vegetables, fruit, and dairy. Education level was lower in the osteoporosis group. CONCLUSION: The results display a positive relationship between increased physical activity and bone health in Hispanic women. This study suggests more education may encourage better habits, potentially reducing osteoporosis incidence in this Hispanic American population.

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Recommendations are for future studies to assess health behaviors to identify young and CVD risk behavior is essential for both prevention and intervention efforts.

Conclusions: Young adults with elevated BMIs are at increased risk for CVD, given their weight status. Results indicate that few were engaging in the maximum number of healthy behaviors. Specifically, 11.0%, 29.9%, 50.5%, 7.6%, and 1.1% had 0, 1, 2, 3, 4 healthy behaviors, respectively. The distribution of number of healthy behaviors provides a useful baseline for public health efforts targeting unhealthy lifestyles and may be used to guide clinical interventions. The distribution of categories of healthy lifestyle behaviors (1) meeting guidelines for moderate-to-vigorous physical activity (MVPA; >150 minutes); 2) never cigarette user 3) never e-cigarette user; 4) low sedentary behavior (<4 hours/day); 5) healthy dietary habits (≥5 servings of fruits and vegetables/day); and 6)不曾是 osteoporosis. The distribution of each category provides information on the proportion of young adults engaging in each behavior, which can be used to inform public health efforts targeting unhealthy lifestyles.

PURPOSE: Participation in healthy lifestyle behaviors is associated with decreased risk for CVD across the lifecycle. Examining clustering of healthy lifestyle behaviors among young adults at increased risk due to elevated BMI could provide insight into CVD preventive interventions that could be implemented during this developmental transition. Methods: Young adults (ages 18-35) enrolled in a healthy body weight clinical trial (n=210; % female=79.5%; M age=22.1 ±3.9; M BMI=31.4±3.7) completed surveys: demographics, the International Physical Activity Questionnaire (IPAQ) and the Population Assessment on Tobacco and Health (PATH) questions. Healthy Lifestyle Behaviors included: 1) meeting guidelines for moderate-to-vigorous physical activity (MVPA; >150 minutes); 2) never cigarette user 3) never e-cigarette user; 4) low sedentary behavior (<4 hours/day). Participants were scored for the presence of up to 4 healthy lifestyle behaviors. Results: Participants reported engaging in 122.7±103.6 minutes/week of MVPA and 8.5±3.4 hours/day of sedentary behavior. Approximately 6.2% met criteria for MVPA, 60.9% reported never smoking cigarettes, 83.2% reported never using e-cigarettes, and 17.6% had low sedentary behavior time. In terms of clustering of healthy lifestyle behaviors, 11.0%, 29.9%, 50.5%, 7.6%, and 1.1% had 0, 1, 2, 3, 4 healthy behaviors, respectively. The distribution of number of healthy behaviors varied little by age, gender or BMI status (overweight vs. obese).

Conclusions: Young adults with elevated BMIs are at increased risk for CVD, given their weight status. Results indicate that few were engaging in the maximum number of recommended health behaviors to mitigate risk. Understanding healthy lifestyle and CVD risk behavior is essential for both prevention and intervention efforts. Recommendations are for future studies to assess health behaviors to identify young adults at risk such that targeted multi behavior interventions can be implemented.

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Figure 1. A. Summary of physical activity during childhood, adulthood, and late adulthood shown in bars with solid bars for healthy and dotted bars for nonrespondents group. B. Nutritional breakdown by number of meals/day containing each element. C. Education status = 1 indicates 8th grade, 2 indicates 12th grade, 3 indicates 2 year college, and 4 indicates 4 year college. Bars represent mean±standard deviation. Significant difference p<0.05 denoted by *.
RESULTS: Compared to a referent group of U.S. adults reporting no use of active transportation, analysis revealed significantly lower odds of having an elevated CRP concentration in those reporting more than two days per week (d/wk.) of active transportation (Odds Ratio [OR] 0.83; 95% Confidence Interval [CI], 0.72-0.94, P=0.0064). A similar relationship was not revealed in those reporting less than two d/wk. of active transportation (OR 0.87; 95% CI, 0.61-1.24, P=0.4267).

CONCLUSIONS: In a nationally representative sample of U.S. adults, increased use of active transportation (≥2 d/wk.) was associated with significantly lower odds of elevated CRP independent of waist circumference.

POURPOSE: To examine the association between self-reported use of active transportation and elevated C-reactive protein (CRP) using a nationally representative sample of U.S. adults.

METHODS: The study sample (n=9937) included male and female adults (≥ 20 years of age) who participated in the 2007-2010 National Health and Nutrition Examination Survey. Elevated CRP was defined using the current Centers for Disease Control and Prevention and the American Heart Association recommendations. Active transportation included walking or use of a bicycle to and from work, for shopping, or to school for at least 10 minutes continuously.

RESULTS: Compared to a referent group of U.S. adults reporting no use of active transportation, analysis revealed significantly lower odds of having an elevated CRP concentration in those reporting more than two days per week (d/wk.) of active transportation (Odds Ratio [OR] 0.83; 95% Confidence Interval [CI], 0.72-0.94, P=0.0064). A similar relationship was not revealed in those reporting less than two d/wk. of active transportation (OR 0.87; 95% CI, 0.61-1.24, P=0.4267).

CONCLUSIONS: In a nationally representative sample of U.S. adults, increased use of active transportation (≥2 d/wk.) was associated with significantly lower odds of elevated CRP independent of waist circumference.

Routine utilization of cardiorespiratory fitness (CRF) in cardiovascular disease risk assessment is limited due to cost and the need for exercise equipment and skilled personnel. Estimated CRF (eCRF), based on non-exercise algorithms utilizing readily available clinical and self-reported data, is a promising alternative though its role as a predictor of incident stroke remains unclear, especially in an African American (AA) population.

POURPOSE: To study the association between eCRF and incident stroke as well as the impact of race on the associations. Methods: This population-based U.S. cohort study included 24,465 participants (54.8% women, 39.6% AA, mean age 64.6 years) from the REasons For Geographic And Racial Differences in Stroke (REGARDS) study who were free of stroke at enrollment 2003-2007. Participants were telephoned every 6 months to assess potential stroke, with retrieval and central physician adjudication of medical charts of suspected strokes through March 31, 2016. Baseline eCRF in maximal metabolic equivalents (METs) was determined using non-exercise sex-specific algorithms and further grouped into age- and sex-specific tertiles of the METs distribution. Hazard ratio (HR) and 95% confidence interval (CI) for incident stroke and its subtypes (ischemic and hemorrhagic stroke) was estimated using Cox proportional hazards regression. Results: After an average of 8.3 years of follow-up, 963 (3.9%) participants developed stroke (856 ischemic, 105 hemorrhagic subtype). Compared to the lower tertile eCRF, those in the middle and upper eCRF groups had 6% (HR, 95% CI: 0.94, 0.81-1.10) and 25% (HR, 95% CI: 0.75, 0.63-0.90) lower risk of developing stroke, respectively. Findings were similar findings for ischemic stroke (middle: 7% (HR, 95% CI: 0.93, 0.79-1.10) and upper 25% (HR, 95% CI: 0.72, 0.60-0.88). No association was observed, however, for hemorrhagic stroke. The pattern of the association between eCRF and stroke incidence was similar in white and women. However, eCRF was not associated with stroke among AAs.

Conclusion: Estimated CRF using non-exercise algorithms is a useful predictor of ischemic stroke, in both men and women. The null finding in AAs has important potential public health and clinical implications regarding primary stroke prevention among different ethnic groups.
Change in Cardiorespiratory Fitness and Ideal Cardiovascular Health in the Aerobics Center Longitudinal Study

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Purpose: To examine the relationship between changes in cardiorespiratory fitness and changes in ideal cardiovascular health (CVH) score over time. METHODS: The association between change in fitness and change in ideal CVH score was examined in 2,555 adults who had at least two clinic visits in the Aerobics Center Longitudinal Study. Fitness was measured as duration in minutes from a maximal treadmill test. Ideal CVH score was calculated on a 14 point scale using the AHA’s simple 7 criteria of smoking status, BMI, physical activity (MET-min/wk), healthy diet, total cholesterol, blood pressure, and fasting plasma glucose. Participants were grouped into categories of loss, stable, or gain, by tertiles of change in cardiorespiratory fitness and also by tertiles of change in ideal CVH score between baseline and last follow-up visit. RESULTS: After a mean follow up of 3.3 ± 2.4 years, the average change in ideal CVH score was 0.14 ± 1.9 and the average change in treadmill time was -0.25 ± 2.7 minutes for the total sample. After controlling for age, sex, and time between exam dates, the gain in fitness group (n=851) significantly (p<0.0001) increased their ideal CVH score by an average of 0.71 ± 1.9, while the stable and loss of fitness groups (n=830 and 873 respectively) significantly (p=0.0001) decreased their scores by -0.07 ± 1.9 and -0.55 ± 1.9, respectively (p=0.0001 for difference between groups). Change in treadmill time per year explained 6.5% of the change in ideal CVH score. For every minute increase in treadmill time per year, the ideal CVH score increased by 0.09 per year. CONCLUSIONS: Improving cardiorespiratory fitness during middle age is associated with higher scores and greater improvement in ideal cardiovascular health.

Change In Knee Extensor Strength And All-cause Mortality In Japanese Elderly Individuals: A Cohort Study

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Previous epidemiologic studies have shown that a low level of lower extremity strength is associated with a high risk of mortality among elderly individuals. However, most of these studies only measured lower extremity strength once, at baseline, and limited data are available on the association between changes in the lower extremity strength and mortality in the elderly, particularly in Asian populations.

Purpose: The purpose of this study was to examine the association between changes in knee extensor strength (KES) over four years and all-cause mortality in Japanese elderly individuals.

Methods: The participants were 338 (185 males and 153 females) physically independent, community-dwelling Japanese individuals 70 years of age at baseline. KES was measured annually from 1998 (baseline) to 2002. We included participants with KES measured at baseline and at least two more times from 1999 to 2002. We estimated the change per year in KES for each person using simple linear regression. Participants were then divided into quartiles based on the regression coefficient (first quartile, < -3.54% per year; second quartile, -3.53% to -0.82% per year; third quartile, -0.81% to 2.31% per year; fourth quartile, >2.32% per year), and were followed up for 8 years (2002-2010). The hazard ratios and 95% confidence intervals (CIs) for death across the baseline quartiles of KES trend were obtained from a Cox proportional hazards model while adjusting for sex, body mass index, smoking status, alcohol intake, medication use, functional capacity and initial KES value.

Results: Forty-six (13.6%) participants died during the follow-up period. The hazard ratios for death across the quartiles of KES trend (lowest to highest) were 1.0 (referent), 0.55 (95% CI 0.25-1.21), 0.61 (95% CI 0.28-1.31), 0.33 (95% CI 0.12-0.86) (P for trend<0.033). Participants in the highest quartile had a significantly lower risk of death compared to those in the lowest quartile.

Conclusions: These results indicate that, among physically-independent Japanese elderly individuals, 4-year change in KES among 70-year-olds is associated with lower risk of all-cause mortality over 8 years of follow-up, independent of the KES value at baseline.
Cardiorespiratory fitness was determined by calculating VO2max from a submaximal treadmill test. Data were analyzed using repeated measures hierarchical linear models in SAS. RESULTS: The sample was middle-aged (45.9±17 years), overweight (BMI: 27.1±5.6 kg/m²), and their VO2max was 36.6±9.8 mL/kg/min. Approximately 53% of the sample reported watching TV often and only 3% of the sample reported engaging in regular physical activity often. In models adjusted for age, BMI, physical functioning and smoking status, there was a significant TV time x sex interaction (p<0.0001) when modeling FEV1, such that higher TV time in females was associated with worse FEV1, compared to males. A physical activity x sex interaction (p=0.0001) was also observed in adjusted models of FEV1. When TV time, physical activity and cardiiorespiratory fitness were included in the same model, only the association between cardioprotective fitness and FEV1, remained significant (p<0.001).

CONCLUSION: Cardiorespiratory fitness is a predictor of age-related changes in lung function. Among deconditioned adults, particularly in females, reducing sedentary time and increasing physical activity may lead to an increase in cardioprotective fitness and thus may attenuate the age-related decline in lung function.

PURPOSE: The American Heart Association (AHA) has developed a new metric representing ideal cardiovascular health. The Life’s Simple 7 (LS7) consists of four health behaviors and three health factor metrics: 1) smoking, 2) body mass index (BMI), 3) healthy diet, 4) physical activity (PA), 5) cholesterol, 6) blood pressure, 7) diabetes and 7) diabetes mellitus. Currently, the AHA promotes meeting all seven components of the LS7 metric, considering each component equal in terms of its impact. The aim of this study was to examine specifically the contribution of PA to the LS7 metric and its relationship to health-related quality of life (HRQOL). METHODS: Data for this study came from a large national survey conducted in 2015. A total of N=46,998 adults 50+ years of age and residing in a rural U.S. county were included. HRQOL was assessed using the CDC Healthy Days Index and dichotomized to represent good or poor health. A modified LS7 metric was assessed to include: 1) not smoking within past year, 2) BMI less than 25, 3) consumption of 5+ fruits and vegetables per day, 4) obtaining 150+ minutes of moderate PA per week, and not being diagnosed with 5) high cholesterol, 6) hypertension, or 7) diabetes. One set of analyses were performed with those meeting the PA metric included and one set with those meeting the PA metric included. Multiple logistic regression was used to compute odds ratios (ORs) and 95% confidence intervals (CIs) while adjusting for age, sex, race, and income. RESULTS: Prevalence of good HRQOL increased linearly (59.0%, 68.9%, 75.1%, 79.6%, 84.2%, 89.6%, & 90.0%, p<.001) across adult groups meeting 0 to 6 LS7 metrics, respectively. Adjusted models with those meeting PA included showed 75.1%, 80.4%, 84.2%, 89.6%, & 90.0%, p<.001) across adult groups meeting 0 to 6 LS7 metrics. Adjusted models with those meeting PA excluded showed 53.7%, 58.8%, 65.6%, 71.5%, 76.8%, & 79.3%, p<.001) across adult groups meeting 0 to 6 LS7 metrics. CONCLUSIONS: Results from this study show that the LS7 metric is a stronger predictor of HRQOL when PA is met in older rural U.S. adults. Health promotion programs should emphasize the importance of both highest eCRF. 

PURPOSE: The cross-sectional study included a total of 886 (51.9% women) healthy children and adolescents. Standing broad-jump and isometric handgrip dynamometry were used as indicators of lower and upper body muscular fitness, respectively. Also, a MetSyn z-score was calculated for each subject from triglycerides, HDL cholesterol, fasting glucose, waist circumference, and arterial blood pressure (NAP). Linear regression models fitted for mediation analyses examined whether the association between MF and MetSyn z-score was mediated by adiposity parameters: fat mass, body mass index, waist-to-height ratio and abdominal visceral fat. A MetSyn z-score was calculated for each subject from triglycerides, HDL cholesterol, fasting glucose, waist circumference, and arterial blood pressure (NAP). Linear regression models fitted for mediation analyses examined whether the association between MF and MetSyn z-score was mediated by adiposity parameters according to Baron and Kenny procedures. RESULTS: Findings revealed that lower levels of MetSyn z-score were associated with the best adults profiles (high MF + low adiposity) for trend <0.001 in the four adiposity parameters), compared with unfit strength and obese (low MF + high adiposity) counterparts. Linear regression models suggest a full mediation of adiposity parameters in the association of MF and MetSyn z-score, for both men and women alone. CONCLUSIONS: Our findings seem to emphasize the importance of obesity prevention in adults, suggesting that having high levels of MF may not counteract the negative consequences ascribed to adiposity.

Smoking and air pollution exposure are modifiable predictors of age-related declines in lung function. There is some evidence to suggest that physical inactivity may be a predictor of age-related changes in lung function; however, the impact of sitting time, physical activity, and cardiorespiratory fitness have not been investigated to date. PURPOSE: To determine the association between age-related declines in lung function with sitting time, physical activity and cardiorespiratory fitness in a population of healthy adults. METHODS: Data from the Health, Aging, and Body Composition Study (HAB 2009-2015) with clinical data available for up to five study visits. Forced expiratory volume in 1 second (FEV1), and forced vital capacity (FVC) were measured using a metabolic cart (SensorMedics VMax). Physical activity was measured using the Baecke questionnaire and TV time was self-reported as either never, seldom, sometimes, often, and very often. 

The risk of developing the metabolic syndrome increases by older age, where older women typically engage in less health-enhancing physical activity (PA) than men. Whether sedentary behaviors influence metabolic risk and related components

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in older adults, and if so to what extent such relationships are independent of PA behavior, remain unclear. **PURPOSE:** To examine cross-sectional associations of objectively assessed PA and sedentary behaviors on metabolic syndrome components and clustered metabolic risk in a sample of older community-dwelling women.

**METHODS:** Components of the metabolic syndrome including waist circumference (WC), systolic and diastolic blood pressures, fasting levels of plasma glucose, HDL-cholesterol and triglycerides were assessed in 120 community-dwelling older women (65-70 yrs). Total amount of sedentary PA (total counts per day) was calculated from different intensities (sedentary, light (LPA), and moderate-to-vigorous PA (MVPA)), continuous bouts of sedentary time and breaks in sedentary time were assessed with accelerometers. Isotemporal substitution models were used to examine influence of PA and sedentary behavior on each component of the metabolic syndrome and on a clustered metabolic risk score.

**RESULTS:** All associations between variables of sedentary behavior and metabolic risk were lost only once variation in total accelerometer counts per day was adjusted for. Replacement of a 10-min time block of MVPA with either LPA or time in sedentary behaviors was related to an increase in WC and clustered metabolic risk score (zMS) (WC, β = 1.78 to 2.19 < 0.01; zMS: β = 0.06 to 0.08, p < 0.05).

**CONCLUSIONS:** Detrimental influence of a sedentary lifestyle on metabolic health is likely explained by variations in amounts of PA rather than sedentary time per se. Given our findings, increased amounts of PA with an emphasis on increased time in MVPA should be recommended in order to promote a favorable metabolic health profile in older women.

2752 Board #272 June 2 11:00 AM - 12:30 PM Disparities Between BMI And BFR To Evaluate Obesity Rate In Chinese Urban-White-collar Population: A Cross-section Study

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Oral red complex bacteria, including Porphyromonas gingivalis, Treponema denticola, and Tannerella forsythia, were significantly associated with the severity of chronic periodontal disease. Previous studies indicated that engaging in physical activity is associated with lower periodontitis prevalence. However, the association between physical activity and periodontal bacteria was not clear. **PURPOSE:** To determine whether physical activity is associated with red complex bacteria among Japanese adults. **METHODS:** We studied 226 adult employees aged 20–69 years. Analysis of bacterial species in saliva was conducted using 16S rRNA gene cloning and sequencing. Physical activity was assessed using the International Physical Activity Questionnaire. Total physical activity was calculated based on intensity and duration of physical activity and divided into three categories according to the Japanese guideline as follows: none (0 METs hours/week), low (0.1–22.9 METs hours/week), and high (≥23.0 METs hours/week). The association between physical activity and prevalence of saliva red complex bacteria was tested with multivariate logistic regression analysis after adjusting for sex, age, smoking, alcohol use, breakfast hours/week), and high (≥23.0 METs hours/week). The association between physical activity and prevalence of saliva red complex bacteria was tested with multivariate logistic regression analysis after adjusting for sex, age, smoking, alcohol use, breakfast consumption, and body mass index. Data were expressed as odds ratios (OR) and 95% logistic regression analysis after adjusting for sex, age, smoking, alcohol use, breakfast consumption, and body mass index. Data were expressed as odds ratios (OR) and 95% confidence intervals (CI).

**RESULTS:** The prevalence of red complex bacteria was 46.0% for Porphyromonas gingivalis, 67.7% for Treponema denticola, and 78.3% for Tannerella forsythia, respectively. Multivariate analysis showed that physical activity was not associated with red complex bacteria (Porphyromonas gingivalis: low, 0.79 [0.40–1.55]; high, 1.13 [0.57–2.24]; P for trend = 0.717; Treponema denticola: low, 1.09 [0.48–2.48]; high, 0.76 [0.33–1.75]; P for trend = 0.816; Tannerella forsythia: low, 1.43 [0.69–2.97]; high, 1.09 [0.52–2.29]; P for trend = 0.520). On the other hand, participants with higher physical activity tended to have a better self-reported oral health than those with lower physical activity (low, 1.85 [0.88–3.89]; high, 2.20 [1.02–4.77]; P for trend = 0.044). **CONCLUSION:** This cross-sectional study demonstrated that physical activity was not associated with periodontal bacteria, such as Porphyromonas gingivalis, Treponema denticola, and Tannerella forsythia in Japanese adults.
Physical activity (PA) has been associated with reduced breast cancer risk, which may be partially mediated through an effect on sex hormones. Prior studies of PA and sex hormones relied on self-reported measures of PA, thus the impact of PA duration and intensity remains unclear. PURPOSE: To evaluate the association between both objective (o-PA) and self-reported measures of PA (sr-PA) with circulating sex hormones.

METHODS: This cross-sectional analysis was conducted within the Women's Lifestyle Validation Study, a sub-study of the Nurse's Health Study 1 and II cohorts (n=525). A triaxial accelerometer was used for 7 days to assess average counts per day (CPD), minutes of light intensity PA (o-LPA), and moderate-vigorous intensity PA (o-MVPA). A modified Paffenbarger PA questionnaire was used to assess self-reported minutes of total, LPA (sr-LPA) and MVPA (sr-MVPA). Dehydroepiandrosterone sulfate (DHEAS), testosterone, and sex hormone binding globulin (SHBG) were assayed among all women; estradiol was measured in postmenopausal women not currently on hormone therapy (n=426). Multivariable linear regression models analyzed each PA measure with each biomarker adjusted for age, race, parity, age at menarche, oophorectomy status and BMI. RESULTS: In general, the associations between PA and sex hormones appeared stronger with o-PA than sr-PA. For example, women in the 4th (vs. 1st) quartile of CPD and o-MVPA had 13% lower SHBG levels respectively (p<0.001), whereas women in the 4th (vs. 1st) quartile of sr-PA (i.e., total, LPA, and MVPA) had 10% lower SHBG levels (p=0.05). Further, women in the 4th (vs. 1st) quartile of o-MVPA had 14% higher testosterone levels (p=0.01). There were no statistically significant relationships between any sr-PA measure with testosterone. CPD had the strongest impact on DHEAS and estradiol. Specifically, women in the 4th (vs. 1st) quartile of CPD had 13% higher DHEAS levels (p=0.001) and 22% lower estradiol levels (p=0.01). There were no statistically significant relationships between any sr-PA measure with DHEAS. Women in the 4th (vs. 1st) quartile sr-MVPA had 10% lower estradiol levels (p=0.01). CONCLUSIONS: PA was modestly related to sex hormones in women. CPD and o-MVPA showed the strongest and most consistent relationships with sex hormones.

Purpose: Examine the associations between muscle strengthening activity (MSA) and elevated C-reactive protein (CRP) using a nationally representative sample of U.S. adults (≥ 45 years of age) with Diabetes Mellitus (DM).

Methods: Cross-sectional analyses utilized data from the 1999-2006 National Health and Nutrition Examination Survey. A dichotomous (yes/no) MSA variable was created based on self-reported participation over the past 30 days. Elevated CRP (> 3.0 mg/L) was based on current recommendations. Pairwise tests were performed to contrast potential differences when comparing measured (fasting plasma glucose [FPG]) ≥ 126 mg/dL, n=757) DM and self-reported physician diagnosed DM (n=1,390).

Results: The prevalence of elevated CRP concentrations was 50.1% and 50.6% in the populations with measured FPG and self-reported DM, respectively. In both groups the prevalence of elevated CRP was significantly lower in those reporting MSA compared to those reporting no MSA (FPG, 39.8% vs. 52.4%, p=0.014; Self-reported diagnosis, 42.9% vs. 51.9%, p=0.0478).

Conclusions: The prevalence of elevated CRP was significantly lower in those reporting engaging in MSA using subjective and objective measures of DM.

The impact of the AHA's 7 health metrics on life expectancy in the US general population remains less explored. PURPOSE: We investigated the impact of the AHA’s 7 health metrics on life expectancy and lifetime risk of all-cause mortality in the US general population. METHODS: We followed 1,5908 men and women, aged 20 to 90 years, who participated in the Third National Health and Nutrition Examination Survey (1988-1994) through December 31, 2006. All participants completed baseline health factors and lifestyle behavior questionnaires. The AHA's 7 ideal health metrics were defined as untreated blood pressure (<120/80 mmHg), untreated total cholesterol (<200 mg/dL), untreated fasting glucose (<100 mg/dL), physically active, never smoked, a healthy diet, and a normal waist girth. We further categorized these variables as having 0, 1, 2, 3, 4, 5, or 6 or 7 combined ideal health metrics. Cox proportional hazards regression was used to investigate the associations of single and a combined number of 7 health metrics and all-cause mortality. Survival analysis was used to compute lifetime risk of all-cause mortality. RESULTS: During an average of 13.2 years of follow-up (217,404 person-years), there was a total of 3,352 all-cause deaths (1,413 CVD, 658 cancer, 299 respiratory diseases, 167 diabetes mellitus). After adjustment for multiple risk factors, men and women with all 6 or 7 combined ideal health metrics had a 62% (95% CI: 43% to 75%) lower risk of all-cause mortality compared with men and women with zero ideal health metrics. The lifetime risks of all-cause mortality (at 20 years of age to 90 years) over 1, 2, 3, 4, 5, and 6 or 7 ideal health metrics were 63.5%, 55.0%, 46.6%, 35.8%, 38.0%, 33.0%, and 17.6%, respectively. Increasing number of ideal health metrics was associated with lower lifetime risk of all-cause mortality. Men and women with 1, 2, 3, 4, 5, and 6 or 7 combined ideal health metrics had 3.1, 5.7, 7.8, 7.6, 8.7, and 11.9 years longer life expectancy, respectively, as compared with men and women with zero ideal health metrics. Approximately 40% (95% CI: 31% to 60%) of all-cause deaths might have been avoided if men and women had adopted all 6 or 7 combined ideal health metrics. CONCLUSION: The AHA's 7 ideal health metrics is associated with lower lifetime risk of all-cause mortality and longer life expectancy in the US general population.

Late-life motor impairment is a common part of aging and increasingly recognized as a barrier to the maintenance of independence and well-being in old age. Loss of motor function, such as slowed walking, is progressive, and there is increasing interest in health disparities related to activity limitations in older adults. Staying physically active is vital for maintaining physical function, but few studies have addressed how physical function and physical activity in urban African American (AA) and rural white (RW) older adults. PURPOSE: The purpose of this investigation is to compare functional ability and physical activity in urban African American and Rural White Older Adults.

Methods: One group of participants included 31 self-identified older African-Americans (age=68.2 yrs±6.5, BMI=34.5±9.2) living in an urban setting. The other group included 60 older white participants (age=72.7 yrs±7.9), BMI=32.3±7.2) living in a rural setting. The participants completed questionnaires related to physical function (physical functioning questionnaire) (PF), physical activity (CHAMPS physical activity questionnaire) (PA), and self-regulation related to physical activity (SR). Additional measures included: 1) timed up and go (TUG), which involved rising from a chair, walking three meters, returning to the chair and sitting down, 2) gate speed (GS) over a six-meter distance, and 3) six-minute walk (6MW). Significant differences (p<0.05) between groups were identified using independent samples t-tests. RESULTS: For the objective physical measures, there were significant differences between AA and RW for TUG (13.1 vs 11.0 seconds) and UGS (0.890 vs 1.180 m/s) respectively. PF and PA were not significantly different. With regard to SR, significant differences between AA and RW were noted for goal setting (2.11 vs 1.55) and relapse (1.87 vs 1.456) respectively, related to being physically active.
CONCLUSION: Our findings suggest that both high %FAT and BMI are risk factors for chronic low back pain.

PURPOSE: The purpose of this study was to compare 10-year longitudinal changes in physical fitness (age 70 to age 80 years) between older Japanese adults who did and did not take medications over the ten years period. METHODS: Six hundred and sixty men (n=306) and women (n=294), 70 years of age at baseline, residing in Niigata City, Japan, participated in this study. Baseline and follow-up physical fitness tests included hand-grip strength, knee extensor strength, leg extensor power, step rate, and one-leg standing time with eyes open, and had medical examinations by physicians. Only the individuals who completed the physical fitness test at age of 80 years were grouped into no-medication or medication groups over the past decade, and divided into three groups: Group A: no medication over the 10 years period, Group B: medication at age 70 years but not at age 80 years, and Group C: medication at age 70 years and 80 years period. Their physical fitness at ages 70 and 80 years were compared using Paired t-test and Chi Square test. RESULTS: 59% of baseline data (n=354) were compared with 10 years follow-up data. Among these subjects, the rate of no medication use at 70 years old was 35.8%, which declined to 15.3% by 80 years of age. The most common chronic disease requiring medication was hypertension (17.3%), followed by diabetes (13.9%) and osteoarthritis (12.4%). Energy expenditure was measured continuously and glucose was measured at baseline and after 40 minutes of continuous LPA. The results showed that older adults in Group B had significantly lower glucose response in a controlled environment. CONCLUSIONS: Older adults with taking medication had higher physical fitness level than medication non-users. This study showed that the older adults with no medication use over the ten years period had higher physical fitness level than medication groups. The findings of this study may provide interesting insight regarding the physical fitness in the elderly population.

PURPOSE: It has been previously demonstrated that higher physical activity (PA) levels and better physical fitness (PF) were associated with higher health-related quality of life (HRQoL). However, Wenderley et al. did not take the differences between PA levels calculated as overall PA (MVPAall) or accumulated in bouts of at least 10 minutes (MVPA10) into account. Therefore, the aim of this study was to compare the different effects of MVPA10 and MVPAall on PF and HRQoL in a population of young and older adults. METHODS: 21 young adults (YA: age 22±6.2 yrs; BMI 22.5±2.6 kg/m²) and 21 older adults (OA: age 68.3±3.3 yrs; BMI 26.1±3.4 kg/m²) wore an activity monitor for 7 consecutive days to obtain time spent in MVPA10, analyzed in bouts of at least 10 continuous minutes (MVPA10) and in overall minutes (MVPAall). To assess maximal isometric strength (IMVC), they performed a hand-grip strength test. Cardiorespiratory fitness (VO2-max) was determined by indirect calorimetry using a maximal treadmill test. HRQoL was measured with the Short-Form 36 Health Status Survey (SF-36v2) that provided the physical (PCS) and the mental (MCS) component summary score. RESULTS: Although young adults resulted fitter than older adults (YA: VO2-max 2.3±0.3 L/min; IMVC 190.6±60.2 N; YA: VO2-max 1.7±0.3 L/min; IMVC 151.4±52.3 N; P<0.05), no differences were detected for MVPA (nor MVPA10) between groups. MVPA10 was significantly lower than MVPAall (MVPA10: 28.7±3.6 min/day; MVPAall: 61.5±7.5 min/day; P<0.01). The overall average PCS and MCS scores were 51.1±6.3 and 47.8±5.8, respectively. Regression analysis, adjusted for age and BMI, revealed that neither MVPA10 nor MVPAall were related to a higher PA or a higher HRQoL. Only VO2-max was associated with a higher PCS (R²=0.095; β=4.216; P<0.05; each 1 L/min was associated with an increase of 4.5% in PCS). CONCLUSIONS: In contrast with Wenderley et al., this study showed that among relatively healthy, active but unfit older individuals HRQoL (PCS domain) is related only to VO2-max. This observed positive association seems to be independent of age and BMI. This information will be useful for designing PA programs, aiming to improve cardiorespiratory fitness and that could also positively affect HRQoL. REFERENCES: Wenderley, Qual Life Res. 2011 Nov;20(9):1371-8.

PURPOSE: This study was designed to examine how increasing the proportion of the day spent in a low-intensity physical activity (LPA) affects glucose response in older adults in a controlled environment. METHODS: Older adults (N=9), 60 y and older, completed four, three-hour treatment conditions, a seated control condition, and three subsequent randomized conditions 1) 20% (36 min) of the condition spent in LPA, the remaining time seated (72 min) of the condition spent in continuous LPA, the remaining time seated, and 3) 60% (108 min) of the condition spent in continuous LPA, the remaining time seated. Energy expenditure was measured continuously and glucose was measured at baseline following mixed meal ingestion and each hour thereafter. Glucose AUC was calculated and compared between conditions using RMANOVA. RESULTS: A significantly greater amount of energy was expended during all activity conditions when compared to the seated condition (p<0.05). There was a significant difference between proportion of time spent in LPA and glucose AUC (F=11.601, p<0.001). Post-hoc analysis showed a significant difference between the seated condition and 60% LPA condition (AUC strength: A: 33.0kg, B: 30.2kg, C: 28.8kg) and knee extensor strength: A: 1.19kg/kg, B: 1.05kg/kg, C: 0.97 kg/kg). There were also significant decline over the ten years period in VO2max strength (A: 5.81±0.4 kg·min⁻¹, B: 5.04±0.4 kg·min⁻¹, C: 4.78±0.4 kg·min⁻¹) and total cholesterol (A: -0.056±0.07 mg·dl⁻¹, B: -0.112±0.07 mg·dl⁻¹, C: -0.223±0.07 mg·dl⁻¹, D: -1.290±0.07 mg·dl⁻¹). Limitation of this study was significant decline of completion rate of the tests (leg extensor power, knee extensor strength) in participants in Groups B and C. CONCLUSIONS: The present study showed that the older adults with no medication use over the ten years period had higher physical fitness level than medication groups. The findings of this study may provide interesting insight regarding the physical fitness in the elderly population.
performed. RESULTS: Both groups were similar in age [25 (SD 2) y], weight [65 (10) kg], height [1.72 (0.06) m], BMI [22.2 (2.7) kg/m²], systolic and diastolic blood pressures [114 (5) (89) mm Hg], fasting glucose [4.5 (3.3) mmol/L] and physical activity level [2144 (4128) MET-min/wk] pre-RT. No interaction was found for all measures (p = 0.65 to .967). There were no group differences (p = .103 to .525) except MO, which was lower in C (5.28 x 10^11) than NC [6.41 x 10^11], 95% CI of difference (.028, .197), p = .009. Significant main effects of time were found for all variables except MO (p = .170) and Body Fat (p = .256). In wk 1, both groups increased WBC (C: -9.2%, NC: -7.0%, p = .025), LY (C: +12.4%, NC: +15.2%, p < .001), BA (C: +11.4%, NC: +23.1%, p = .003) and PL (C: +10.3%, NC: +12.1%, p < .001) at UT 0h compared to UT Pre. LY fell below UT Pre at UT 24h (p < .002). In wk 12, T O contents for all measures were not significantly different from T Pre values (p = .772 to .999) except for an increase in PL (p = .001). There was no difference between UT Pre and T Pre values for all measures (p = .335 to .999). CONCLUSION: Both groups had similar immune response to RT. Supported by NIE ACFR R I 5/14 YF

Previous studies have shown that women with obesity have higher concentrations of Bisphenol A (BPA), but an intervention to reduce BPA is lacking in women. PURPOSE: To determine whether a theory-based behavioral intervention designed to reduce BPA would decrease urinary BPA concentrations over 3 weeks in women with obesity. METHODS: Thirty college-aged, women were randomly assigned to an intervention (N=15; 31.5 ± 5.6 kg/m²; 21.6 ± 3.3 yrs) or control (N=15; 30.8 ± 5.8 kg/m²; 21.5 ± 3.1 yrs). The intervention included weekly face-to-face meetings to reduce BPA exposures from food, cosmetics, and other packaged products. Women were provided with BPA-free cosmetics, hygiene, glass food/water containers and daily self-monitored major sources of BPA. Fasting urine BPA and creatinine concentrations, and weight were assessed at baseline and after 3-weeks. RESULTS: BPA was non-detectable (limit of detection 0.05 µg/L) in 26% of samples at baseline. No significant (P=0.55) treatment x time interaction effect was observed on creatinine-adjusted BPA concentrations from baseline to 3-weeks in women with obesity. METHODS: Thirty college-aged, women were randomly assigned to an intervention (N=15; 31.5 ± 5.6 kg/m²; 21.6 ± 3.3 yrs) or control (N=15; 30.8 ± 5.8 kg/m²; 21.5 ± 3.1 yrs). The intervention included weekly face-to-face meetings to reduce BPA exposures from food, cosmetics, and other packaged products. Women were provided with BPA-free cosmetics, hygiene, glass food/water containers and daily self-monitored major sources of BPA. Fasting urine BPA and creatinine concentrations, and weight were assessed at baseline and after 3-weeks. RESULTS: BPA was non-detectable (limit of detection 0.05 µg/L) in 26% of samples at baseline. No significant (P=0.55) treatment x time interaction effect was observed on creatinine-adjusted BPA concentrations from baseline to 3-weeks in women with obesity.
performed using the Pearson’s correlation coefficient (r) with a significance level of 0.05. RESULTS: In the evaluated subjects, one was diabetic and 16 men smoke up to 20 cigarettes per day. The total-C was 5.58 ± 1.09 mmol/l, the HDL-C 1.27 ± 0.24 mmol/l and the SHP 106.7 ± 10.2 mmHg. The 10-y-CVR was 5.5 ± 5.2%, with a range of 0.5 - 23.1%. The average of MP was 34.7 ± 3.1% and the relative VO2max 49.1 ± 1.1 ml/kg/min. A negative correlation was observed between the VO and 10-y-CVR (r = -0.38 p = 0.01) as well as between VO2max and RV (r = -0.51 p < 0.01). CONCLUSION: Results of this research evidence the protective effect on the risk of cardiovascular disease arising from a good aerobic capacity, especially by the reduction total-C, lower SHP and a greater amount of MP. This work contributes to evidence the beneficial effects of combining aerobic and of strength exercise in reducing cardiovascular risk, which will be used in prevention programs within the Santo Tomas University population.

2765 Board #285 June 2 11:00 AM - 12:30 PM Effect of Bikram Yoga on Heart Rate Variability and Associated Outcomes in Stressed and Sedentary Adults
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PURPOSE: This study investigated the effect of a 16-week Bikram yoga intervention on the high frequency (HF) power component of heart rate variability (HRV) and associated physiological and psychological outcomes in stressed and sedentary adults.

METHODS: Eligible adults were randomized to an experimental group (n=29) or a no-treatment control group (n=34) after baseline testing. Experimental group participants were instructed to attend three to five Bikram yoga classes per week at local studios. All outcomes were collected at baseline (week 0) and completion (week 17), with psychological outcomes also collected at midpoint (week 8).

Secondary physiological outcomes included additional HRV measures, blood pressure, augmentation index, body composition (via DEXA), waist circumference, fasting blood glucose, cholesterol, and C-reactive protein. Secondary psychological outcomes included the Perceived Stress Scale, the General- and Exercise Self-Efficacy Scales and health-related quality of life (HRQoL) measures (via Short-Form-36).

RESULTS: Sixty-three adults (37.2±10.8 years, 79% women) were enrolled in the study and included in the intention-to-treat analysis. The experimental group attended 27±18 classes. The HF component of HRV did not significantly change between groups over time, nor did any secondary physiological endpoints. However, higher attendance to the intervention was associated with significant reductions in diastolic blood pressure (p=0.039), body fat percentage (p=0.001), fat mass (p=0.003) and body mass index (p=0.05). Further, the experimental group significantly improved several psychological outcomes compared to the control group including perceived stress (p=0.003), general self-efficacy (p=0.034), exercise self-efficacy (p=0.003), and HRQoL ‘Vitality’ (p=0.019) and ‘General Health’ (p=0.034).

CONCLUSIONS: A 16-week Bikram yoga program did not increase the HF power component of HRV or any physiological outcomes evaluated. Low adherence possibly contributed to these null effects. However, participants in the experimental group significantly improved perceived stress, and measures of self-efficacy and HRQoL. Future studies are required to address barriers to adherence and elucidate the dose–response effects of Bikram yoga practice.

2766 Board #286 June 2 11:00 AM - 12:30 PM Association of Cardiorespiratory Fitness, Viscer al Fat and Weight Cycling History in Pre-menopausal Women.
Karen Moreno, Pamela D. Swan, FACSM, Matthew Buman, FACSM, Zachary Zeigler, Arizona State University, Phoenix, AZ. (Sponsor: Pamela Swan PhD, FACSM) Emeterio@asu.edu (No relationships reported)

Weight cycling (WC), or repeated bouts of intentional weight fluctuations are common among overweight and obese women and have been linked to various cardiometabolic health risks such as visceral fat (VF) accumulation. Cardiorespiratory fitness (CRF), independent of weight, is a well-known cardiovascular health risk and, although WC has been positively associated with increases in VF, this association may be confounded by age and/or physical activity status. Purpose: This cross sectional study explored the association of multiple factors (i.e., AG E, WC and CRF) on VF and investigated WC as a potential moderator on the relationship between CRF and VF among pre-menopausal women. Methods: 41 overweight and obese (BMI = 27.0 ± 6.2 kg/m²) participants (median age = 41.0 ± 6.2 years), 36 women and 5 men were recruited. Dichotomous WC groups were established from the number of self-reported WC bouts and total weight lost per bout. WC (n = 19) was defined as ≥ 3 cycles of ≥ 10 lb; and Non-WC (n = 22) was defined as not meeting WC definition. Additionally, a weight cycling index (WCI) was constructed to form a continuous variable. WC due to pregnancy and illness were excluded from the totals. CRF was determined with indirect calorimetry using a cycle ergometer protocol to peak VO₂ and VF volume (cm³) was assessed with CoreScan computer technology (iDXA, GE Lunar). Correlation and multiple regression analysis were used to examine the relationship between VF and potential predictors, and possible moderator effects. Results: Significant (p < .001) differences were noted among WC vs. Non-WC groups for AGE (33.1 ± 7.3 vs. 29.3 ± 6.4 yrs), BMI (34.6 ± 3.1 vs. 26.7 ± 3.8 kg/m²), MP (426.6 ± 547.0 cm²); and CRF (24.1 ± 5.7 vs. 31.0 ± 6.5 ml/kg/min). The strongest association was found between CRF and VF (R = -0.718, p < .001). The regression model with four factors (AGE, WCI, CRF, WC x CRF) was significant (R² = 0.570, p ≤ 0.01); however, only CRF significantly predicted VF (p < .001). The WCI x CRF interaction was not significant (p = .150) with a ΔR² = .026, predicting only 2% of VF. Thus, no moderator effect was detected. Conclusion: These findings suggest the relationship between CRF and VF was independent of WC status and that CRF was the most influential factor predicting VF among overweight and obese pre-menopausal women with a history of weight cycling.

2767 Board #287 June 2 11:00 AM - 12:30 PM Improvement Of Cognitive Function By dual-task Exercise
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(No relationships reported)

Studies have shown that exercise improves cognitive function and that dual-task exercise, in particular, has neuroprotective effects effective in elderly individuals.

Purpose: The purpose of this study was to examine the improvement of cognitive function by a dual-task exercise intervention. We also tested if the improvement of cognitive function was associated with the number of steps and exercise duration at different exercise intensity levels.

Methods: In all, 17 men and 25 women (mean [SD], age 73.8 [6.0] years, height 158.6 [7.0] cm, weight 56.0 [7.6] kg, and body mass index 22.3 [3.2] kg/m²) participated in square-step exercise (dual-task) once per week for 12 weeks. The number of steps was recorded from a waist-mounted accelerometer, and weekly data were classified into four levels based on the exercise intensity (inactivity, light, moderate, and vigorous). Participants performed the Cognitive Assessment for Dementia (CAD2) and Trail Making Test (TMT) before and after the exercise program to evaluate cognitive function. Results: The total reaction time determined by CAD2 was significantly shorter in the post-exercise test than that in the pre-exercise test (post: 89.3 [25.7] vs. pre: 96.1 [28.3], p = 0.025), which suggests that cognitive function improved during the 12-week exercise program. Conversely, there was a significant change in TMT score (TMT A post: [47.6] ± 19.1, TMT B post: [113.0] ± 25.9 vs. pre: [138.5] ± 20.6, p = 0.005, TMT B A Post: [63.3] ± 22.5 vs. pre: [83.8] ± 24.9, p = 0.59). However, changes in CAD2 score did not correlate with the number of steps and exercise duration at each level of exercise intensity. Conclusion: These results demonstrate that the improved cognitive function was not primarily derived from increases in physical activity but, specifically, from involvement in dual-task exercise.

2768 Board #288 June 2 11:00 AM - 12:30 PM Physical Activity and Sedentary Behavior among Hispanic Obstructive Sleep Apnea Patients in Puerto Rico
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(No relationships reported)

Obstructive sleep apnea (OSA) is a chronic respiratory disease more prevalent in men compared with females, and commonly associated with obesity and poor quality of life. Few studies have reported low physical activity (PA), but none has evaluated sedentary time (ST) in this population; and these characteristics among Hispanics are unknown. Purpose: To describe PA behavior and ST, and their association with waist circumference and BMI in a partial of Hispanic adults living with OSA in Puerto Rico (PR). Methods: A group of 15 adults (10 men and 5 women, mean age = 44.3±9.9 yrs) in treatment for OSA completed measurements of height and weight, and wore an ActiGraph GT3X+ accelerometer attached to a waist band placed in the right hip area for 7 days. Wilcoxon signed-rank tests were used to detect gender differences, and Spearman correlations to evaluate the association between PA, ST and BMI. Results: No gender differences were observed. Participants spent 34.7±6.9 min/week in moderate to vigorous physical activity (MVPA), and 8.8±1.3 hrs/day in ST. Mean BMI was 34.7±5.9 kg/m². No significant correlations were observed between PA and ST.

Abstracts were prepared by the authors and printed as submitted.
and BMI (p<0.39, P=0.15), ST and MVPa (p<0.23, P=0.42), and ST and BMI (p<0.05, P=0.86). CONCLUSION: Obesity was highly prevalent (93%) in this group of Hispanic adults living with OSA in PR, probably obscuring its association with PA and ST. In general, these participants could be classified as physically inactive and sedentary, factors associated with reduced life expectancy and poor quality of life. Clinical treatment must integrate strategies to help control body weight, improve PA, and reduce ST in this population.

2769 Board #289
June 2 11:00 AM - 12:30 PM
Effects of Short Term Detraining in Metabolic Syndrome Patients
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PURPOSE: Aerobic exercise training improves some of the components of metabolic syndrome (MSyn). Although it would be advisable to incorporate exercise permanently into lifestyle of MSyn patients, training discontinuation due to holidays, minor illness and/or musculoskeletal disorders is frequent. The aim of this study was to identify which of the metabolic syndrome factors reverses faster during short-term detraining.

METHODS: Forty MSyn patients (54±8.9 yrs old; 32:1±1.2 BMI; 28 males and 12 females) underwent 8-wk of aerobic interval training (AIT). Then they were randomly divided into two groups, one that ceased training for 3 months (i.e., detraining group; TR, n=22) and another that stopped training during those 3-wks (i.e., detraining group; DeTR, n=18). Body composition, blood pressure and biochemistry were collected prior to start training, after 8 weeks (i.e., common training period) and 3 further weeks of either continuing training (TR group) or detraining (DeTR group).

RESULTS: Before training started subjects in both groups were similar in body weight (90.6±13.9 vs 93.9±4.2, P=0.56) body fat (36.1±1.4 vs 33.1±1.4; P<0.15), number of MSyn factors (3.7±0.2 vs 3.4±0.3; P=0.28) and cardiopulmonary fitness level (2.5±1.0 to 2.2±1.0 L/min). DeTR group did not increase body weight or fat mass and thus both groups remained similar in these parameters at week 11 (P<0.05). Both groups reduced total cholesterol (T-Chol), triglycerides (TG) and LDL-cholesterol (LDL-c) similarly after 8 weeks of training. However, DeTR compared to TR group showed blunted reductions TCHOL (-9.6±3.9 vs. -19.7±5.5 mg·dl⁻¹, P<0.05), TG (-6.0±3.6 vs. -13.1±4.7 mg·dl⁻¹; P<0.05) at week 11, respectively. Furthermore, DeTR also blunted the reduction in resting heart rate (14.2±2.0 vs -5.2±1.1, lat min⁻¹; P=0.03) although it did not affect arterial blood pressure that remained similarly reduced in both groups after 11 weeks.

CONCLUSION: Our data suggest that short-term detraining (3 weeks) halts and tends to revert the benefits of 8 weeks of intense aerobic interval training in blood lipid profile despite no gains in body weight or body fat. In contrast, the cardiovascular benefits of training seemed more resilient to short-term detraining.

E-37 Free Communication/Poster - Respiratory
Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2770 Board #290
June 2 11:00 AM - 12:30 PM
Effect of Age on Sex Differences in the Inspiratory Muscle Metaboreflex
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Sex differences exist in the cardiovascular consequences of the inspiratory muscle metaboreflex in young adults. However, it is unknown if these sex differences are present in older adults. PURPOSE: To determine the effect of age on sex differences in the cardiovascular consequences of the inspiratory muscle metaboreflex. We hypothesized that, compared to their younger counterparts, older men and women would exhibit greater 1) increases in mean arterial pressure (MAP) and limb vascular resistance (LVR) and 2) decreases in limb flow blood (Q_L). We also hypothesized that the inspiratory muscle metaboreflex-induced cardiovascular responses would not be different between older men and women.

METHODS: Sixteen young (8 men, 8 women; 18-24 yr) and older (8 men, 8 women; 60-73 yr) adults were recruited for this study. Subjects performed inspiratory resistive breathing tasks (IRBTs) at 2% and 6% of their maximal inspiratory pressure. During the IRBTs, breathing frequency was 20 breaths min⁻¹ with a 50% duty cycle. At rest and during the IRBTs, MAP was measured via automated oscillometry. Q_L was measured via Doppler ultrasound, and LVR was calculated. End tidal CO₂ remained at baseline levels during the IRBTs. EMG was recorded on the leg to ensure no muscle contraction occurred.

RESULTS: The 65% IRBT led to significantly greater increases in MAP from baseline in OW (15.9±8.1 mmHg) compared to YW (9.6±1.4 mmHg), but not (p<0.05) between OM (12.3±5.7 mmHg) and YM (10.8±5.7 mmHg). OW (20±2.7%) had greater (p<0.05) decreases in Q_L from baseline compared to YW (9±4.10.2%), but no differences (p>0.05) were present between OM (12±8.9%) and YM (12±7.11%) during the 65% IRBT. The 65% IRBT led to greater (p<0.05) increases in LVR in OWM (48±2.55%) compared to YW (19±15.0%), but no differences (p<0.05) existed among OM (54±1.78%) and YM (47±1.23%) %. No differences (p<0.05) were present in MAP, Q_L or LVR between OM and OW. The 2% IRBT resulted in no changes (p>0.05) in MAP, Q_L or LVR across time or among groups.

CONCLUSIONS: These data suggest older men compared to younger women exhibit greater inspiratory muscle metaboreflex-induced cardiovascular consequences, while there were no differences between older and younger men. Lastly, sex differences in the inspiratory muscle metaboreflex are not present in older adults.

2771 Board #291
June 2 11:00 AM - 12:30 PM
Respiratory Muscle Endurance And Cardiovascular Response To Hyperpnoea After Respiratory Muscle Training In Hypoxia
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Respiratory muscle endurance training improves respiratory endurance and attenuates respiratory muscle-induced metaboreflexes. In an animal study, it was shown that a larger increase in citrate synthase activity in the diaphragm occurred after exercise training under hypoxic conditions than under normoxic conditions. From these findings, it was hypothesized that respiratory muscle training under hypoxic conditions would lead to a greater respiratory endurance and a larger reduction of cardiovascular responses to increased respiratory muscle work. PURPOSE: The purpose of the present study was to clarify the effects of respiratory muscle endurance training under hypoxic conditions on respiratory muscle endurance and respiratory muscle-induced metaboreflex.

METHODS: Collegiate male endurance runners were assigned to a normoxic (n=6) or hypoxic group (n=6). Before and after 6 weeks of respiratory endurance training, cardiovascular responses to an incremental respiratory endurance test were measured. The training was isocapnic hyperpnoea under normoxic and hypoxic conditions. Minute ventilation during the training was initially set at 50% of the individual MVV, and thereafter, target minute ventilation increased progressively. Target SpO₂ in the hypoxic group was set at 90%, in the first and second weeks, and thereafter it was set at 80%. RESULTS: Respiratory endurance time was extended after the training in both groups, but there was no difference between the normoxic and hypoxic groups (norm: +45.1%, hyp: +39.6%). The changes in HR and arterial BP during the incremental respiratory endurance test were significantly reduced after 6 weeks of respiratory endurance training in both groups. There were no significant differences between the normoxic and hypoxic groups in either HR or arterial BP during hyperpnoea. CONCLUSION: These results suggest that respiratory muscle endurance is improved and respiratory muscle-induced metaboreflex is attenuated by respiratory muscle endurance training, but there is no additional effect when the training is performed under hypoxic conditions.

2772 Board #292
June 2 11:00 AM - 12:30 PM
Pulmonary Function And Endurance Performance In Triathlon
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Pulmonary function, which supplies adequate and instantaneous amounts of oxygen consumption, is associated with the exercise performance. Endurance athletes, such as triathlon and swimming, have a higher and prolonged demand than power athletes and non-athletes for gas exchange and ventilation during exercise.

PURPOSE: The purpose of this study was to analyze pulmonary function and the relationship between pulmonary function and endurance performance in triathletes.

METHODS: Twenty-four male subjects, aged 20-25 years old, were recruited and divided into triathletes (n=12), who participated in international competition, and non-athletic control (n=12) groups. Anthropometry and body fat were measured at rest.
Pulmonary function tests were performed using a spirometry, including tidal volume (Vt), vital capacity (VC), forced vital capacity (FVC), Forced expiratory volume in 1 second (FEV1), and maximal voluntary ventilation (MVV). Endurance performance tests were examined during treadmill exercise testing with respiratory gas analysis, including maximal oxygen consumption (VO2 max) and time to exhaustion (TTE). Informed consent forms had been completed by all participants before the experiments started.

RESULTS: Baseline characteristics were not significantly different between two groups, except for the percentage of body fat (15.3±3.0 % and 19.7±4.73 %, p<0.05 in triathletes and control groups). Triathletes had significantly higher pulmonary function in Vt (0.80±0.20 vs 0.63±0.13 L, p<0.05), FVC (5.09±0.50 vs 4.53±0.43 L, p<0.05), and MVV (181.72±21.70 vs 157.7±17.83 L/min, p<0.05) compared with the control group. Moreover, they had greater VO2max (66.90±6.93 vs 47.00±8.45 ml.min⁻¹.kg⁻¹) and sprint group (1074.80±43.10 vs 782.40±92.30 secs) compared with their counterpart (p<0.05). We also found that FVC, FEV1, and MVV were significantly correlated with VO2max in all subjects (p<0.05).

CONCLUSIONS: This study indicated that triathletes had higher pulmonary function and some correlations existed in pulmonary function and VO2max, which may provide useful information for triathlon training.

High levels of ventilatory work have been shown to compromise locomotor muscle blood flow during endurance exercise. Inspiratory muscle training (IMT) may provide a useful technique to deal with increased ventilation during hypoxic exercise and maintain skeletal muscle blood flow.

PURPOSE: To examine if 6 weeks of IMT affects leg blood flow during endurance exercise in normobaric hypoxia.

METHODS: Ten endurance trained athletes (VO2max=61.6± 5.6 ml.kg⁻¹.min⁻¹) were pair matched based on pre-exercise maximal inspiratory pressure (MIP) as inspiratory muscle strength, and peak inspiratory flow rate (PIFR). Subjects underwent IMT for 3-d per week over a period of 6 weeks, with training set at either 80% of sustained MIP (IMT group, n=5) or 30% sustained MIP (sham group, n=5), within a regimen of progressively increased work-rest ratios until task failure. Pre- and post-training, subjects completed respiratory muscle strength tests and a 20km cycling time trial (TT) in normobaric hypoxia (Fo2=16.1%), where VO2 was measured breath by breath and skeletal muscle deoxygenation (deoxygenated hemoglobin+myoglobin [Hb]) was measured via near-infrared spectroscopy. Using the change in HbR from unloaded cycling to exercise as a surrogate for aVo2, difference (O2 extraction), VO2/ HbR gives an estimation for skeletal muscle blood flow.

RESULTS: The IMT group significantly improved MIP (145.3± 27.9 cmH2O vs 171.7± 38.7 cmH2O) following training (p<0.05) while the sham group remained unchanged. During the last min of the 20km TT, VO2 of the IMT group was at 87.4± 12.5% and the sham group at 90.17± 8.9% of normoxic VO2max. 20km TT mean VE was higher post-IMT (99.9± 15.9 min⁻¹ vs 109.3± 24.4 min⁻¹, p=0.055) and unchanged in sham. VE in the last min post-IMT was 133.6±30.0 L.min⁻¹ compared to pre-IMT of 110.9±18.2 L.min⁻¹ (p=0.08), and was unchanged in sham. The change in pre- to post-VO2/HbR in the IMT group was 21.2±1.6%, but was not significant (p=0.38). There was no significant change in VO2/HbR in the sham group and no differences were seen between groups following IMT.

CONCLUSION: Despite an increase in VE and therefore, increased respiratory muscle work, there was no change in leg blood flow with IMT. IMT may allow for greater tolerance for increased ventilation during hypoxic exercise while maintaining leg blood flow.

It has been reported that women exhibit less inspiratory muscle fatigue during exercise. Additionally, a recent study found a lower blood pressure response to resistive inspiratory muscle activity (high-resistance, low-speed inspiratory muscle contractions), indicating that women exhibit an attenuated inspiratory muscle metaboreflex compared to men. Another way to model the respiratory muscle metaboreflex is to measure the cardiovascular response to exercise-mimicking hypopnoea (low-resistance, high-speed inspiratory and expiratory muscle contractions). It is hypothesized that women will have a lower cardiovascular response to low-resistance, high-speed inspiratory and expiratory muscle contractions.

PURPOSE: To test this hypothesis, the cardiovascular response during voluntary normocapnic incremental hypopnoea was evaluated in young women and age-matched men.

METHODS: Healthy young subjects (8 men, 10 women) participated in this study. An incremental respiratory endurance test was performed as follows: target minute ventilation was initially set at 30% of maximal voluntary ventilation (MVV₁₂) and was increased by 10% MVV₁₂ every 3 min. The test was terminated when the subject could no longer maintain the target ventilation. Heart rate and arterial blood pressure (BP) were continuously measured.

RESULTS: There was no significant difference in respiratory endurance time between women (11.6±0.6 min) and men (12.3±0.5 min). The change in mean arterial BP (MBP) during the incremental inspiratory endurance test was significantly lower in women compared to men: women (105.9±3.2 mmHg, men: 126.0±6.0 mmHg) at 9 min.

CONCLUSIONS: The data from the present study suggests that the respiratory muscle-induced metaboreflex is blunted in women compared to age-matched men.
Then, subjects matched their flow rate to 20, 40, 60, 80, and 100% PIFR during volitional inspiration from residual volume (Flow rate-control task) to determine the index of recruitment onset for the neck inspiratory muscles. Flow rate-control task was performed with (W; 23cmH2O) and without (WO) inspiratory load. Mean %PIFR and EMG amplitude (aEMG) of the sternocleidomastoid (SC) and scalene (SC) were calculated over the duration of every 10% of maximal lung volume (MLV) ranging from 20% to 60% of MLV. The index of recruitment onset for each muscle was determined by the processed %PIFR vs. aEMG curves at each %MLV. Finally, a linear regression analysis was performed between MIP normalized to body weight (MIP/BW) and index of recruitment onset for each muscle across subjects, for which the Pearson product-moment correlation coefficient (r) was calculated at each %MLV. RESULTS: MIP was ranged from 124 to 205 cmH2O across subjects. When collapsed across %MLV, there were highly negative correlations between MIP/BW and index of recruitment onset for both muscles under W (SC: r = −0.866, SC: r = −0.877, p < 0.01) and WO (SC: r = −0.789, SC: r = −0.735, p < 0.05). CONCLUSION: The current results indicate that the neck inspiratory muscles of a subject who has lower inspiratory muscle strength are recruited at lower flow rate with a certain lung volume, suggesting that MIP/BW becomes useful outcome for assessing not only inspiratory muscle strength but also recruitment onset of the neck inspiratory muscles.

2777 Board #297 June 21 11:00 AM - 12:30 PM Ventilatory Strategies Of Swimming During Submaximal Efforts
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Background: Pulmonary ventilation while swimming is constrained by the medium (water) and the timing associated with arm mechanics. Attempts at describing ventilation have been technically complex and therefore little published data exists on ventilatory strategies and pulmonary function while swimming. This is in contrast to the considerable data available for other exercise modes.

Methods: Ten trained, competitive men swimmers (age = 24.4 ± 1.9 yrs) were asked to perform six submaximal exercise tests on separate days, three on a cycle ergometer and three while swimming in a flume. Workloads were set to elicit 70, 80, and 90% VO2peak, (P1, P2, and P3 respectively), and maintained at eucapnic levels (NH). Two-way, repeated measures ANOVAs were used for all comparisons, with the level of significance set at 0.05.

RESULTS: T2 across all intensities (3.16 ± 0.64, 3.36 ± 0.73, 3.57 ± 0.69 vs. 2.65 ± 0.35, 2.96 ± 0.44, 3.19 ± 0.50 L/min; p>0.05). Two-way, repeated measures ANOVAs were used for all comparisons, with the level of significance set at 0.05.

CONCLUSION: The current results indicate that the neck inspiratory muscles of a subject who has lower inspiratory muscle strength are recruited at lower flow rate with a certain lung volume, suggesting that MIP/BW becomes useful outcome for assessing not only inspiratory muscle strength but also recruitment onset of the neck inspiratory muscles.

2779 Board #299 June 21 11:00 AM - 12:30 PM Hypoxic Preconditioning Enhances Diaphragm Function Via Erk And Akt Signaling In COPD Mice
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Diaphragm experiences sustained hypoxia in chronic obstructive pulmonary disease (COPD). Prolonged low O2 exposure is linked with excessive reactive oxygen species formation, which may exacerbate muscle fatigue and compromise respiratory efficiency. Hypoxic preconditioning (HPC) represents a novel strategy that can effectively protect diaphragm against hypoxic stress caused by COPD. During HPC, muscles are treated with alternate high and low levels of O2, which can induce certain adaptive changes to hypoxia. However, the associated mechanism remains unresolved.

PURPOSE: To determine whether ERK and AKT signaling contribute to the protective effect of HPC during hypoxia in COPD mice.

METHODS: C57BL/6 mice were exposed to cigarette smoke for two hours each day, five days a week for three months to develop COPD symptoms. When the smoking protocol was completed, mice were sacrificed, and their diaphragms were dissected out. Isolated muscle strips were mounted in a contractile chamber and treated (n = 6) or non-treated with HPC (n = 5) or incubated with AKT inhibitor (MK 2206, 50 μM, n = 5) or ERK inhibitor (PD 98059, 100 μM, n = 5) prior to HPC. Muscle strips were electrically stimulated for five minutes during the middle of a 30-min hypoxia treatment (PO2 = 5 Torr). The contraction force at the end of contraction protocol was recorded and normalized by the initial force to indicate muscle function. Data were expressed as mean ± SE and analyzed using multi-way ANOVA.

RESULTS: Our results show that HPC significantly improve muscle function during hypoxia (29 ± 2.8% for HPC vs. 6 ± 1.3% for control, p < 0.05). Either the inhibition of AKT or ERK diminished HPC protective effect on diaphragm (9 ± 2.6% for AKT inhibitor + HPC; 5 ± 1.3% for ERK inhibitor + HPC vs. 29 ± 2.8% for HPC, p < 0.05).

CONCLUSION: We propose that HPC attenuates diaphragm fatigue during hypoxia through AKT and ERK activation in COPD mice.

2780 Board #300 June 21 11:00 AM - 12:30 PM Effects Of Inspiring Hyperoxic Air On Excess Post-exercise Oxygen Consumption And Muscle Temperature After Exhaustive High Intensity Intermittent Exercise
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PURPOSE: The purpose of the present study is to elucidate effects of inspiring hyperoxic air (60% O2; 40% N2) on excess post-exercise oxygen consumption (EPOC) and muscle temperature after exhaustive high intensity intermittent exercise.

METHODS: Eight young males volunteered for this study. Means ± standard deviations (SDs) of the subjects’ age (22.6 yrs), body mass (kg), and VO2max (ml/kg/min) were 23.2±2, 65.1±9.0, and 48.2±6.5, respectively. For normoxic experiment (N-E), the subjects entered the metabolic chamber at 10:00. After 10 min of warming up, the subjects started an exhaustive high intensity intermittent bicycle exercise (6 to 7
sets of 20-s exercise at an intensity of 170% VO₂ max with a 10-s rest between each bout. HIEE) from 10:30. Until 14:00, the subject stayed in the metabolic chamber, and were measured oxygen uptake, rectal temperature and temperature of the vastus lateralis which is a mainly recruited muscle during the bicycle exercise. For hypoxic experiment (H-E), the subjects followed the same protocol, except for inspiring the 60% O₂ air during the exercise. The order of N-E and H-E were randomly assigned for each subject.

RESULTS: Compared with the N-E (81.0±15.6 kg/m²), total work during the HIEE was significantly higher on the H-E (464±26.4 kg/m²) than the N-E (130±27.4 kg/m²). However, no differences in oxygen uptake between N-E and H-E was observed after 10:49. Compared with the N-E (36.1±0.5%, p<0.001), the muscle temperature after the HIEE was significantly higher from the end of the HIEE until 10:48 on the H-E (37.0±0.7%, p<0.01), while no difference in rectal temperature between H-E and N-E was observed after HIEE to 10:48. The Δ oxygen uptake observed in H-E over N-E (15.7±14.3 ml/kg) from the end of the HIEE to 10:48 was highly correlated with the Δ muscle temperature measured in H-E over N-E during the same time period after the HIEE (0.91±0.66%, r=0.95, p<0.001).

CONCLUSIONS: The present investigation demonstrated that hypoxia elevates the total work during HIEE and EPOC after the HIEE. Furthermore, a significant part of the increased oxygen consumption observed until 15 min after the HIEE may be explained by the elevated muscle temperature which might enhance metabolism in the exercised muscle.

2782 Board #302 June 2 11:00 AM - 12:30 PM
Gait Parameters of Individuals with Chronic Obstructive Pulmonary Disease
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(No relationships reported)

Gait assessment for persons with chronic obstructive pulmonary disease (COPD) is beneficial in assessing fall risk and potentially treating limitations with ambulation associated with the disease. Some of the studies that estimated gait parameters in persons with COPD used the 6-minute walk test whose objective is to cover as much distance as possible in 6 minutes rather than focusing on the pace at which they walk. There is a current lack of literature identifying fall risk among persons with COPD estimated using standard testing procedure for gait.

PURPOSE: To determine differences in gait parameters among individuals with COPD, healthy older adults, and older adults at high fall risk. METHODS: Seven persons with COPD (mean age 61.7±17.7 years), seven healthy older adults (mean age 70.4±6.8 years) and seven older adults at high fall risk (mean age 68.1±8.6 years) walked across a GAITRite walkway at their normal comfortable pace. Gait speed, stride length, % of swing phase of the three groups were compared using a one-way ANOVA. RESULTS: Persons with COPD had a significantly slower gait speed (75.6±17.3 cm/s) when compared to healthy older adults (132.4±14.6 cm/s; p<0.001) and to older adults at high fall risk (116.5±17.2 cm/s; p<0.001). Persons with COPD also had a significantly shorter stride length (94.3±16.9 cm) when compared to healthy older adults (138.4±17.4 cm; p<0.001), but not to older adults at high fall risk (116.5±17.2 cm; p=0.08). Persons with COPD spent less percentage of their gait cycle in swing phase (32.8±1.9%) when compared to healthy older adults (38.4±1.3%; p<0.001) and to older adults at high fall risk (37.2±1.8%; p<0.001). There were no significant differences between the healthy older adults and older adults at high fall risk. CONCLUSIONS: These results indicate that persons with COPD exhibit more conservative gait, walking slower, with a shorter stride length and less time spent in swing phase compared to healthy older adults and older adults at high fall risk. A gait-training program for this population may be beneficial. A randomized control trial with persons without COPD is also needed.
Effects of Heavy Load Exercise and Acupuncture on Mitochondria in Rat Skeletal Muscle

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No relationships reported.

PURPOSE: To examine the effects of heavy load exercise and acupuncture on mitochondrial structure and mitophagy in rat skeletal muscle.

METHODS: Male Sprague-Dawley rats were divided into four groups: control (C, n=40), exercise group (E, n=40), acupuncture group (A, n=40), exercise and acupuncture group (EA, n=40). The experimental procedure was conducted in a 2-min session of acupuncture (needling of the bilateral soleus muscle). Each group was further divided into 6h, 12h, 24h, 48h, and 72h sub-groups (n=8 each), and at each time point the bilateral soleus muscle was collected and analyzed. Mitochondrial ultrastructural changes in skeletal muscle were monitored by transmission electron microscopy. The content of reactive oxygen species (ROS) was measured by ELISA. Protein expression of PTEN-induced putative kinase 1 (PINK1), mitochondrial Parkin, mitofusin-2, and COX-7 were measured by western blot. Mitochondrial co-localization with Parkin and LC3 was measured by immunofluorescence double labeling technique. The data points of variables were analyzed by one-way or multivariate ANOVA.

RESULTS: After heavy load exercise, the mitochondrial structure appeared to be abnormal and formed a large number of mitochondrial aggregates; the CS activity content decreased by 25.8%±5.1%; the expression of PINK1 (E12=2.552±0.14, Parkin (E12=2.535±0.10, LC3 (E12=2.757±0.180) was significantly increased (p<0.05) over baseline. Acupuncture promoted the recovery of mitochondrial ultrastructure, alleviated the reduction of CS content, and lowered the expression of PINK1 (EA12=1.738±0.083, Parkin (EA24=2.053±0.117, LC3 (EA12=1.718±0.095) in mitochondria (C=1.000, p<0.05).

CONCLUSION: Heavy load exercise may activate the PINK1/Parkin pathway, promote the combination of LC3 and mitochondria, and result in mitophagy and mitochondrial damage within skeletal muscle. Acupuncture can decrease the expression of PINK1 and Parkin, and inhibit the combination of LC3 and mitochondria, thereby inhibiting excessive activation of mitophagy and alleviating mitochondrial damage within rat skeletal muscle. (Supported by Sports Medicine key laboratory of Sichuan province Foundation).

The Combined Effect of Obesity & Pulmonary Arterial Hypertension on the Gastrocnemius in Zucker Rats


No relationships reported.

Pulmonary arterial hypertension (PAH) often leads to systemic hypoxic conditions promoting peripheral dysfunctions that affect skeletal muscle. Clinically, PAH is often observed concomitantly with obesity; as many as 35%-45% of PAH patients are obese. Recent studies have focused on the cellular mechanisms involved in PAH-associated skeletal muscle dysfunction; however, many of these studies have not included the consumption of different COX-inhibiting drugs and the adaptive cellular response may have a reduced impact on the relative phosphorylation of mTORC1 signaling. Changes in muscle strength across isoinotropic protocols have been used as a non-invasive method to estimate fast-twitch muscle fiber-type. However, few have determined the utility of estimated muscle fiber-typing in predicting performance.

PURPOSE: To determine if prior consumption of acetaminophen (APAP) alters skeletal muscle mitochondrial and mitophagy in mTOR1C1 signaling in response to RE. METHODS: In a double-blinded, counter-balanced, crossover design, healthy young men (n=8; 25 ± 1 yr, BMI: 26 ± 2 kg/m²) performed two trials of unilateral knee extension (8 sets, 10 reps, 70% 1RM). For 24h prior to each trial, subjects ingested either APAP (100mg/3h) or placebo (PLA) (final dose consumed immediately post RE). Muscle biopsies (vastus lateralis) were collected at rest and 24h postexercise during each trial. Western blot was utilized to assess phosphorylation and total protein levels of mTORC1 signaling proteins. RESULTS: Total protein for all markers was unchanged with time or treatment (p>0.05). Relative phosphorylation (pS/pT) of mTORC1 was similarly increased from rest (p<0.05) in both trials at 1h (PLA, 1.5 ± 0.2; APAP, 1.8 ± 0.2 fold) and 3h postexercise (PLA, 1.6 ± 0.2; APAP, 1.8 ± 0.2 fold), while, the relative phosphorylation of S6K1Thr389 was only increased (p<0.05) in APAP at 3h (PLA, 2.0 ± 0.3; APAP, 3.5 ± 1.2 fold). In contrast, absolute phosphorylation levels of mTORC1S6 and S6K1Thr389 were only increased from rest (p<0.05) following RE in PLA, while absolute phosphorylation levels of 4E-BP1Thr37/46 were reduced (p<0.05) postexercise in APAP. Absolute phosphorylation of eEF2Thr56 were reduced (p<0.05) following RE only in APAP. CONCLUSION: Compared with other COX-inhibiting drugs (i.e., ibuprofen), prior APAP consumption may have a reduced impact on the relative phosphorylation of mTORC1 signaling proteins following RE. These findings further highlight the unique interaction between the consumption of different COX-inhibiting drugs and the adaptive cellular response of skeletal muscle to exercise. Supported by intramural funds from ASU and MU.

Relationship Between Estimated Muscle Fiber-type And Peak Velocity For The Upper And Lower Extremity

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No relationships reported.

Changes in muscular strength across isoinotropic protocols have been used as a non-invasive method to estimate fast-twitch muscle fiber-type. However, few have determined the utility of estimated muscle fiber-typing in predicting performance.

PURPOSE: To determine the relationship between estimated fast-twitch (FT%) muscle fiber-type and peak velocity (PV) of upper (UE) and lower (LE) extremity muscle groups. METHODS: Nineteen (mean ± SD: age = 23.6 ± 2.9 years, height = 178.67 ± 5.22 cm, mass = 88.91 ± 13.86 kg) males visited the laboratory 2 occasions separated by 2-3 days. During the first visit, participants were familiarized with the isokinetic protocols and maximal voluntary contractions (MVCs) of the UE (Elbow Flexors (EF) and Extensors (EE)) and LE (Knee Flexors (KF) and Extensors (KE)). During the second visit, participants performed a maximal isokinetic protocol (50 repetitions at 180°·s⁻¹) for the UE and LE. The order of testing was randomized at 1 and a 20-minute rest period was implemented between protocols. Peak torque was calculated for each repetition of the isokinetic protocol and the average of the highest and third lowest repetitions were used to calculate fatigue index (FI%) [FI% = (height - lowest) / height *100] and FT% muscle fiber-type [FT% = (FI% - 5.2) / 0.90].

Prior to each protocol, isokinetic MVCs at 50°·s⁻¹ were completed in order to assess PV. The highest values recorded for PV were used for analysis. A Pearson correlation coefficient was computed to assess the relationship between FT% and PV for all muscle groups. RESULTS: The means ± SDs for each muscle group, as well as the results of the Pearson correlations are shown in Table 1. CONCLUSION: The results of the present investigation revealed that of the four muscle groups examined, only the FT% showed a significant relationship between FT% and PV. These findings indicate that FT% may have a limited ability to accurately predict PV performance in various upper and lower extremity muscle groups.
Recent meta-analysis has shown the association between FTO risk allele and the odds of obesity to be attenuated by 27% in physically active adults, which may suggest a possible relationship between exercise and FTO protein function. PURPOSE: To examine differences in FTO gene expression and protein function following high and low intensity exercise. METHODS: Twenty eight apparently healthy untrained males and females were genotyped for the FTO rs9939609 (T>A) polymorphism, prior to performing continuous isocaloric (400 kcal) cycle ergometer exercise on two separate occasions at 80% (HI) and 40% (LO) VO2peak. Skeletal muscle biopsies were sampled from the vastus lateralis at pre exercise (0 mins), 10 and 90 mins post exercise. Differences in FTO genotype, gene and protein expression, and m6A RNA methylation status before and/or after exercise were determined using an ANOVA. RESULTS: Distribution of the FTO variant alleles was 36% homozygous (AA), 32% heterozygous (AT) and 32% wild-type alleles (TT). No significant differences between genotypes in time to expend 400 kcal during the HI (AA: 36:45 ± 2:00min:sec, AT:39:29 ± 3:07min:sec, TT: 41:21 ± 4:06min:sec, p = 0.511) and LO intensity exercise protocol, or for average RER, glucose utilization and fat utilization (AA: 54:28 ± 2:58min:sec, AT: 57:59 ± 4:06min:sec, TT: 61:04 ± 4:19min:sec, p = 0.003). No main effect for time, genotype or genotype by time interaction was significantly increased at 10 mins post HI exercise (AA: 0.69-fold, AT:0.472-fold, TT: 0.23-fold, p = 0.003). No genotype or genotype by time interaction expression was significantly increased at any other time point. TSI% was unchanged during and following massage (P = 0.05). CONCLUSION: A reduction in muscle perfusion during massage therapy likely reflects the mechanical action of massage inhibiting capillary inflow but aiding outflow from the muscle. Whilst a lack of change in perfusion, oxygenation and TSI% following massage suggests a modest impact upon microcirculation, it is acknowledged that skeletal muscle perfusion but not blood flow was assessed. A lack of change in perfusion suggests that massage did not result in more capillaries being perfused; however, blood flow may still have been altered. Future studies should simultaneously assess blood flow through the microcirculation, as well as microcirculation perfusion and blood flow.

In vitro studies have supported an important role for intracellular calcium ion concentration ([Ca2+]i) as an intracellular signal for protein synthesis and degradation. Eccentric contractions (ECC) facilitate Ca2+ influx from the extracellular space via stretch-activated channels and cause high levels of [Ca2+]i accumulation. Accumulated [Ca2+]i activates proteolysis-related enzymes and induces muscle damage. A few days after ECC, the damaged muscle fiber shifts from this proteolytic to a regenerative phase. Whether there is any temporal and/or spatial correspondence between [Ca2+]i accumulation and structural damage/repair during recovery from ECC is unknown. PURPOSE: Specifically, we tested the hypothesis that there would be a dynamic pattern of [Ca2+]i accumulation post-ECC that would relate temporally to the damage-recovery cycle. METHODS: In anesthetized adult Wistar rats, the tibialis anterior muscles (TA) were subjected to unexercised controls (CONT) and ECC (5 sets of 40 contractions). After 1day (1D), 3 days (3D), and 7 days (7D) of ECC, the TA was loaded with ratiometric dye Fura-2 AM. We used the 340/380 nm ratio to analyze alterations in [Ca2+]i, by in vivo fluorescence imaging. After in vivo observations, the TA muscles were dissected to identify the histological features of the damage-to-regeneration cycle. RESULTS: After ECC, there was profound swelling at 1D followed by infiltration at 3D and regeneration at 7D (i.e. appearance of central nucleus). The mean [Ca2+]i was significantly increased after ECC at 1D (1.48 ± 0.09) and 7D (1.47 ± 0.04) but not at 3D (1.34 ± 0.05) compared with CONT (1.31 ± 0.05). Whereas there was a heterogeneous [Ca2+]i accumulation pattern evident among fibers it was interesting that [Ca2+]i accumulation significantly more over the 30 minute observation period at 1D (mean variation range: 0.10 ± 0.07) than at any other time (CONT; 0.08 ± 0.03, 3D; 0.07 ± 0.02, 7D; 0.08 ± 0.02). CONCLUSIONS: We determined that: 1. There were peaks of [Ca2+]i accumulation during both the swelling (1D) and regeneration (7D) phases. 2. The swollen and edematous fibers at 1D evidenced an oscillatory [Ca2+]i pattern. These profiles of [Ca2+]i accumulation may be key to controlling the extended pattern of protein synthesis and degradation that characteristically follows novel ECC.
June 2 9:30 AM - 11:00 AM

GROWTH INHIBITION OF MESENCHYME STEM CELLS BY LAMINARIN, A β-D-GlucAN: IMPACT ON CHONDROCYTE DIFFERENTIATION

ABSTRACT

Mesenchymal stem cells (MSCs) are multipotent adult stem cells that differentiate to form cartilage, bone, tendons, muscle, and skin. Usually found in the bone marrow and can also be isolated from other tissues including cord blood or adipose tissue. Given the innate ability of MSCs to promote cellular damage recovery and tissue repair, there is rising interest in their use in a broad repertoire of cell-based therapy for the treatment of several diseases. One of the most important tasks of MSC therapy is to control cells proliferation and differentiation. These processes model and shape tissue and organ relationships in multicellular organisms. Previous investigations showed that cell growth pathways are mediated through protein-glycan interactions. We have adopted this approach to study the effect of laminarin, a β-(1→3)-D-glucans.

METHODS: MSCs were isolated from the bone marrow of six-week old male Wistar rats then cultured in MSC growth and chondrogenic differentiation mediums. Proliferation rate and apoptosis were explored by cell count, MTT assays and Annexin V staining. mRNA and protein expression of specific markers for MSCs and chondrocytes were studied using qPCR and immunofluorescence.

RESULTS: Laminarin treatment reduced cell proliferation of MSCs cultured in both growth and chondrogenic mediums. Annexin V staining showed no apoptosis. Cells in MSC growth medium showed no impact of laminarin for Tβ1, nucleostemin and endoglin mRNA analysis. Conversely, in chondrogenetic medium, laminarin had a negative effect on Tβ1 levels and no change in nucleostemin and endoglin. Collagen II responded positively to laminarin and no change in nucleostemin and endoglin. The innate ability of MSCs to promote cellular damage recovery and tissue repair, although none of the latter were identified.

CONCLUSION: These results indicate that laminarin inhibited both cells proliferation and chondrogenic differentiation suggesting potential clinical applications in MSC therapy.

June 2 9:30 AM - 11:00 AM

Leg Dominance and Fiber Type Composition Influence Landing Performance in Resistance-Trained Men

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Leg dominance may lead to asymmetrical performance and injuries. No study has investigated this issue at both the biomechanical and single muscle fiber level.

PURPOSE: Simultaneously investigate leg dominance, muscle fiber type composition, and landing performance in resistance-exercise-trained (RE) men.

METHODS: Fourteen men (age=24.1±1.6 yrs; height=181.6±6.6cm; mass=87.8±10.9kg) answered a leg dominance questionnaire (preferred kicking leg) and performed drop-jumps (30cm) onto two independent force plates (one foot per plate), alternating the step off leg. Muscle biopsies were performed on the vastus lateralis in both dominant (D) and non-dominant (ND) legs. Individual muscle fibers (107.8±34.3/leg/person) were isolated and sodium dodecyl sulfate polyacrylamide gel electrophoresis was used to identify myosin heavy chain fiber type (MHC1, MHCIIa, MHCIIx, MHCIIx/X, or MHCIIc).

RESULTS: Significant differences in MHC1 [r(df=13)=3.135, p=0.008] and MHCIIa [r(df=13)=2.898, p=0.012] between legs were identified; D had a higher percentage of MHC1 (33.9±11.2% vs. 24.9±15.3%) and ND had a lower percentage of MHCIIa (54.8±13.3% vs. 61.8±14.8%) fibers. Significantly more fibers containing MHC I isoforms (MHC1/MHCIIa) in D was present [r(df=13)=3.273, p=0.006] compared to ND (42.1±14.6% vs. 34.1±14.5%), and significantly more fibers containing MHC II isoforms (MHCIIa/MHCIIx/MHCIIx/X) in ND was present [r(df=13)=1.923, p=0.077] compared to D (57.9±13.9% vs. 65.3±14.5%). A significant interaction existed between landing foot and step-off foot [f(11,99)=0.004]. ND produced a significantly higher landing rate of force absorption (RFA) compared to D (p=0.003) when stepping off with ND. The RFA in ND (stepping off with ND) was negatively correlated with the percentage of fibers containing MHCII isoforms (r=0.029, r=0.581) and positively correlated with the percentage of fibers containing MHCII isoforms (r=0.048, r=0.536). CONCLUSIONS: The preferred kicking leg was not preferred to absorb landing force. The greater abundance of MHCIIa fibers in the preferred force absorbing leg may provide an explanation for, or a result of, the observed asymmetry. These results enhance our understanding of leg dominance, performance, and muscle fiber type composition in RE men.
lower fecundability compared to women with lower mean expenditure/working hour. Seven cohort studies reported associations between PA and assisted fertility (in China, Italy, Turkey, and the United States): assisted fertility was found to be associated with intrauterine insemination (IVF) in 6 studies and intracytoplasmic sperm injection (ICSI) in 2 studies. PA was self-reported in all studies; one study also used accelerometer. Four studies found favorable associations, 1 found unfavorable associations, and two found no association between higher PA and assisted fertility.

**CONCLUSION:** The association between PA and natural and assisted fertility remains unclear. Future studies should incorporate objective PA measures and explore the PA volume and dose associated with fertility.

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### Board #315

**June 2 9:30 AM - 11:00 AM**

**Motor Impairments in Transient Ischemic Attack and Subsequent Stroke**

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(No relationships reported)

**PURPOSE:** Transient ischemic attack (TIA) increases the risk for a subsequent stroke. Typical symptoms include motor weakness, difficulty with speech, and loss of coordination. The association between the presence of motor impairments during a TIA and the chance of a subsequent stroke has frequently used in health promotion. This meta-analysis included TIA individuals who experience motor impairments as compared to those who don’t experience motor impairments.

**METHODS:** We conducted systematic search of electronic databases as well as manual searches of retrieved articles. The meta-analysis included studies that reported an odds ratio relating motor impairments to a subsequent stroke, or the number of individuals with or without motor impairments who experienced a subsequent stroke. We examined these using rigorous meta-analysis techniques including random effects models, forest and funnel plots, publication bias, and funnel-safe analysis.

**RESULTS:** Twenty-two studies with 11,084 participants from North America, Australia, Asia, and Europe qualified for inclusion. An odds ratio of 2.14 (95% CI, 1.124 - 0.480; p=0.001), as well as gamma-glutamyl transferase (SMR=0.726; 95% CI, 1.203 to 0.249), did not alter any other liver enzymes.

**CONCLUSIONS:** This meta-analysis supports current recommendation for physical exercise, mainly aerobic, as an effective intervention in the treatment of non-alcoholic fatty liver disease, through reduction on visceral and subcutaneous adipose tissue and intrahepatic fat.

**Systematic review registration:** PROSPERO CRD42016042163

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### Board #317

**June 2 9:30 AM - 11:00 AM**

**Effects Of Mhealth Apps On Physical Activity And Weight Loss Outcomes: A Meta-analysis**

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(No relationships reported)

**PURPOSE:** Little systematic review has been conducted on mobile device health application (mHealth) use and its effect on physical activity (PA) and weight loss (WL). This systematic review will evaluate the effectiveness of mHealth apps on PA and WL outcomes.

**METHODS:** A total of 150 published articles regarding mHealth apps and PA/WL were found. Twelve studies met the following inclusion criteria: 1) empirical articles published between 2000 and 2016 in English; 2) examined the effectiveness of an mHealth app on PA or WL outcomes; and 3) each study contained ≥ 1 comparison. Data extraction for comparisons was completed for the following outcomes: 1) PA; 2) WL; and 3) body mass index (BMI). Moderator analyses were performed for studies reporting intervention fidelity frequency of: 1) greater than every two weeks; 2) less than every two weeks; or 3) not reported. Calculation of effect size (ES; Hedge’s g) was completed with Comprehensive Meta-Analysis software for each entry. Analyses were run separately between mHealth apps and control (i.e., standard care or no treatment) or comparison (i.e., another experimental treatment) conditions.

**RESULTS:** mHealth apps were most commonly used for WL (n= 10). Compared to control and comparison, mHealth apps had no effect on WL (ES=−0.22 and ES=−0.08, respectively; all p > .05). Seven and six studies investigated mHealth apps effect on BMI and PA, respectively (one study examined both outcomes). Regarding BMI, mHealth apps had no effect versus control (ES=−0.08, p > 0.05) or comparison (ES=−0.09, p > 0.05). The same result was seen when using mHealth apps to promote PA outcomes. Specifically, when compared to control, mHealth apps demonstrated no effect on percentage of increased step counts (ES=−0.10, p > 0.05) and moderate-to-vigorous PA (ES=−0.12, p > 0.05). Intervention fidelity was only reported by 4 of the included studies, with moderator analyses revealing no effect of intervention fidelity frequency on the study outcomes (all p > .05).

**CONCLUSIONS:** Findings indicate mHealth apps to be at least as effective as standard care/no treatment or another experimental treatment condition. To improve effectiveness of mHealth apps in promoting PA and WL, future studies need to improve intervention fidelity measures and use established behavioral theory to implement the study.

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It is well known physical activity (PA) plays a role in the prevention of Type 2 diabetes (T2D). However, the extent to which PA may impact T2D risk among different race/ethnic groups is unknown. PURPOSE: To systematically examine the protective relationship between PA and T2D across five common race/ethnic groups (Caucasian, African American, American Indian, Hispanic, and Asian). METHODS: PubMed and Embase databases were systematically searched through June 2016. Study assessment for inclusion was conducted in three phases: 1) title review (N=13,022), 2) abstract review (N=2,200), and 3) full text review (N=265). A total of 27 studies met the inclusion criteria and were used in the analysis. Relative risk of having T2D compared to participants with ≥ 50% confidence intervals (CI) were extracted and analyzed using the Comprehensive Meta-Analysis software. All analyses used a random-effects model. RESULTS: Statistically significant protective summary RRs, comparing the most active to the least active PA group, were found for Caucasians (RR 0.71, 95% CI 0.60-0.85), Asians (RR 0.76, 95% CI 0.60-0.95), and Hispanics (RR 0.76, 95% CI 0.60-0.95) compared to inactive participants.
95% CI 0.67-0.85), Hispanics (RR 0.75, 95% CI 0.64-0.89), and American Indians (RR 0.73, 95% CI 0.60-0.88). The RR for African Americans did not attain statistical significance (RR 0.91, 95% CI 0.76-1.08). CONCLUSIONS: The results of this study indicate that PA (comparing most to least active groups) provides significant protection from T2D across the race/ethnic groups, with the exception of African Americans. Although the reason is not completely elucidated, this may be due to lowered fat oxidation rates at-rest and during exercise, large increases in susceptibility to diabetes with small decreases in insulin sensitivity, and higher percentages of type II muscle fibers in African Americans. The results also suggest a need for race- and ethnicity-specific reporting of T2D RR's related to PA dose among prospective cohort studies.

2799 | Board #319 | June 2 9:30 AM - 11:00 AM | The Effect Of Exercise Training On Leptin: A Meta-Analysis Of Randomized Controlled Trials |
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PURPOSE: Leptin is the primary energy balance hormone released from adipose cells. Lower leptin levels activate peripheral and central systems to restore energy balance; higher leptin levels inhibit feelings of hunger and are associated with increased energy expenditure. The effects of acute exercise bouts on leptin has been previously examined, however the effect of chronic exercise training on leptin is still incompletely characterized. As such, the primary aim of this study was to quantify the effect of exercise training on leptin level. METHODS: Articles published before April 14, 2016 were located using searches of the Physical Education Index (n=149), PubMed (n=355), Scopus (n=225), SPORTDiscus (n=54), and Web of Science (n=314) online databases using combinations of the terms: exercise, training, exercise training, leptin, randomized, randomized controlled study, and randomized controlled trial. All studies included in this meta-analysis were peer reviewed and published in English. Human participants were assigned to a non-exercise comparison group or exercise training group, with interventions lasting ≥2 weeks. Leptin levels were measured at baseline, during and after completion of the exercise training program. Each study effect size (ES) was calculated as the change in the control group subtracted from the change in the treatment group, divided by the pooled standard deviation of baseline values. Random-effects models were used to aggregate a mean ES and 95% confidence intervals (CI). A positive ES indicated a decrease in leptin following exercise training. RESULTS: The cumulative results from 128 effects extracted from 73 articles published between 1998 and 2016 indicate that exercise training can effectively reduce leptin levels (ES=−0.278, 95% CI 0.149-0.285; P<0.001). The estimate of the percent increase significantly after accounting for the nesting of multiple effects within a single study (ES=−0.2431, 95% CI 0.141-0.341; P<0.001). The significant decrease in leptin following exercise training was moderately heterogeneous (Q=218.66, F=41.92%; P<0.001), with sampling error accounting for 64.8% of the observed variance. CONCLUSIONS: These results suggest that exercise training decreases leptin levels.

2800 | Board #320 | June 2 9:30 AM - 11:00 AM | Current Evidence of Gait Modification Strategies to Reduce Knee Adduction Moment: Systematic Review and Meta-Analysis |
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Knee osteoarthritis (KOA) is a debilitating joint disease that predominantly occurs in the medial compartment due to excessive joint loads. Gait retraining using real-time biofeedback (RTB) is a conservative approach for reducing knee joint loads. While outcomes suggest moderate to large short-term treatment effects, existing evidence limits generalizability and clinical application.

PURPOSE: To determine if gait retraining interventions using RTB are beneficial for altering knee adduction moment (KAM) in KOA and asymptomatic individuals.

METHODS: An electronic search was conducted using the following databases: PubMed, EBSCo host, Embase, PROQuid, and Cochrane [1970 to January 2016]. Duplicates were removed within then across databases. A total of 11 full text articles were retained that evaluated the effects of RTB on KAM. Methodological quality was assessed using the PEDro scale. Standardized mean differences (SMDs) were calculated for 1st peak KAM. Gait modification strategy (medial weight shift, lateral trunk lean, and self-selected) and mode of RTB (haptic and visual) were used as moderators for separate meta-analyses of studies with healthy participants. An inverse variance with random effects model approach was used with SMDs to account for heterogeneity between studies. Heterogeneity was quantified with the I² statistic with P<0.10 being statistically significant.

RESULTS: Mean PEDro score was 6.0±0.6 out of a possible 11 with internal validity scoring poorly across all studies. For studies including healthy participants, the I² index averaged 93%, with P<0.10, in the two meta-analyses. Gait modifications strategies presented: Tau²=3.2644, Chi²=180.6403, df=14 (P<0.0001); F=94.66%, z=2.4552 (P<0.05). The overall SMD was 1.18 [0.24; 2.13]. Self-selected gait modification strategies presented the greatest SMD. Mode of RTB results presented: Tau²=2.4776, Chi²=122.9895, df=12 (P<0.0001); F=92.31%, z=3.7829 (P<0.0001) with an overall SMD of 1.19 [0.95; 1.43].

CONCLUSIONS: Evidence presented in this review suggests that gait modification via RTB is effective in reducing KAM in both symptomatic and asymptomatic individuals. However, evidence is limited and of low quality, meaning the optimal combination of gait modification strategy and mode of RTB delivery remains unclear.

2801 | Board #321 | June 2 9:30 AM - 11:00 AM | Arterial Stiffness Is Reduced Regardless Of Exercise Training In Obese Paediatric Populations: A Meta-Analysis Of Randomised Controlled Trials |
| Alejandra Tordecilla-Sanders | Antonio García-Hernaso | Katherine Gonzalez-Ruiz | Robinson Ramirez-Veléz |
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PURPOSE: In paediatric populations, the use of carotid intima-media thickness (IMT) as a marker of cardiovascular risk has increased. However, previous studies examining the effects of exercise training on arterial structure and function in obese children and adolescents have shown inconsistent findings. The primary aim of this systematic review and meta-analysis is to expand on the current body of literature by providing a quantitative estimate of the change in carotid IMT following exercise training, as well as to provide an exploratory analysis of potential moderators associated with the variation in response to an exercise training intervention in overweight and obese youth.

METHODS: A search of the literature was performed using the electronic databases CENTRAL, EMBASE, and MEDLINE. The terms used were: [‘Obesity’ and ‘Overweight’ OR] [‘Exercise’ and ‘Training’ and ‘Physical activity’ and ‘Sport’ OR]. All medical subject heading terms were combined with intima-media thickness* and children and adolescent as limiters. Studies reported in languages other than English were not explored. The analysis was restricted to studies that examined the effect of exercise interventions on carotid IMT in paediatric obesity (6-18-year-olds). Six randomised controlled trials (RCTs) (303 youths) were included. Hedge’s g and 95% confidence intervals were calculated. Kendall’s τ and I² were calculated as measures of heterogeneity. RESULTS: Exercise was associated with a small-to-moderate but significant reduction in carotid IMT (g=−0.306; 95% CI, −0.540 to −0.072; p=0.011). Likewise, exercise programme duration per week significantly influenced the effect of exercise on carotid IMT (β=-0.060; 95% CI, −0.540 to −0.072; p=0.011). The meta-regression analysis showed that there was a greater decrease in carotid IMT in studies with a duration of more than a week. The slope regression coefficient was -0.060 [95% CI = −0.136 to −0.015] and was significant (p=0.015). These data indicate that greater decrease in carotid IMT was observed in individuals that achieved larger interventions in terms of minutes per week.

CONCLUSIONS: Exercise seems to reduce carotid IMT in childhood obesity. Therefore, encouraging obese paediatric individuals to become physically active can lead to favourable changes in the arterial wall.

PROSPERO Registration: CRD42016045232

2802 | Board #322 | June 2 9:30 AM - 11:00 AM | Exploring the Relationship between Fundamental Motor Skills & Physical Activity Levels in Children: A Meta-Analysis |
| Belinda Parmenter | Carolyn Broderick | Nancy van Doorn, Alexander Engel |
| University of NSW, Sydney, Australia. |
| (No relationships reported) |

PURPOSE: Fundamental motor skills (FMS) are the building blocks for movements used throughout life and its proficiency is correlated with higher levels of physical activity (PA) and decreased incidence of obesity in school-aged children (SC) (5-12 years). However, it is unknown if the same relationship exists in preschool children (PC) (3-5 years). This review aims to evaluate interventions for improving FMS and PA levels in children from 3-5 and 5-12 and determine whether there is a similar relationship between a change in FMS and a change in PA across age groups.
E-40 Free Communication/Poster - Vascular Function

Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2805 Board #325
June 2 9:30 AM - 11:00 AM
The Impact of Laminar and Oscillatory Shear Stress on Cellular Adhesion Molecule Expression in HUVEC
Edward B. Crabb, Daniel E. Conway, Lindsay M. LaFratta, Edmund O. Acevedo, FACSM, Robert L. Franco, Virginia Commonwealth University, Richmond, VA.

No relationships reported

PURPOSE: To investigate the influence of acute laminar shear stress (LSS) on the expression of VCAM-1 and fractalkine on human umbilical vein endothelial cells (HUVEC) following prolonged exposure to oscillatory shear stress (OSS) in vitro.

METHODS: Cultured EC were stimulated with TNF-α for 24 hr and immediately exposed to shear experiments using a parallel-plate flow chamber: (i) 24 hr of LSS or OSS, and (ii) 24 hr of OSS followed by 30 min of LSS. Cells were collected and incubated with primary antibodies for surface VCAM-1 and fractalkine. Samples were analyzed via standard fluorescence-activated cell sorting. RESULTS: Prolonged LSS and OSS significantly reduced the TNF-α-induced elevation in the % of gated cells expressing VCAM-1 (p<0.001) and fractalkine (p<0.001); however, the reduction in VCAM-1 caused by LSS was shown to be significantly greater than the reduction elicited by OSS (p=0.006). Interestingly, the mean fluorescent intensity (MFI) of TNF-α-induced VCAM-1 was significantly elevated by prolonged OSS (1.60±0.01 fold [p<0.001]). Whereas, prolonged LSS had no impact on the MFI of TNF-α-induced fractalkine (p=0.017). Lastly, acute LSS following prolonged OSS had no effect on the % of gated or MFI of cells expressing VCAM-1 and fractalkine. CONCLUSIONS: Prolonged OSS may increase markers of vascular inflammation. However, an acute period of LSS, utilized as a model of physical activity, does not appear to alter the OSS-induced inflammatory state.

Exercise minutes per week (e.g., ≥150 mins, <150 mins) on overall ES. Heterogeneity was evaluated using Cochran’s Q statistic. Comprehensive Meta Analysis (Version 2.2) software was used to conduct the meta-analysis and conduct sensitivity analysis. RESULTS: Key search words included short, intermittent, and accumulated bouts in Ebscohost and Google Scholar databases. The searches yielded 446 articles. After initial screening of titles and abstracts, 34 potentially relevant studies were reviewed in full, 10 studies involving 163 participants were included, and 20 ESs were calculated in this meta-analysis. Overall mean ES for SBP was significant (ES = −0.324, CI = −0.59, −0.05). This indicated that accumulated short-bout exercise was effective in reducing SBP. Moderator analyses indicated that the mean ES for SBP was influenced by total intervention period, %Δ (ES = −0.10, CI = −0.37, 0.18). This indicated that short-bout exercise was not effective in reducing DBP. Moderator analyses indicated that the mean ES for DBP was not influenced by any of the two moderator variables. CONCLUSION: The accumulation of short-bout exercise can have a significant effect on decreasing SBP, especially with a longer intervention period (≥ 12 weeks). However, these changes are not seen in DBP. To better establish guidelines, more research should be conducted to understand the effects of short-bout exercise on DBP.
RESULTS: The reactive hyperemia index (RHI), a marker of endothelial function, was significantly higher after exercise than before exercise (P < 0.05). Moreover, aerobic exercise training increased the RHI (P < 0.05) and tended to increase serum cSBP level (P = 0.09). Additionally, the training-induced change in cSBP was negatively correlated with training-induced change in serum adiponectin, CTRPs and CTRP levels (r = -0.46, r = -0.52, r = -0.39, respectively, P < 0.05). By contrast, none of these parameters changed significantly in the control group.

CONCLUSION: These results suggest that the exercise training induced increase in serum CFR values may be associated with the reduction of arterial stiffness in middle-aged and older adults.

Supported by Grants-in-Aid for Scientific Research (15K08748) and JSPS KAKENHI (16H03451, N. Hasegawa)
cardiovascular disease risk with age. Physical activity can prevent, and/or reverse, age-related vascular function is reduced with sedentary aging, which contributes to increased systolic blood pressure and cfPWV were significantly decreased (each $P<0.05$).

$70\%$ peak oxygen uptake [$\mathrm{VO}_2\text{peak}$] for $45$ min, $3$ days/week). We measured brachial pulse wave velocity (baPWV) as an indicator of systemic arterial stiffness. However, in preliminary height, right coronary and microvascular dilator function tends to be impaired in burn survivors. However, endothelial independent vasodilation is well maintained in these individuals, suggesting that endothelial dysfunction contributes to their attenuated macrovascular and microvascular dilator responses. Funded by National Institutes of Health (GM-068865).

**RESULTS:** Macrovascular dilator function tended to be reduced in burn survivors (controls $7.6 \pm 1.0\%$ vs burn survivors $5.1 \pm 0.8\%$; $P = 0.08$). Likewise, forearm vascular conductance area under the curve (controls $2.73 \pm 0.34 \mathrm{ml} \mathrm{mmHg}^{-1}$ vs burn survivors $2.03 \pm 0.26 \mathrm{ml} \mathrm{mmHg}^{-1}$, $P = 0.1$) and forearm vascular conductance (controls $5.27 \pm 0.56 \mathrm{ml} \mathrm{min}^{-1}$ vs burn survivors $4.07 \pm 0.42 \mathrm{ml} \mathrm{min}^{-1}$; $P = 0.1$) tended to be lower in burn survivors. Nitrergic mediated vasodilation did not differ between groups (controls $21.8 \pm 2.3\%$ vs burn survivors $21.1 \pm 2.4\%$; $P = 0.8$). CONCLUSION: In these preliminary height, right coronary and microvascular dilator function tends to be impaired in burn survivors. However, endothelial independent vasodilation is well maintained in these individuals, suggesting that endothelial dysfunction contributes to their attenuated macrovascular and microvascular dilator responses. Funded by National Institutes of Health (GM-068865).

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Aging-induced elevation of blood pressure and arterial stiffness is reduced by aerobic exercise training. Administration of salusin-α to healthy rats induces a decrease in mean arterial blood pressure, and circulating salusin-α level was lower in patients with hypertension or coronary artery disease compared with healthy controls. Additionally, circulating salusin-α level is significantly negative correlated with brachial-ankle pulse wave velocity (baPWV) as an indicator of systemic arterial stiffness. However, it is unclear whether circulating salusin-α level is associated with exercise training-induced reduction of risks for hypertension and arteriosclerosis. PURPOSE: The aim of this study was to investigate whether serum salusin-α level is associated to exercise training-induced Blood Pressure: A Meta-Analysis

Email: engellq@gmail.com (No relationships reported)

Systemic arterial hypertension is a multifactorial disease with high prevalence in the elderly population. Resistance training has shown promising results in reducing hypertension; finding mainly explained by the post-exercise hypotensive effect. PURPOSE: The purpose of this meta-analysis was to determine the acute effect of the total resistance training load on blood pressure (BP). METHODS: A systematic search of articles evaluating post-exercise BP responses published until June 2016 was performed in $6$ databases. Risk of bias was assessed using a $5$ point Likert-type scale. Hedge’s standardized mean difference effect size (ES) was calculated for each result; then, ESs were weighted using random-effects models. Non-overlapping $95\%$ confidence intervals were considered statistically significant. Heterogeneity was assessed using $Q$ and $I^2$, while funnel plots and Egger’s regression test were used to assess small-study effects (potential bias). The $z$-test was computed to determine whether ESs were different from zero. RESULTS: Twelve studies were selected, representing $171$ subjects for a total of $342$ ESs. For systolic BP, the overall ES was $-0.86$ ($C_{I_{-0.37}}$ - $-1.02$, $z = 0$, $p < 0.05$), which translates to a reduction of $6.3 \mathrm{mmHg}$. For diastolic BP, the ES was $-0.51$ ($C_{I_{-0.15}}$ - $-0.69$, $z = 0$, $p < 0.05$), which translates to a reduction of $3.3 \mathrm{mmHg}$. Normotensive and physically-active participants who were prescribed exercise intensities based on submaximal tests showed higher reductions in BP than hypertensive, sedentary, and when one maximal repetition ($1\text{RM}$) was used for resistance training. CONCLUSIONS: The total resistance training load is highly correlated to post-exercise BP reductions, providing significant clinical benefits for patients.
females; age 40 ± 15 years; height 170 ± 11 cm; mass 80 ± 19 kg; mean ± SD). Burn survivors had an average of 49 ± 23% (range: 16 - 85%) body surface area burned and were at least two years post burn injury. Results: Neither peripheral arterial stiffness (controls: 8.3 ± 0.5 m s⁻¹; burn survivors: 7.8 ± 0.4 m s⁻¹; P = 0.5) nor central arterial stiffness (controls: 6.6 ± 0.6; burn survivors: 6.7: 0.5 m s⁻¹; P = 0.9) differed between groups. Conclusions: These data suggest that arterial stiffness is not altered in well-healed burn survivors. Supported by NIH Grant R01 GM-068865.

2815 Board #335 June 2 9:30 AM - 11:00 AM
Effect Of Topical EMLA Application On Cutaneous Sympathetic C-fiber Function
Kevin Wr Kunz, Gary W. Mack, S4602, FACSMM, Brigham Young University, Provo, UT. (Sponsor: Gary W. Mack, FACSMM)

Purpose: Activation of nociceptive afferents (small C-fibers) in the skin results in the activation of an axon reflex mediated increase in cutaneous blood flow. Topical lidocaine (EMLA) is often used to mitigate the axon reflex and its impact on the skin blood flow response to local heating. However, it is possible that EMLA would impact cutaneous sympathetic nerves which are also small C-fibers. Methods: To evaluate this hypothesis, we examined the effect of topical EMLA application on axon reflex mediated sweating induced by intradermal electrical stimulation in 10 subjects with and without EMLA application. Local sweat rate (SR) was measured by passing dry gas through a small sweat capsule mounted on the skin. The skin was stimulated at a constant current intensity of 2.5 mA for 30 s at frequencies of 0.2, 1, 2, 4, 8, 16, 32, and 64 Hz using two small stainless steel stimulating electrodes. This procedure produced a sigmoid shape stimulus-response curve when we plotted the area under the SR-time curve versus stimulus frequency. Results: In control conditions peak local SR during 64 Hz stimulation averaged 0.364 ± 0.219 mg • min⁻¹ • cm⁻² which was significantly (p=0.05) reduced by application of EMLA to 0.078 ± 0.098 mg • min⁻¹ • cm². The stimulus-response curves were significantly different from each other with a significant reduction in the plateau with EMLA (11.7 ± 1.3 versus 2.6 ± 0.6, p=0.05) but with a similar EC₅₀ values (7.2 ± 0.11 versus 9.9 ± 0.2 Hz). Conclusion: These data support the hypothesis that topical application of EMLA does impact cutaneous sympathetic C fiber function. As such, topical EMLA cream should not be viewed as an appropriate method to selectively eliminate superficial sensory fiber activity from studies of human cutaneous blood flow.

2816 Board #336 June 2 9:30 AM - 11:00 AM
Effect Of Habitual Interval Walking On Arterial Stiffness In Older Adults
Takanobu Okamoto, Ryota Kobayashi, Yuto Hashimoto, Hiyoriyuki Hatakeyama. Nippon Sport Science University, Setagaya-ku, Tokyo, Japan. Email: tokamoto@nittai.ac.jp

Arterial stiffness that increases with aging is an independent risk factor for cardiovascular diseases. Interval walking is an effective way to prevent cardiovascular diseases.

Purpose: The present study aimed to determine whether habitual interval walking decreases arterial stiffness in older adults. Methods: Fifty-four older adults (72.3±5 years) were randomly assigned to undergo interval walking (IW; n=26; male, n=14) or normal walking (NW; n=28; male, n=11) in 30% maximum voluntary contraction with and without lower body negative pressure (LBNP; 40mmHg) applied before, during and for 1 min following HG. Results: IW decreased systolic blood pressure and mean arterial pressure by 9.29±2.6 mmHg and 9.2±1.9 mmHg, respectively; heart rate increased by 20.3±6.6 beats per minute. With LBNP, heart rate increased by 15.3±5.0 beats per minute in both groups. Bradycardia significantly increased with NW compared with IW (NW: ±30.9 ± 2.8 %baseline; LBNP: 30% ± 3.3 mmHg, P<0.05). Post exercise hypertensive response was elicited in a sustained exercise after exercise.

2817 Board #337 June 2 9:30 AM - 11:00 AM
Post Exercise Hypotension and Blood Flow Characteristics Between Eccentric and Concentric Exercise
Jon Stavres, Stephen Fischer, John McDaniel. Kent State University, Kent, OH.

Purpose: Post exercise hypotension following resistance training has been reported in a variety of populations, though its mechanisms are not clear. The role of metabolism in post-exercise hypotension can be explored through the isolation of eccentric and concentric contraction, due to the greater metabolic cost of concentric contractions. Therefore the purpose of this study is to determine how metabolic activity, independent of mechanical work, influences post-exercise hypotension. Methods: Twelve healthy participants (6 male, 6 female) completed a traditional, a concentric, and an eccentric exercise session, each matched for total work. Participants performed 3 sets of 10 repetitions in the traditional session and 3 sets of 20 repetitions in the concentric and eccentric session, all at 65% of a predetermined 1 repetition max. Blood pressure was collected at baseline, after each exercise (6), and every 15 minutes after exercise for 2 hours. Brachial and femoral blood flow were also assessed at baseline, immediately after exercise, and at 30, 60, 90, and 120 minutes after exercise. Results: Repeated measures ANOVA results indicated a significant main effect of time (F3,2407 = 0.017, condition (F3,2409 = 0.011), and a significant main effect of time by condition interaction (F3,2409 = 5.12, P<0.001) for mean arterial pressure (MAP). Results also indicated significant main effects of time (F6,4801 = 10.10, P<0.001), condition (F6,4801 = 32.24, P<0.001), and a time by condition interaction (F6,4801 = 9.13, P<0.001) for brachial blood flow; and significant main effects of time (F6,4801 = 25.9, P<0.001), condition (F6,4801 = 7.95, P<0.001), and a time by condition interaction (F6,4801 = 17.5, P<0.012) for femoral blood flow. Conclusions: Results from this study indicate that metabolic activity during post exercise hypotension independently from factors related to force production. Furthermore, these data suggest that eccentric exercise may elicit a sustained post exercise hypertensive response.
Flow Mediated Dilation (FMD) has immense potential to become a clinical, non-invasive assessment of endothelial function. However, FMD analysis techniques could deviate significantly in different laboratories if a validation process is not involved.

**Purpose:** To provide validation to the assessment of FMD analysis in our lab and to standardize this process as a first step in every lab before reporting results of FMD. METHODS: Brachial and femoral arteries FMD was performed on 30 young, apparently healthy participants (15 males). For the intratester reliability study, 10 subjects were asked to come to the lab for a second brachial FMD within 48 hours. All FMD procedures were performed by the same investigator, while the FMD analyses were performed by 2 independent testers who were blind to each other analyses. FMD analyses included baseline artery diameter measurements, peak artery diameter after 5 minutes of ischemia, and FMD. Analysis was completed via Brachial Analyzer for Research Software (Medical Imaging Applications LLC, Coralville, Iowa) by both testers. Intrater and intertester reliability were determined by using coefficient of variations (CV) between first and second visit (intrater) and between results obtained by both testers (interter).

RESULTS: For tester 1, the intrater CV’s were 4.45% (±0.61%) for brachial baseline artery diameter, 5.23% (±0.47%) for brachial peak artery dilation, and for brachial FMD was 2.42% (±1.77%). For tester 2, the intrater CV’s were 5.08% (±0.64%) for baseline brachial artery diameter, 5.69% (±1.49%) for peak brachial artery dilation, and for FMD was 4.82% (±5.82%). The interter CV’s were 2.40% (±1.94%) for brachial baseline artery diameter, 3.16% (±0.00%) for brachial peak artery dilation, and 3.37% (±3.46%) for brachial FMD, and 4.52% (±0.42%) for femoral baseline artery diameter, 5.50% (±12.5%) for femoral peak artery dilation, and 3.46% (±3.36%) for femoral FMD.

CONCLUSIONS: All CVs were under or around 5%, confirming a strong reliability of the method. Our lab has illustrated the accuracy necessary to reproduce quality results from FMD procedures results due of the significantly low coefficient of variation. It is necessary for all labs to validate FMD procedures, to obtain a reproducible and validated value for future procedures utilizing FMD.
Individuals with Down syndrome (DS) commonly exhibit autonomic dysfunction, which may contribute to abnormal arterial function and partially explains low exercise tolerance in this population. Arterial stiffness, reduced arterial compliance and distensibility, is a strong predictor of future CV events and all-cause mortality. Individuals with DS also have alterations in arterial function and the effect of sympathetic stimulation on arterial distensibility is unclear in individuals with DS. **Purpose:** To examine potential differences in carotid artery distensibility, arterial compliance (AC), and hemodynamics to sympathoexcitation using hypovolemic lower body negative pressure (LBNP) in individuals with and without DS. **Methods:** VO_{2peak} was measured in 20 volunteers (DS=9, 23 yrs; Control=11, 24 yrs) using an individualized treadmill protocol. Changes in hemodynamics and vascular reactivity (BP, carotid distensibility, AC and J-stiffness) were measured by ultrasonography at baseline, during and immediately after LBNP (20 mmHg). **Results:** Compared with controls, individuals with DS have lower VO_{2peak} (24.6 ± 5.9 vs. 41.1 ± 7.1 mL/kg/min, respectively) and higher BMI (22.6 ± 2.4 vs. 33.5 ± 8.1 kg/m^2) (p<0.05). LBMP did not alter arterial stiffness, AC or distensibility for either group. Overall carotid distensibility appeared to be higher in individuals with DS with a medium effect size (partial η^2 = 0.092). In addition, AC approached a significant group effect and yielded a large effect size (p < 0.06, partial η^2 = 0.175) for those with DS. **Conclusions:** Our results indicate that individuals with DS exhibit more compliant arteries than controls, which may be due to autonomic dysfunction with reduced sympathetic tone, as well as alterations in collagen and elastin, which are commonly observed in the skeletal muscles and ligaments in this population. However, the medium effect size suggests that a larger sample size is necessary.
PURPOSE: Obesity is strongly associated with vascular dysfunction, including a reduction in flow-mediated dilation (FMD), and evidence has shown that exercise training improves vascular dysfunction and FMD. The objective of this meta-analysis is to summarize the effect of exercise intervention on FMD in overweight and obese adults, as well as to investigate the role of age, weight, body mass index (BMI), exercise type, and intervention period on the effects observed.

METHODS: We searched four electronic databases (PubMed, Scopus, CINAHL, and Medline), through June 2016 for relevant studies pertaining to the effectiveness of exercise intervention on FMD. Search terms were “(obesity OR overweight) AND (Exercise OR training) AND (FMD mediated or flow mediated dilation OR FMD)”. Inclusion criteria were as follows: 1) included value of relative FMD, 2) included exercise intervention at least 7 days, 3) studied only obesity or overweight adult subjects, and 4) published in English language peer-reviewed articles. Comprehensive Meta-Analysis version 3 software was used to compute the mean effect size (ES) and 95% CI using a random effects model. Cochran’s Q statistic was also used to assess heterogeneity across individual studies. Subgroup analyses were conducted to identify moderator effects.

RESULTS: Of 91 citations identified by the search strategy, 17 and 4) published in English language peer-reviewed articles. Comprehensive Meta-Analysis version 3 software was used to compute the mean effect size (ES) and 95% CI using a random effects model. Cochran’s Q statistic was also used to assess heterogeneity across individual studies. Subgroup analyses were conducted to identify moderator effects.

CONCLUSIONS: Counter to previous published data, traditional and sophisticated DXA-based anthropometric measures as well as VO2max were not significantly associated with brachial artery flow-mediated dilation in this cohort of predominantly overweight and obese, sedentary men and women without evidence of cardiovascular disease.

PURPOSE: Exercise And Vascular Function In Overweight And Obese Adults: A Meta-analysis

Younsun Son1, Kyungun Kim2, Soecn Jeon2, Minsoo Kang1, FACSM2, Yoonjung Park1,1University of Texas at Houston, Houston, TX. 2Texas AM University-San Antonio, San Antonio, TX. 3Middle Tennessee State University, Murfreesboro, TN. Email: xppzim@naver.com

Increased sitting time has been associated with increased risk of cardiovascular disease and cardiovascular mortality. In young adults, sitting time was found to correlate with arterial stiffness and wave reflection, two subclinical markers of early atherosclerotic progression. PURPOSE: To determine if sitting time is associated with markers of subclinical atherosclerosis in older adults. METHODS: 99 adults between the ages of 60 and 85 yrs (mean: 68.6 yrs; 46.5% female) completed the International Physical Activity Questionnaire to assess physical activity behavior, including sitting time. Markers of subclinical atherosclerosis included common carotid intima-media thickness (IMT), carotid β stiffness, and Young’s elastic modulus (ε) as measures of carotid stiffness, carotid-femoral pulse wave velocity (cPWV) as a measure of arterial stiffness, and aortic augmentation index (AIX) as a measure of global wave reflections. IMT, β stiffness, and ε were assessed on the left common carotid artery using ultrasound, while cPWV and AIX were assessed on the right side via applanation tonometry. Pearson correlations were performed to determine the strength of the relationship between sitting time and subclinical atherosclerotic measures.

RESULTS: Older adults sat for an average of 6.3±2.8 hrs/d, and sitting time was not different between the sexes (6.0±2.5 vs. 6.6±3.6 hrs/d; p = 0.279, for women and men, respectively). Sitting time was not significantly correlated with IMT (r = −0.089, p = 0.193), β stiffness (r = −0.047, p = 0.324), and ε (r = −0.013, p = 0.449). cPWV (r = −0.038, p = 0.556), or AIX (r = −0.003, p = 0.488). When exploring associations by sex, there were no significant associations between sitting time and any measure of arterial stiffness or wave reflection (p > 0.073). CONCLUSIONS: Sitting time is not associated with measures of subclinical atherosclerosis in older adults. These data suggest sitting time may not further impact the structure of the aged artery. Future studies using objective measures of sedentary behavior are needed to further explore the relationship between sitting time and subclinical atherosclerotic risk. Supported by Dairy Research Institute/ Dairy Management Inc.

PURPOSE: Cardiorespiratory Fitness and Adiposity do not Predict Vascular Reactivity in Sedentary Men and Women

Siddhartha S. Angadi1, Catherine L. Jarrett1, Wesley J. Tucker2, Brandon J. Sawyer3, Zachary S. Zeigler4, Glenn A. Gaesser, FACSM1, 1Arizona State University, Phoenix, AZ. 2University of Texas at Arlington, Arlington, TX. 3Point Loma Nazarene University, San Diego, CA. 4Grand Canyon University, Phoenix, AZ. (Sponsor: Glenn A Gaesser, FACSM1)

Abstracts were prepared by the authors and printed as submitted.
between PM+BR and MW+BR (P=1.0). Diastolic BP was lower in PM+BR (63 ± 5 mmHg) compared to MW+BR (67 ± 5 mmHg, P=0.018) but not different between other experimental arms (P>0.43). There were no differences in systolic BP, mean arterial BP, or salivary cortisol between any arms of the experiment (all P>0.16).

CONCLUSIONS: As expected, MW reduced plasma [NO3] but not [NO2-], with and without ingestion of BR. Contrary to our hypothesis, however, MW did not alter BP or cortisol levels suggesting that it does not induce a stress response with short-term use. Further research employing a longer intervention and more extensive assessment of stress markers is required to perform these observations.

PURPOSE: Female pearl divers in Japan, called “Ama”, perform repeated breath-hold free-diving for collecting pearls in oysters, seaweed, and shellfish in the cold sea. In a typical day, they dive 50-200 times, 4-6 days/week throughout the year. We have previously reported significantly lower systemic arterial stiffness values in Ama compared to the age-matched sedentary peers living in the same fishing villages. As a follow-up study, the primary aim of the present study was to evaluate their aortic reservoir function and segmental arterial stiffness.

METHODS: We recruited 115 female pearl divers (mean age: 65±11 yr) as well as age-matched 50 physically inactive and 33 physically active female non-divers living in the same fishing villages in rural locations. Aortic reservoir and excess pressure were calculated from the synthesized aortic pressure waveforms derived from carotid arterial pressure waveforms obtained with arterial applanation tonometry. Pulse wave velocity from the heart to the brachial artery (hbPWV; partly reflecting proximal aortic stiffness) and between the brachial artery and the ankle (baPWV; reflecting stiffness of abdominal aorta and leg arteries) were measured.

RESULTS: There were no significant differences in age, body weight, and body mass index among the groups. Blood pressure and pulse pressure in the brachial artery and the aorta were not different among the groups. Aortic reservoir function, as measured by the normalized area under the curve of aortic reservoir pressure by area under the curve of the aorta were not different among the groups. Aortic reservoir function, as measured by the normalized area under the curve of aortic reservoir pressure by area under the curve of the aortic reservoir pressure, tended to be higher in physically active individuals (P=0.06) and significantly greater in Ama (P=0.05) compared with their sedentary peers. hbPWV was 8-9% lower in Ama and physically active adults than in sedentary adults (P<0.05 for both). hbPWV was 5% lower in physically active adults and 9% lower in Ama compared with their sedentary peers (P<0.05).

CONCLUSIONS: Our present findings suggest that life-long repetitions of breath-hold diving are associated with proximal aortic destiffening and improved aortic reservoir function.

Purpose: Heart failure (HF) is characterized by a complex blend of central and peripheral pathophysiologic alterations, among which is vascular dysfunction and increased arterial stiffness. Applanation tonometry (AT) non-invasively assesses central blood pressure (CBP) and arterial stiffness [augmentation index (AIx)]. The presence of lower arterial compliance (higher AIx) represents an abnormal state and is a prognostic marker in HF. The influence of HF etiology on AT measures has not been explored. Thus, the aim of this study was compare AT measurements in patients with ischemic and Chagas HF.

Methods: Three-two male subjects, 11 ischemic (IS) HF, 10 Chagas (CH) HF, and 11 healthy controls (HC) matched by age and body mass index were included in this analysis. The radial artery pulse wave was measured non-invasively by resting AT.

Results: The Chagasic group had a lower peripheral systolic (SBPp) and central blood pressure (CBP). While the ischemic HF group demonstrated a higher AIx (Table 1). The ischemic HF group presented with greater arterial stiffness, reflected by a significantly higher AIx. Otherwise, chagasic patients as healthy control individuals had non incremental arterial stiffness. These findings indicate assessment and treatment strategies for arterial stiffness may be more relevant in HF patients with an ischemic etiology. In conclusion, key AT differences were observed in patients with ischemic and Chagas HF, indicating these two HF etiologies present with unique pathophysiologic mechanisms.

Table 1: Applanation Tonometry Measurements.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Control (m ± sd)</th>
<th>Ischemic HF (m ± sd)</th>
<th>Chagas HF (m ± sd)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBPp</td>
<td>118 ± 12.44</td>
<td>113 ± 16.59*</td>
<td>97 ± 14.23</td>
<td>0.01</td>
</tr>
<tr>
<td>CSP</td>
<td>108 ± 13.97</td>
<td>108 ± 15.29</td>
<td>88 ± 10.10</td>
<td>0.0074</td>
</tr>
<tr>
<td>AIx</td>
<td>80.27 ± 15.23</td>
<td>93.36 ± 10.74*</td>
<td>80.60 ± 17.91*</td>
<td>0.049</td>
</tr>
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Legends: SBPp = Peripheral Systolic Blood Pressure; CSP = Central Systolic Blood Pressure; Aix = Augmentation index. * = significant difference between ischemic HF and control Groups; # = Significant difference between ischemic HF and Chagas HF groups; = = Significant differences between Chagias HF and Control Groups.

In aged adults, acute lower limb heating increases leg blood flow, vascular shear stress, and improves macro- and microvascular dilator function. However, the effect of chronic lower limb heating on indices of vascular function and functional capacity remains unclear.

Purpose: To test the hypothesis that chronic lower limb heating improves macro- and microvascular dilator function and functional capacity in aged humans.

Methods: Five healthy aged adults (4 females; age 66 ± 4 years; height 163 ± 4 cm; weight 68 ± 7 kg; mean ± SD) were exposed to 8 weeks of chronic lower limb heating. Subjects immersed their lower limbs –33 cm into a heated (~42°C) and circulated water bath 4 days per week, for 45 min per session. Prior to and after the chronic limb heating regimen, duplex ultrasonography was used to assess macro-
A positive chronic effect of different exercise modalities on vascular endothelial diameter and function has been reported; however, little is known about the arterial vascular response to acute bouts of exercise. **PURPOSE:** The purpose of the study was to investigate the acute response of two exercise modes (aerobic and resistance training) on the endothelium to vascular diameters. **METHODS:** A meta-analysis was planned where the inclusion criteria for studies were: 1) experimental trials; 2) only one exercise session (acute treatment); 3) aerobic or resistance training elicited an acute response on vascular function. More research is needed to better understand the physiological mechanisms responsible for this response.

### Conclusion

Recent studies demonstrate that single bouts of prolonged, uninterrupted sitting (3-6 hours) can negatively impact peripheral vascular health (i.e., decreased endothelial function and reduced blood flow-induced shear stress in legs). It is unknown whether or not prolonged, uninterrupted sitting can have a similar impact on central cardiovascular hemodynamics and vascular stiffness. **PURPOSE:** To test the hypothesis that prolonged sitting will increase central blood pressure, and pulse wave velocity, and microvascular dilator function and microvascular dilator function in healthy, college-aged individuals. **METHODS:** In 6 subjects (Age=23±1 yrs, BMI=30±kg/m2, 3 males and 3 females), brachial artery pulse wave analysis was performed before (baseline-BL), during (10, 60, 120, and 180 mins), and immediately after 3 hours of uninterrupted sitting. Aortic pulse wave velocity (PWV, an index of vascular stiffness) was also examined before and after sitting using carotid artery ultrasound transducer. **CONCLUSION:** Over the course of sitting, no significant change was noted for heart rate (P=0.05). Peripheral (brachial) systolic blood pressure (BP) and mean arterial pressure (MAP) were greater than central (aortic) systolic BP and MAP across all time points; however, both exhibited a biphasic response to sitting, characterized by an initial decrease of 60 mins, with a return to baseline at 180 mins (e.g., MAP at BL=90±4, vs. 60 mins=82±4, P=0.001; vs. 180 mins=87±3 mmHg, P=0.05). No change was noted for peripheral and central diastolic BP across all time points (P=0.05). Augmentation pressure (AP) and index (AIX), wave reflection height (PH) and magnitude (RM%) all exhibited a significant decrease over the course of 3 hours sitting, most notable at 180 mins (e.g., AIX at BL=7±6, vs. 180 mins sitting=8±3, P<0.05). No change was observed for aortic PWV in response to sitting (P=0.05). **CONCLUSION:** These preliminary findings indicate that a single bout of prolonged, uninterrupted sitting results in a significant alteration in central cardiovascular hemodynamics (i.e., decreased aortic pulse wave reflection), with no change occurring in arterial vascular stiffness.
after applications of MHP and WLP. METHODS: Nineteen healthy adults underwent one of three treatment sessions (45°C of MHP or WLP, or control: no treatment for 20-min). Vascular reactions were measured using a Doppler ultrasound (4 MHz) at the posterior tibial artery (10 cm above the medial malleolus). Temperature probes (60 Hz) were attached on the skin of lateral foot (1 cm below from the lateral malleolus) for skin and inner tissue—insulated by neoprene fabric. After baseline measurements, each treatment was randomly assigned to the area just brought from the right lateral malleolus. Each measurement was recorded at baseline and every 3 min thereafter until the end of the protocol (total time: 42-min). To test treatment effects over time, 3×16 mixed model ANOVAs and Tukey-Kramer post-hoc tests were performed (p<0.05). RESULTS: From the baseline values, WLP immediately increased volume (50%, p<0.0001) and velocity (40%, p<0.0001) of blood flow, and increased values were maintained during treatment (F1,14=3.6, p=0.001). After the removal of WLP, increased values were maintained for 13-min as compared to baseline (p=0.02). MHP did not produce any change in vascular reaction. Both MHP (2°C, p=0.0001) and WLP (6°C, p=0.0001) immediately increased skin temperature, and increased temperatures were maintained until the removal of both treatments (F1,14=47.6, p<0.0001). Both MHP (4°C, p=0.0001) and WLP (6°C, p=0.0001) took 3-min to increase temperature in the inner tissue (F1,14=52.9, p<0.0001). An increased temperature (2°C from baseline) was maintained for 10-min (MHP) and 12-min (WLP) after the removal of each treatment. CONCLUSIONS: When treating tissues, especially located in 2.5 cm deep (e.g. ankle sprain), WLP may produce a similar effect as deep thermotherapy since it increases vascular response and inner tissue temperature. Application of MHP should be reconsidered as it does not affect vascular reaction at all.

E-41 Free Communication/Poster - Women-Exercise Responses
Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2838 Board #358 June 2 11:00 AM - 12:30 PM
Effects of Aquarobic Exercise on Senior Fitness, Prostaglandin I2, And Thromboxane A2 in Elderly Korean Women
Do-Yeon Kim1, Ji-Hyeon Kim1, Jong-Won Kim2, Su-Jin Hyun1, Jung-Sook Kim1, Su-Han Koh1, Ji-Hoon Kim1, Min-Seong Ha1. 1Pusan National University, Busan, Korea, Republic of. 2Busan National University of Education, Busan, Korea, Republic of. (No relationships reported)

South Korea is fast approaching an aging society phase, as 9.5% the population was aged 65 and older in 2006, and is expected to be 14.3% in 2018 and 20.8% in 2026, entering the aging society and the ultra-aging society phases, respectively, based on the United Nation’s standard.

PURPOSE: The purpose of this study was to analyze the effects of aquarobic exercise on senior fitness, prostaglandin I2 (PGI2), and thromboxane A2 (TXA2) in elderly Korean women. METHODS: Thirty two healthy elderly, women aged 74.11 ± 4.12 years, were randomly assigned to aquarobic exercise group (EX; n = 11) trained for 8 weeks with an exercise program corresponding to the United Nation’s standard. The participants were aged 65 and older in 2006, and is expected to be 14.3% in 2018 and 20.8% in 2026, entering the aging society and the ultra-aging society phases, respectively, based on the United Nation’s standard.

RESULTS: Changes from baseline to the end of the intervention were determined by a paired t-test and independent t-test. RESULTS: The results of the present study were consistent with the findings of the previous studies, as the cardiorespiratory endurance (492.55±73.92 vs. 414.50±19.87 m), muscular strength (24.89±1.93 vs. 19.29±1.96 kg), muscular endurance (24.05±5.38 vs. 19.38±5.39 times/30sec), and flexibility (13.32±5.00 vs. 11.56±5.04 cm) increased significantly in the aquarobic exercise group (p<0.05). The results of the present study show no changes in prostaglandin I2 and thromboxane A2 levels in the present study.

CONCLUSIONS: The findings of this study discussed so far indicate that aquarobic exercise has a positive effect on senior health-related fitness, highlighting the importance of aquarobic exercise for elderly women.

2839 Board #359 June 2 11:00 AM - 12:30 PM
Total Workload And Energy Expenditure During And After A Bodypump Session In Overweight Women
Anne Mette Rustadøn1, Christina Gjestvang1, Kari Bo2, Lena Annette Hagen Haakstad1, Gøran Paulsen1. 1Norwegian School of Sports Sciences, Oslo, Norway. 2The Norwegian Olympic and Paralympic Committee and Confederation of Sport, Oslo, Norway. Email: anne.mette.rustad@nh2.no (No relationships reported)

PURPOSE: Resistance training is part of the physical activity recommendations for overweight and obese individuals, and the health- and fitness industry is a popular venue to perform resistance training. Group exercise sessions, like BodyPump, is a popular alternative with over 5 million participants weekly, as well as individual heavy load resistance training. BodyPump is a high-repetition low-to moderate load session, claimed to burn up to 540 calories each session. The purpose of this study was to estimate total exercise workload and energy expenditure during one-hour session with BodyPump, and to compare these outcomes with a time-matched session of traditional individual heavy load resistance training. METHODS: Eighteen previously untrained, overweight women participated in the study (mean age 36.4 years ±10.1, BMI 29.8 kg/m²±4.6), ten exercising BodyPump and eight heavy resistance training (8 repetition maximum [RM] x 3 set). Exercise workloads were estimated by multiplying load (kg) x repetitions x sets, and energy expenditure was assessed with indirect calorimetry, during the sessions. RMR was estimated before and twice after the sessions (0-20 min and 120-140 min). RESULTS: The participants exercising BodyPump lifted significantly more loads than the heavy resistance training group (1948 kg ±2258 vs 1561 kg ±2976, p=0.006), while the energy expenditure was similar with 302 kcal ±67 in BodyPump and 289 kcal ±69 in the heavy resistance training group (p=0.69). With no group differences, RMR 0-20 min post-exercise increased by 31% after BodyPump, and 27% after heavy resistance training. CONCLUSION: One session of BodyPump resulted in a higher total workload compared to traditional heavy load resistance training. In contrast, the energy expenditure during exercise and changes in RMR were similar between the groups. With a modest energy expenditure of approximately 300 calories, the women did not reach the claimed energy costs during a BodyPump session.

2840 Board #360 June 2 11:00 AM - 12:30 PM
Can The Lambert’s Submaximal Cycle Test Reflect Overreaching In Professional Female Cyclists? Lieselot Decroix1, Robert Patrick Lambert2, Romain Meuesen, FACSM1, 1Vrije Universiteit Brussel, Brussel, Belgium. 2University of Cape Town, Cape Town, Belgium. Email: lieselot.decroix@vub.ac.be (No relationships reported)

Purpose: The Lambert and Lambert Submaximal Cycle Test (LSCT) consists of 3 stages during which cyclists cycle for 6 minutes at 60%, 6 minutes at 80% and 3 minutes at 90% of their maximal heart rate, followed by one minute recovery. It was the aim of this study to determine if the LSCT is able to reflect a state of functional overreaching in professional female cyclists during an 8 day training camp and the following recovery days.

Methods: Six professional female cyclists performed an LSCT on day 1, day 5, and day 8 of the training camp and 3 days after the training camp. During each stage of the LSCT, power output and rating of perceived exertion (RPE) were determined. Training diaries and profile of mood status (POMS) were also completed and results were analysed by repeated measures ANOVA to verify differences between days 1, day 5, day 8 and day +3. To investigate differences in performance parameters (P60, P80, RPE, HRR), a contemporary approach of data analysis using magnitude-based inferences was employed, where chances for meaningful changes (larger than normal day-to-day variability) were assessed as “likely” (>75-95%), “very likely” (>95-99%) and “most likely” (>99-100%).

Results: Power output and RPE during the 2nd stage of the LSCT were “likely” higher on day 5 and “very likely” (power) and “most likely” (RPE) higher on day 8, compared to day 1. During the 3rd stage of the LSCT, power output and RPE were “likely” higher on day 5 and “very likely” (power) and “likely” (RPE) higher on day 8, compared to day 1. On day 8, increased power output and RPE during these stages were accompanied by the inability to reach 90% of their maximal heart rate. All athletes reported increased feelings of fatigue (F1,20=17.43; p<0.001) and muscle soreness (F1,20=6.5; p<0.02). No significant changes were found in any of the parameters of the POMS (anger, vigor, fatigue, depression), nor in the energy-balance (vigor-fatigue) during and after the training camp. After 3 days of recovery, all parameters of the LSCT returned to baseline, indicating a state of functional overreaching during the training camp.

Conclusion: The LSCT can be used to reflect a state of functional overreaching in elite professional female cyclists during an 8 day training camp and the following recovery days.
Several chronic illnesses are characterized by low-grade chronic inflammation, resulting in increased levels of circulating pro-inflammatory cytokines. Exercise has been shown to reduce the levels of circulating cytokines, as well as create an anti-inflammatory environment through the release of interleukin-6 from skeletal muscle. PURPOSE: The current study was designed to investigate whether or not family history of hypertension affected levels of interleukin-6 (IL-6) and systolic blood pressure (SBP) in young, physically active females, in response to an acute bout of resistance exercise. METHODS: A totally of 14 females (age = 23.14 ± 2.28 years) completed the study. Subjects were split into two groups of seven based on familiar pre-disposition of hypertension. Subjects completed a resistance protocol of three sets of 10 at 67% of 1 repetition maximal. Blood samples and SBP was taken pre-exercise, post-exercise, and 1-hr post exercise. RESULTS: No significant interaction (p > .05) was found for levels of IL-6 or SBP between both groups. No change in IL-6 was found from pre to post exercise (p = .942). A significant main effect (p < .05) was found for SBP across the time periods. Post-systolic blood pressure was higher immediately following exercise (p = .000, Mpre = 110.28, Mpost = 123.00) and decreased to baseline or lower after 60-minutes of recovery (p = .942, Mpre = 123.00, Mbaseline = 107.71). CONCLUSIONS: The results of this study indicate that family history of hypertension does not affect the levels of IL-6 or SBP in young, healthy females following resistance exercise. However, systolic blood pressure can decrease following a 60-minute recovery, after an acute bout of resistance exercise to levels at baseline or below.

The risk factors of stress urinary incontinence (SUI) are obesity, diabetes, metabolic syndrome, and pelvic floor dysfunction in postmenopausal women. Combined exercise with aerobic and resistance training included core exercise would be effective intervention for the SUI. PURPOSE: To investigate the effect of combined exercise program (CEP) on SUI in postmenopausal women. METHODS: This study was conducted with stratified random sampling, random assignment and a pre-post test design. Forty-two postmenopausal women with SUI (58.95 ± 4.16 years old) were divided into an exercise group (EG) and control group (CG) and categorized for metabolic syndrome (MSE, N=7; MCG, N=7), obesity (OEG, N=7; OCG, N=7), and normal (NEG, N=7; NCG, N=7) conditions, respectively. The CEP consisted of 12 weeks aerobic (40-75% of Heart Rate Reserve) and 11-13 based on Rate of Received Exertion, 50-70 minutes, 3 times/week) and resistance training to strengthen the core muscles for total body training. Control groups maintained their normal daily lifestyle. Vaginal contraction, HOMA-IR, estradiol (E2), and body composition were assessed. Repeated measures ANOVAs were used to determine differences between each condition. RESULTS: Duration of vaginal contraction (F=15.410, p=0.002) and HOMA-IR (F=15.410, p=0.002) were measured. Data were analyzed using independent t-tests and statistical significance was set at p < 0.05. RESULTS: There were no significant differences in cardiorespiratory function between groups at baseline. Total time duration on the treadmill (27.5±9.6 vs 57.4±7.0 min; p=0.01), Kt (8.4±2.8 vs 13.4±4.4; p=0.02), and ΔVO2 (0.65±0.17 vs 0.85±0.17 L/min, p=0.04) were decreased in the SLE group compared to controls. CONCLUSION: Previous studies have characterized relationships between overall patient-perceived fatigue severity, performance fatigueability and etiologically mediated cardiorespiratory dysfunction in women with SLE. The current study expands on this evidence suggesting that decreased cardiorespiratory endurance may be mediated through delayed metabolic transition during physical activity in these women. The inability to sustain the energy requirements requisite for a 5-MET work rate accentuates the severity of functional limitations ultimately impacting health-related quality of life in this population.