Aerobic exercise acutely increases the production of reactive oxygen species (ROS), which creates an imbalance between free radicals and the body’s antioxidant defenses, resulting in increased oxidative stress. Oxidative stress levels are reportedly higher in males compared to females, however there is limited knowledge regarding the role of gender in the antioxidant response following an acute bout of aerobic exercise.

**Purpose:** To determine whether changes in serum antioxidant levels after an acute aerobic exercise bout differed between genders.

**Methods:** The study comprised of 15 healthy adults (9 females, 6 males; age 27±8 years; BMI 24±3 kg/m²) enrolled in the NIH Fatigue in Healthy Individuals Protocol (NCT00888563). During the first visit, subjects completed a treadmill cardiopulmonary exercise test (CPET) to volitional exhaustion. On a separate visit, subjects performed a vigorous-intensity continuous work rate (WR) test, to volitional exhaustion on the treadmill. Serum samples were collected before and immediately after the vigorous exercise bout. A Human Oxidative Stress Multiplex panel was used to determine serum peroxidase (PRX2) and catalase levels. Student’s t-tests were performed between genders for WR and antioxidant levels.

**Results:** Males performed vigorous-intensity exercise at a higher WR than WR for females (p<0.0001). No difference was found in baseline PRX2 and catalase levels between males and females. Relative change in PRX2 (+32% in males; -17% in females) and catalase (+18% in males; -11% in females) was different between genders after a vigorous bout of aerobic exercise (p=0.013, p=0.0344, respectively). This difference became insignificant when WR was accounted for. Conclusion: This study suggests that higher levels of oxidative stress in males may be explained by higher work rates. However, response to exercise-induced oxidative stress demonstrated that males (6 of 6) increased anti-oxidant levels, while females (8 out of 9) showed decreased levels. Previous studies have suggested that gender differences in oxidative stress may be related to an increased production of ROS by NADPH-oxidase in males, or antioxidant properties of estrogen which may assist in minimizing oxidative stress in females.

**Funding:** National Institute of Nursing Research, Division of Intramural Research

**Abstract:**

**Title:** Aerobic Exercise In Healthy Adults Role Of Gender In Anti-oxidant Response To A Bout Of Acrobic Exercise

**Authors:** Anam Ahmad, Anne Morris, Lisa M.K. Chin, Rebekah Feng, Leo Saligan, Leighton Chan, Randall Keyser, FACSM.

**Institutions:** National Institutes of Health, Bethesda, MD. George Mason University, Fairfax, VA.

**Email:** anam.ahmad@nih.gov

**No relevant relationships reported**

**Board #1 May 30 1:30 PM - 3:30 PM**

### Board #2 May 30 1:30 PM - 3:30 PM

**Sex Differences in Anabolic Regulators during Development of Atrophic Pathology in Hindlimb-Unloading-Induced Disuse**


(Sponsor: Stavros A. Kavouras, FACSM)

Email: ljtansen@uarke.edu

**No relevant relationships reported**

**Board #3 May 30 1:30 PM - 3:30 PM**

**Similar Central and Peripheral Fatigue in Men and Women after Running**


(Sponsor: Malachy P. McHugh, FACSM)

Email: lb@nismat.org

**No relevant relationships reported**

**Board #4 May 30 1:30 PM - 3:30 PM**

**The Effects Of Swimming On Bone Density In Female Collegiate Swimmers**

Margaret Miller, Sarah Kojetin, Lesley M. Scibora. University of St. Thomas, St. Paul, MN.

(Sponsor: Stavros A. Kavouras, FACSM)

Email: lb@nismat.org

**No relevant relationships reported**

**Abstract:**

Swimming provides numerous health benefits, but as a non-weight bearing activity research suggests it provides no constructive benefits on bone strength at dual energy x-ray absorptiometry (DXA)-measured hip and lumbar spine sites. However, little research has focused on skeletal sites stressed during swimming such as the upper arm.

**Purpose:** To determine potential site-specific bone strength adaptations at the humerus among collegiate swimmers compared to sedentary controls.

**Methods:** Bone geometry and strength were assessed by peripheral quantitative computed tomography (pQCT) in ten collegiate female swimmers (BMI 23 kg/m²; mean 13.9±1.5 pool hours/week) and ten sedentary controls (BMI 24 kg/m²; <150 minutes/week of physical activity) ages 18-23 years. Total volumetric bone mineral density (vBMD, mg/mm²) and total bone area (ToA, mm²) were assessed at the distal (4%) tibia. Cortical bone area (CoA, mm²), cortical density (vBMD), cortical thickness each sex, α=0.05. Pre-planned contrast comparisons determined sex differences at each time point, α=0.01. **RESULTS:** Soleus and gastrocnemius masses presented lower in 24h in female (+11.8%, -9%; p<0.05) and 48h in male (-16%, +13%; p<0.05) compared to control. In predominantly type 1 soleus, Pgc-1α4 mRNA content showed a decline from control across time in females, while spiking >15, >6-fold in males at 72h and 168h (p<0.05). In contrast, IGF-1 showed higher content in females at 72h and 168h (+77%, +77%, p<0.05) than males. In gastrocnemius, a more mixed fiber type, Pgc-1α mRNA content was 3-fold higher in females at 24h (+13%, p<0.05). Female IGF-1 content was significantly elevated compared to male at 72h (p<0.05). Deprt content in gastrocnemius was >3-fold from baseline in 24h and -2-fold from baseline at 48h in males (p<0.05) depicting the only mRNA content change aligning with the observed time course for appearance of loss in muscle mass. **CONCLUSION:** Anabolic regulator responses to atrophic stimuli differ across sex, muscle tissue and time course of muscle atrophy. These early findings could suggest Deprt as a novel therapeutic target to ameliorate muscle wasting conditions. Supported by NIH Grant R15 AR069913/AR/NIAMS. Sponsoring Fellow: Stavros A. Kavouras, stavros.kavouras@asu.edu

**Abstract:**

Swimming provides numerous health benefits, but as a non-weight bearing activity research suggests it provides no constructive benefits on bone strength at dual energy x-ray absorptiometry (DXA)-measured hip and lumbar spine sites. However, little research has focused on skeletal sites stressed during swimming such as the upper arm.

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**Title:** Unloading-Induced Disuse Aerobic Exercise In Healthy Adults Role Of Gender In Anti-oxidant Response To A Bout Of Acrobic Exercise

**Authors:** Anam Ahmad, Zoe Morris, Lisa M.K. Chin, Rebekah Feng, Leo Saligan, Leighton Chan, Randall Keyser, FACSM.

**Institutions:** National Institutes of Health, Bethesda, MD. George Mason University, Fairfax, VA.

**Email:** anam.ahmad@nih.gov

**No relevant relationships reported**

**Board #1 May 30 1:30 PM - 3:30 PM**

**Role Of Gender In Anti-oxidant Response To A Bout Of Aerobic Exercise In Healthy Adults**

Anam Ahmad, Zoe Morris, Lisa M.K. Chin, Rebekah Feng, Leo Saligan, Leighton Chan, Randall Keyser, FACSM.

**National Institutes of Health, Bethesda, MD. George Mason University, Fairfax, VA.**

**Email:** anam.ahmad@nih.gov

**No relevant relationships reported**
(CoTh, mm), bone bending strength (polar strength-strain index (SSIp, mm3) were measured at the midshaft (66%) tibia, humerus (50%), and radius 33% sites. Using DXA areal BMD (g/cm2) was assessed at the hip, humerus and radius sites.

Results: There were no significant between-group differences in DXA outcomes at any site. PQCT-derived outcomes are presented in Table 1. At the 66% tibia site the control group had a 14.8% greater CoA and 6.1% greater CoD compared to swimmers (both p<0.05). However, no significant bone strength differences were found at the humerus, radius, or distal tibia sites.

Table 1: pQCT-derived Outcomes.

<table>
<thead>
<tr>
<th>Site</th>
<th>Swim</th>
<th>Control</th>
<th>Significance (p&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radius 33%</td>
<td>78.4±3.4</td>
<td>85.0±3.6</td>
<td>0.215</td>
</tr>
<tr>
<td>Cortical Area (CoA, mm2)</td>
<td>1191.3±8.6</td>
<td>1163.6±9.1</td>
<td>0.051</td>
</tr>
<tr>
<td>Cortical Thickness (CoTh, mm)</td>
<td>3.1±0.1</td>
<td>3.5±0.1</td>
<td>0.097</td>
</tr>
<tr>
<td>SSIp (mg/mm3)</td>
<td>215.4±13.2</td>
<td>227.0±14.0</td>
<td>0.574</td>
</tr>
<tr>
<td>Humerus 50%</td>
<td>178.0±6.8</td>
<td>172.5±7.2</td>
<td>0.596</td>
</tr>
<tr>
<td>Cortical Area (CoA, mm2)</td>
<td>1170.5±12.3</td>
<td>1173.0±13.0</td>
<td>0.890</td>
</tr>
<tr>
<td>Cortical Thickness (CoTh, mm)</td>
<td>4.1±0.1</td>
<td>4.0±0.2</td>
<td>0.856</td>
</tr>
<tr>
<td>SSIp (mg/mm3)</td>
<td>886.0±55.2</td>
<td>868.5±58.4</td>
<td>0.835</td>
</tr>
<tr>
<td>Tibia 66%</td>
<td>270.1±13.5</td>
<td>313.2±14.2</td>
<td>0.045</td>
</tr>
<tr>
<td>Cortical Area (CoA, mm2)</td>
<td>1074.4±8.0</td>
<td>1143.1±8.4</td>
<td>0.000</td>
</tr>
<tr>
<td>Cortical Thickness (CoTh, mm)</td>
<td>4.6±0.2</td>
<td>5.0±0.2</td>
<td>0.179</td>
</tr>
<tr>
<td>SSIp (mg/mm3)</td>
<td>2121.5±134.2</td>
<td>2178.6±134.3</td>
<td>0.764</td>
</tr>
<tr>
<td>Tibia 4%</td>
<td>139.4±25.4</td>
<td>141.6±26.9</td>
<td>0.953</td>
</tr>
<tr>
<td>Total Area (ToA, mm2)</td>
<td>507.0±35.5</td>
<td>538.1±38.5</td>
<td>0.571</td>
</tr>
</tbody>
</table>

Conclusion: Our results showed that swimming does not appear to improve bone microarchitecture or strength, even at loaded sites such as the humerus. This data suggests that swimming should be supplemented with weight-bearing and resistance exercises to preserve bone strength. Future research should investigate whether site-specific bone adaptations occur at skeletal sites not yet measured.

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Board #5 May 30 1:30 PM - 3:30 PM
Sex Differences in Recovery from Extreme and Severe Intensity Exercise
Andrew M. Alexander, Shane M. Hammer, Kaylin D. Didier, Lillie M. Huckaby, Camryn N. Webster, Thomas J. Barstow, FACSM. Kansas State University, Manhattan, KS.
Email: andrewa06@ksu.edu

Previous protocols investigating neuromuscular fatigue have typically discarded the first 2 of 6 electrical stimulation sets in recovery and have reported the average of the remaining force values. However, our lab has recently shown that central (as measured by maximal voluntary contraction force, MVC; and voluntary activation, VA) and peripheral fatigue (as measured by potentiated twitch force, Qmax) had significantly recovered within 90s following extreme intensity exercise and would otherwise be missed using contemporary protocols. PURPOSE: The purpose of this study was to test the hypothesis that MVC, VA, and Qmax immediately following task failure of extreme intensity exercise would be significantly lower than those measured 2 min into recovery in both men and women, while remaining suppressed following severe exercise.

METHODS: Two men (26 ± 5 yrs; 109 ± 9 kg; 179 ± 1 cm) and two women (23 ± 2 yrs; 55 ± 3 kg; 159 ± 1 cm) performed 2 intermittent isometric knee extension tests to exhaustion at 40% (severe intensity) and 70% (extreme intensity) MVC in random order. Neuromuscular measurements were made every 30 s beginning immediately after task failure for a total of 6 sets. The last two MVC, VA, and Qmax were averaged and compared to the first measurement immediately following task failure using paired t-tests.

RESULTS: Qmax and MVC significantly decreased following severe and extreme exercise (p<0.01). However, VA was not different across severe or extreme exercise. VA was not different across recovery following severe or extreme exercise. MVC was not different following severe, however, had increased following extreme exercise (p=0.02) exercise. Qmax was significantly recovered after severe (p<0.02) exercise. Further, qualitative analysis suggests women may be able to recover MVC and Qmax faster than men following extreme exercise, while these differences may not be evident following severe exercise.

CONCLUSIONS: These current data suggest central fatigue (as measured by VA) does not significantly impact exercise tolerance during severe or extreme exercise. Importantly, these data suggest that the measurements typically used to represent the condition of the muscle are taken too far post-exercise such that much of the recovery of the muscle has already occurred, especially following extreme exercise.

1591 Board #5 May 30 1:30 PM - 3:30 PM
Sex Differences in Recovery from Extreme and Severe Intensity Exercise
Andrew M. Alexander, Shane M. Hammer, Kaylin D. Didier, Lillie M. Huckaby, Camryn N. Webster, Thomas J. Barstow, FACSM. Kansas State University, Manhattan, KS.
Email: andrewa06@ksu.edu

(No relevant relationships reported)

ACSM May 28 – June 1, 2019
Orlando, Florida
data were collected and BMD (g/cm2) was measured at the hips and lumbar spine with a Hologic dual energy x-ray absorptiometry (DEXA) machine. RESULTS: Significant correlations (p < .05) were found between lumbar spine and hip BMD, and BMI (r = .33, p = .031), (r = .35, p = .022) respectively. Regression analysis confirmed that BMI was a statistically significant predictor of BMD for both the hips F(1,41) = 5.71, MSE = .02, p = .022, Adj. R² = .10 and lumbar spine F(1,41) = 5.02, MSE = .03, p = .031, Adj. R² = .09. CONCLUSIONS: Among this group of premenopausal women, BMI was positively correlated with, as well as being a significant predictor of BMD at the hips and lumbar spine. Medical and fitness professionals may find it useful to advise clients about the importance of having a healthy BMI value not only for the management and prevention of obesity but also for healthy bone mineral density and osteoporosis prevention. Future research might establish more clear guidelines for the use of BMI as it relates to osteoporosis risk among men and women. IRB#: 1213-0223

PURPOSE: To assess the association between dynapenic abdominal obesity (DAO) and the incidence of falls over 18 months in older community-dwelling women. METHODS: A total of 188 older women (67.97±6.02 years; 27.70kg/m2) underwent waist circumference measurement and had handgrip strength assessed at the dominant arm using a hydraulic dynamometer. Dynapenia was classified using the lower tertile of handgrip strength as cut-off value (20.7kgf), while obesity was considered as a WC > 88cm. DAO was the combination of both aforementioned criteria. Therefore, volunteers were divided into 4 groups: Eutrophic, Dynapenic, Obese, and DAO. Participants were tracked by phone calls for ascertainment of falls during a follow-up period of 18 months. Chi-square and modified Poisson regressions were conducted.

RESULTS: Proportions of each classification were 17.6%, 46.8%, 13.3%, and 22.3% for eutrophic, obese, dynapenic, and DAO, respectively. The incidence of falls over 18-month follow-up period was 24.5%. Thus, the proportion of fallers regarding each classification were 12.1%, 12%, 25%, and 46.5% for eutrophic, dynapenic, obese, and DAO, respectively (X²=10.662; p=0.014). Noteworthy, only DAO was consistently associated with a higher risk of falls (relative risk: 3.339; 95% CI: 1.242-8.979), even after adjustments for age, body mass index, physical activity level, regular use of four medications, reduced peripheral sensation, presence of two or more chronic diseases, and history of lower-limbs pain.

CONCLUSIONS: These results provide support for the concept that the combination of abdominal obesity and dynapenia has clinical implications and might be an useful supplement to other routine falls risk assessment tools. These relationships were stronger than obesity or dynapenia alone.
PHYSICAL ACTIVITY AND STRESS:
Numerous studies show that physical activity can help reduce stress levels and improve mental health. However, not all types of physical activity are equally effective in reducing stress. For example, high-intensity exercise like running or weightlifting may initially increase cortisol levels, a hormone associated with stress, before eventually reducing them. Moderate-intensity activities such as walking or yoga are generally more effective at reducing stress and cortisol levels.

CONCLUSION:
Sensor-measured PA was low in overweight and obese pregnant women in early pregnancy with significant differences by race, education, parity, and pre-pregnancy weight status. Programs targeting PA are needed for this population. Funded by NIH/NICHD.

Physical activity has been linked to many health benefits such as reduced cardiovascular disease risk. Furthermore, the health benefits of intensity and type of activity vary (e.g., vigorous aerobic activity reducing cardiovascular risk more than moderate). During parenthood, mothers can experience increased levels of stress, such as the stress hormone cortisol, and are also less likely to engage in physical activity compared to other populations. However, few studies have focused on mothers and on the impact of type and intensity of physical activity on their cortisol levels.

PURPOSE: The current pilot study examined whether different types and intensities of physical activity (walking, housework, fitness, recreational, occupational, and miscellaneous activity; moderate and vigorous activity) were associated with cortisol patterns among 30 low-income, ethnic-minority mothers (57% average annual income <$20,000; 53% Latina) and whether this association varied by the number of children the mothers had.

METHODS: The authors collected maternal saliva at four times on the same collection day (on waking time, breakfast, lunch, and before bedtime) to assess cortisol levels.

RESULTS: Multiple regression analyses found that cortisol was positively associated with walking, housework, fitness, recreational, occupational, and miscellaneous activity, and negatively associated with moderate and vigorous activity. Mothers who engaged in greater minutes of moderate or vigorous PA had higher cortisol levels, but only among mothers who engaged in greater minutes of moderate or vigorous miscellaneous PA.

CONCLUSIONS: Mothers who engaged in greater minutes of moderate or vigorous miscellaneous PA had higher cortisol levels, but only among mothers with more children (β = 1.65, t(21) = 2.40, p = 0.03). Additionally, mothers who engaged in greater minutes of vigorous recreational activity had higher cortisol levels, but only among mothers with more children (β = 0.93, t(21) = 3.12, p = 0.01).

Diet is strongly associated with many risk factors for chronic disease. Educational programs such as the Expanded Food and Nutrition Education Program (EFNEP) are designed to improve dietary behaviors among low-income populations. Although EFNEP has seen improvements, they do not yet meet recommendations. Self-

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S346 Vol. 49 No. 5 Supplement

vigorouse PA (MVPA), daily steps, and meeting MVPA guidelines (≥150 min/wk of MVPA in ≥10 min bouts). PA was presented as median (interquartile range). Subgroup differences in medians were examined with Kruskal-Wallis tests. Correlations of PA measures with perceived stress, depressive symptoms, PA social support, PA self-efficacy, and PA self-regulation were studied. A logistic regression model was used to examine correlates of meeting MVPA guidelines.

RESULTS: Participants (mean of 12.4 weeks gestation) had a median of 203 (254) min/d MVPA, 1.67 (2.10) steps/d, 3% meeting the national recommendations of daily aerobic activity (>30 minutes moderate). During parenthood, mothers can experience increased levels of stress, such as the stress hormone cortisol, and are also less likely to engage in physical activity compared to other populations. However, few studies have focused on mothers and on the impact of type and intensity of physical activity on their cortisol levels.

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regulation is the process of guiding thoughts, feelings, and behaviors to stay in line with perceived goals. Previous studies have been successful in eliciting behavior change when improving self-regulation in conjunction with dietary education.

PURPOSE: The purpose of this study was to examine self-regulation in EFNEP participants and its relationship to participants change in dietary behavior.

METHODS: All participants were currently enrolled in EFNEP and were asked to complete an additional self-regulation survey. This survey included five questions on a Likert scale from 1-5 with 5 indicating high self-regulation. These were averaged to assess overall self-regulation capacity pre- and post-program. Fruit and vegetable intake were measured using EFNEPs current diet-recall survey.

RESULTS: On average, the participants had low levels of self-regulation both pre- and post-intervention (2.74 ± 0.71 and 2.59 ± 0.78, respectively). Regarding vegetable intake, there was no statistically significant change from pre- to post-program (1.51 ± 1.36 and 1.42 ± 1.32 cups, respectively). However, there was a statistically significant difference in fruit intake, increasing from 0.86 ± 0.94 to 1.39 ± 1.39 cups per day. Neither fruit nor vegetables increased to MyPlate recommendations.

CONCLUSIONS: Participants self-regulation capacity was on average low, and did not increase from pre- to post-program. Results also indicate that fruit and vegetable intake did not meet MyPlate recommendations. From these results, we can conclude that self-regulation training may be a necessary supplement to the program to see improvements in the participants dietary behavior.

Postpartum depressive symptoms (PDS) are common among U.S. women and may be related to postpartum body image satisfaction (BIS). The effect of postpartum moderate to vigorous intensity physical activity (MVPA) on this relationship is less studied.

PURPOSE: To examine the relationship between postpartum BIS and PDS, and to examine whether MVPA moderates this relationship.

METHODS: Non-pregnant pregnant women who were ≤12 months postpartum and ≥18 years of age completed an online survey. Participants (n=256) self-reported 1 demographics, 2 pre-pregnancy height and weight, 3 current BIS via Body Attitudes Questionnaire (BAQ); 4 subscales: attractiveness, feeling fat, disparagement and strength, fitness, salience of weight shape, and lower body salience, and lower body fat, 4) PDS via the 10-item Center for Epidemiologic Depression Scale (CES-D), and 5) postpartum MVPA. Relations between BAQ subscales and PDS were examined using linear regression, controlling for months postpartum. MVPA and the BAQ x MVPA interaction were added to the model to examine the moderating effects of MVPA on the relationship between postpartum BIS and PDS. An alpha level of 0.05 was used to determine statistical significance.

RESULTS: On average, participants were 30.3±3.9 years of age and 5.6±3.8 months postpartum. A majority of the sample were Caucasian (96.1%), married (89.9%), and college graduates (75.2%). Four BAQ subscales were positively related to PDS (disparagement: p<0.0001, feeling fat: p<0.0001, salience: p<0.0001 and lower body fatness: p<0.0003). MVPA did not moderate the relationship between BIS and PDS (BAQ subscale x MVPA interactions: attractiveness: p=0.7998, disparagement: p=0.8842, feeling fat: p=0.4515, salience: p=0.1311, lower body fatness: p=0.9376, and strength and fitness: p=0.7429).

CONCLUSION: Postpartum BIS may be a significant factor that predicts PDS; however, our findings indicate that MVPA may not moderate this relationship. Future intervention research should include strategies that promote positive body image during the postpartum period. Although not a moderator, efforts aimed at promoting PA should continue, as it has numerous other benefits to pregnant and postpartum women.

Postpartum mental health issues are common, yet predictors are less understood. Pre-pregnancy weight and weight change during pregnancy through the postpartum period may be associated with postpartum mental health issues.

PURPOSE: To investigate the associations between postpartum depressive symptoms and 1) pre-pregnancy body mass index (BMI), 2) weight gain during pregnancy, 3) weight loss at 6 months postpartum, and 4) postpartum weight retention (PPWR).

METHODS: Women (n=323) who gave birth within the past 12 months completed an online survey assessing demographics, self-reported pre-pregnancy weight and height (to calculate pre-pregnancy BMI), weight gain during pregnancy, weight loss at 6 months
Pregnancy-related anxiety (PRA) is experienced by many women, given the physical and psychosocial challenges common during pregnancy and the prospect of childbirth. Some health behaviors, such as physical activity and quality of sleep (QS), are related to decreased PRA, but their joint influence is unclear. **PURPOSE:** We examined the individual and joint influences of physical activity behaviors and QS on PRA among pregnant women at two locations. **METHODS:** Third-trimester pregnant women (N=33) participated in a series of measurements between 28-36 weeks gestational age. Participants answered questions recalling their moderate and vigorous physical activity (min/wk) for prepregnancy, in the first and second trimesters, and concurrently. Moderate to vigorous physical activity (MVPA) was calculated for prepregnancy and for each trimester. Participants also wore a validated physical activity monitor (Modus StepWatch) for one week, and average steps/day were calculated. QS was measured using the Pittsburg Sleep Quality Index (PSQI), calculating a global score. The Pregnancy Related Anxiety Questionnaire (PRAQ-R) was used to assess women’s anxiety regarding childbirth and the health of the baby. Median split was used to categorize PRA as “high” [≥15.0 PRA scale] or “low” [<15.0]. Participants were also asked to set self-selected goals focused on either PA, healthy dietary habits (Diet), or stress management (Stress).**RESULTS:** Women with a higher pre-pregnancy BMI had increased odds of high PRA [β=1.34, 95% CI: 0.99-1.80]. Average steps/day and self-selected goals were related to third-trimester global QS scores [p=0.048]. Likewise, global QS scores were related to increased odds of high PRA [β=1.34, 95% CI: 0.99-1.80]. Average steps/day and self-selected goals were related to third-trimester global QS scores [p=0.048].**CONCLUSIONS:** Lower QS is related to higher PRA during the third trimester of pregnancy. Physical activity was not related to PRA and interactive effects with QS on PRA were not found. Larger samples are needed to confirm these findings.

**D-10**

**Thematic Poster - Physical Activity Interventions in the Modern Age**

**Thursday, May 30, 2019, 1:30 PM - 3:30 PM**

**Room: CC-102A**

**1603 Chair:** Jeremy Loenneke, FACSM. The University of Mississippi, University, MS.  
(No relevant relationships reported)

**1604 Board #1**  
**May 30 1:30 PM - 3:30 PM**  
**Effects of Four Types of Physical Activity Courses on College Students’ Perceived Stress, Well-Being, and Social Support**  
Zhonghui He1, Sen Lin Chen1, Weiyun Chen1, Linchen Kong1, PeiQing University, Beijing, China. 1Louisiana State University, Baton Rouge, LA. 2University of Michigan, Ann Arbor, MI. 1University of Virginia, Charlottesville, VA.  
Email: zhethh@pku.edu.cn  
(No relevant relationships reported)
decline in dietary habit (p=0.01), and 20.4% decline in stress levels (p=0.01). There were no significant group by time interactions, indicating that students had similar outcomes regardless of what behavior they were targeting.

CONCLUSIONS: HC seems to be an effective strategy for promoting healthy lifestyles in college students. Students had similar gains in PA and similar declines in stress, regardless of the behavior they reported focusing on. It is not clear why confidence in sticking with dietary changes decreased over time, but this may be due to participants possibly becoming more sensitized to their dietary habits through the HC sessions. Additional research is needed to understand student reactions to peer-led HC in college settings.

1606 Board #3 May 30 1:30 PM - 3:30 PM
Per-protocol Analysis Of BAILAMOS™ Dance Program On self-reported and Device-assessed Physical Activity in Older Latinos
Guilherme M. Balbin1, Susan Aiguilhaga2, Priscilla Vazquez2, Isabela G. Marques2, Jaqueline Guzman1, Deborah Salvo1, David X. Marquez3, FACSM1. 1University of Illinois at Chicago, Chicago, IL. 2University of Illinois at Urbana-Champaign, Champaign, IL. 3University of California San Diego, San Diego, CA. 4University of Victoria, Victoria, BC, Canada. 5Washington University in St. Louis, St. Louis, MO. (Sponsor: David X. Marquez, FACSM)

Email: gbalbin2@uc.edu

No relevant relationships reported

PURPOSE: Test the impact of the BAILAMOS™ dance program on PA levels in older Latinos.

METHODS: Older Latino adults (n=333; M=64.89±7.08) were randomized into a dance (n=167) or health education (HE) (n=166) group. For purposes of per-protocol analysis, participants with attendance ≥75% in dance and HE classes, respectively, were included. The final analytic sample was 145 participants (dance = 63, HE = 82). The dance group participated in four months of Latin dancing, two times per week for one hour per session. The HE group participated in classes once per week for two hours per session for four months. Participants completed the CHAMPS PA Questionnaire and wore an Actigraph™ GT3X+ accelerometer for seven consecutive days on their non-dominant wrist. Data was used if the participant wore for it at least 10 hours/day over three weeks. Wrist cut-points utilized were provided by Kamada (2016) (moderate-to-vigorous PA (MVPA) ≥5700 counts per minute). We performed a fixed-intercept mixed model (p & t0.05), adjusting for baseline covariates of age, sex, education, income, and health status. Cohen’s d effect sizes were computed.

RESULTS: Self-reported MVPA (minutes) increased significantly (t1, 120)=3.2, p=0.002 from baseline (Dance: M=140.81±111.35; HE: M=115.48±182.65) to month 4 (Dance: M=2911±20.45; HE: M=23.21±18.27), but no group*time interaction was demonstrated (t1, 121)=1.33, p=0.19, d=0.22. Total leisure-time PA (LTPA) (minutes) increased significantly from baseline (Dance: M=280.50±285.35; HE: M=360.71±361.05) to month 4 (Dance: M=579.72±346.10; HE: M=500.34±483.04). With significant group*time interaction (t1, 121)=2.16, p=0.03, d=0.33. Accelerometer-assessed MVPA did not increase significantly from baseline (Dance: M=24.43±22.67, HE: M=22.51±17.91) to month 4 (Dance: M=29.11±20.45; HE: M=23.21±18.27) and there was no group*time interaction (t1, 121)=1.53, p=0.13, d=0.43.

CONCLUSIONS: The BAILAMOS™ dance program showed a positive impact on self-reported LTPA. This impact was not observed in device-assessed PA, however, there was a moderate effect. Supported by NIH Grant 1R01NR013151-01.

1607 Board #4 May 30 1:30 PM - 3:30 PM
Reducing the Uncertain Geographic Context Problem in Physical Activity Research: The Houston TRAIN Study
Deborah Salvo1, Casey P. Durand1, Erin E. Dooley1, Ashleigh M. Johnson1, Abiodun Olyomii1, Kelley P. Gabriel1, FACSM1, Alexandra E. van den Berg1, Adriana Perez1, Harold W. Kohl III1, FACSM1, 2Washington University in St. Louis, St. Louis, MO. 3The University of Texas Health Science Center at Houston, Houston, TX. 4The University of Texas Health Science Center at Houston, Austin, TX. 5Baylor College of Medicine, Houston, TX. Email: dsalvo@wustl.edu

No relevant relationships reported

PURPOSE: The Uncertain Geographic Context Problem (UGCP) arises when studying the effect of static area-level factors (e.g. parks within walking distance from home) on individual-level outcomes, like physical activity. The UGCP is largely due to temporal uncertainty, as people may spend significant portions of the day outside of the geographic area captured by static spatial measures. The aim of this study was to determine if spatial exposure indicators for physical activity research are improved by including measures of both the home and work neighborhood environments.

METHODS: Baseline data from the Houston TRAIN Study were used (n=153). Participant home and work addresses were geocoded, and two spatial exposure indicators were built per location: transit stops within 1.25 Km, and parks within 2.25 Km (counts). A categorical variable was built for each feature, with four levels based on median spatial characteristics: no park, low access at work, high access at work & low access at home, low access at home & high access at work, and low access at both locations. Weekly minutes of moderate to vigorous physical activity (MVPA) were measured with wGT3X-BT Actigraph monitors using Freedson cut-points. Linear regressions estimated the association between the combined ‘home plus work’ access variables and MVPA. Models were adjusted for sex, age, education, and race/ethnicity.

RESULTS: Relative to the ‘low-low’ group, having high access to transit in both the home and work neighborhood was associated with 3.7±1.2 additional weekly minutes of MVPA (p=0.039). Similarly, those having high access to parks both in their home and work neighborhood had 2.5±1.9 (p=0.044) more weekly minutes of MVPA than those with low access in both locations. Having high transit or park access only in one of the two studied neighborhood locations was not significantly associated with MVPA (p=0.05).

CONCLUSIONS: When examining the effect of both transport and leisure related urban infrastructure on MVPA, the UGCP is improved by incorporating measures of both the home and work environment. Pending confirmatory studies, our results suggest that approaches exclusively focused on improving the built environment of residential neighborhoods may have limited impact on physical activity. A citywide, systems level approach may be warranted. Supported by NIH R01DK110593.

1608 Board #5 May 30 1:30 PM - 3:30 PM
Developing a National Network of Physical Activity Promotion: The Case of Germany
Stefan Peters1, Hagen Wäsche1, Alexander Wolf1, Gerhard Huber1. 1DVGS e.V., Hürth-Efferen, Germany. 2Karlsruher Institute of Technology, Karlsruhe, Germany. 3Heidelberg University, Heidelberg, Germany. Email: stefan.peters@dvgs.de

Reported Relationships: S. Peters: Salary; Stefan Peters works for the DVGS, which is one of the actors in physical activity promotion that have been a central part of the presented research.

PURPOSE: Physical activity supports the health of human beings of every age group in various ways. However, the worldwide prevalence of physical inactivity is high and many people do not reach the amount of physical activity that is recommended by physical activity guidelines. National Action Plans (NAPS) and Initiatives try to counteract this situation but have not always been successful. To support targeted measures in such NAPS, it is necessary to gain knowledge of relevant actors, professionals groups and multipliers as well as their structural connection. In Germany, an exploratory address addressed 2 goals accordingly: (1) the identification of relevant actors, professional groups and multipliers of physical activity promotion, and (2) the analysis of structural relations among these actors as well as the formulation of recommendations for the sustainable development of a national network of physical activity promotion.

METHODS: Qualitative expert interviews, a subsequent network visualization and an analysis for network development were carried out.

RESULTS: It became apparent that the field of actors in the area of physical activity promotion is very heterogeneous and extensive with regard to different forms of actors, sectors of society and administrative levels. Overall, 128 actors were identified, of which 22 actors are considered to hold key positions. Concerning the multipliers, 19 current and 17 potential ones were identified. Structural relations among actors are sparse.

CONCLUSIONS: For carrying out a network development of physical activity promotion, various prerequisites, benefits, and barriers were revealed. Subsequently, recommendations that contribute to the development and effective governance are presented. The study provides a first detailed consideration of the structure of physical activity promotion in Germany and thereby offers a perspective, which can also inform NAPS around the globe.

1609 Board #6 May 30 1:30 PM - 3:30 PM
Exercise Interventions Improve Drug Abstinence at an In-Patient Rehabilitation Center
Emily L. Roessel1, J. Mark VanNess1, Mercedes K. Steidley1, Ryan C. Bain2, Courtney D. Jensen1. 1University of the Pacific, Stockton, CA. 2Tree House Rehabilitation, Orange County, CA.

No relevant relationships reported

Exercise training likely enhances coping skills and sobriety among patients with substance use disorder. Better examination of the mechanisms producing these changes may help identify more effective interventions. PURPOSE: To test the effect
of a vigorous exercise prescription on drug abstinence in voluntary rehabilitation patients. METHODS: 25 male subjects in a drug treatment program underwent a 12-week intervention, which included cardiovascular exercise, resistance training, and supportive psychotherapy. Five days a week, subjects were asked to participate in either yoga with mindfulness practices or action-based induction therapy lasting two hours; there was also a 90-minute exercise boot camp. Data collected were exercise adherence, exercise performance, sobriety and relapse rates, and an assessment of emotional coping skills. Chi-squared tests and t-tests compared exercisers to non-exercisers; logistic and linear regressions tested the effect of exercise behavior on measurements of coping and sobriety. RESULTS: Subjects had experienced frequent relapse (5.5±8 episodes) prior to the current admission. Across the sample, 84% were sober on completion of the program, 88% relapsed during treatment, and 36% relapsed after treatment. During the program, 84% exercised regularly, 68% practiced yoga, and 60% followed a disciplined diet. Bench press max improved over the program (39%; p<0.001), as did squat max (55%; p<0.001) and deadlift max (70%; p<0.001).

Among patients who exercised regularly, 91% were sober on completion compared to 50% of patients who did not engage in regular exercise (p=0.045). Owing to a small number of patients (N=5), in the sample of exercisers who relapsed during treatment (5%) and non-exercisers who relapsed (25%) was not significant (p=0.171). Following treatment, 29% of exercisers and 75% of non-exercisers relapsed (p=0.076). The odds of successfully managing addictive emotional states when they arose increased 20-fold in subjects who exercised regularly (p=0.036). Each additional session of yoga per week predicted a 20-day increase in the longest duration of sobriety (p=0.016). CONCLUSION: Exercise appears to exert a positive effect on drug and alcohol sobriety and coping skills in a population that struggles with frequent relapse.

1610 Board #7 May 30 1:30 PM - 3:30 PM Effectiveness Of Aerobic Exercise Programs For Health Promotion In Metabolic Syndrome
Felix Morales Palomo, Miguel Ramirez-Jimenez, Juan Fernando Ortega, Ricardo Mora-Rodriguez. UCLM, Toledo, Spain.

The effects of different modalities of aerobic training on cardiometabolic fitness (CRF) and metabolic syndrome (MetS Z-Score) have been previously studied in patients with different cardiometabolic diseases. Continuous (Jonshon et al., 2007) and interval (Mora-Rodriguez et al., 2014) training have been shown to be effective to improve MetS Z-Score. On the other hand, a recent metanalysis suggest that high-intensity interval training (HIIT) may be superior to traditional modality (MICT) to improve CRF (Milanovic et al., 2015) even when exercisers who relapsed during treatment (5%) and non-exercisers who relapsed (25%) was not significant (p=0.171). Following treatment, 29% of exercisers and 75% of non-exercisers relapsed (p=0.076). The odds of successfully managing addictive emotional states when they arose increased 20-fold in subjects who exercised regularly (p=0.036). Each additional session of yoga per week predicted a 20-day increase in the longest duration of sobriety (p=0.016). CONCLUSION: Exercise appears to exert a positive effect on drug and alcohol sobriety and coping skills in a population that struggles with frequent relapse.

D-11 Thematic Poster - Running Injuries
Thursday, May 30, 2019, 1:30 PM - 3:30 PM Room: CC-101B

1612 Chair: Allison H. Gruber. Indiana University Bloomington, Bloomington, IN.

1613 Board #1 May 30 1:30 PM - 3:30 PM Increased Ground Reaction Force Load Rates In Runners With Active Patellofemoral Pain
Caleb D. Johnson, Jereme Outeley, Julia M. Reilly, Adam S. Tenforde, Irene S. Davis, FACSM. Harvard University, Cambridge, MA. (Sponsor: Dr. Irene Davis, FACSM)
Email: cdj9825@gmail.com

Increased vertical ground reaction force load rates have been associated with running injuries, and specifically with tibial stress fractures and plantar fasciitis. Inconsistent findings have been reported regarding the role of load rates in runners with patellofemoral pain (PFP), one of the most common injuries in runners. Limited studies in this patient population have been performed and prior investigators did not examine components of load rates beyond the vertical component. PURPOSE: To compare vertical, resultant, posterior, medial and lateral load rates, and peak vertical forces in runners with active patellofemoral pain (PFP) and healthy runners. METHODS: Twelve participants, five females, and seven males, were included in the study. Twelve runners with active PFP (16F, 14M, 40.2±12.8 yrs, 67.5±10.0 kg) and 30 healthy controls (CON) (18F, 12M, 34.8±10.9 yrs, 70.4±14.0 kg), all habitual rearfoot strikers, completed an instrumented treadmill assessment at a self-selected speed. Controls were matched for speed (PFP=2.50 m/s, CON=2.51 m/s). Load rates (vertical average and instantaneous...
Illitibial band syndrome (ITBS) is the second most common running injury, accounts for 1.6%-12% of all running-related injuries. The exact etiology of ITBS is unclear, but gait and posture are considered one of the factors. Most of studies on ITBS were retrospective cross-sectional in design and could not elaborate on the pathogenesis of ITBS.

PURPOSE: This prospective study aimed to determine the gait characteristics that may easily induce ITBS and explore the posture changes after the occurrence of ITBS.

RESULTS: In trial2, the ITBS group exhibited greater peak anterior pelvic tilt and peak trunk inclination angle, whereas the control group demonstrated lower peak hip flexion angle than the control group(Fig1a). The ITBS group showed increased reliance on visual information.

CONCLUSION: Decreasing the peak hip flexion and peak hip adduction angle may be a reasonable strategy to avoid the occurrence of ITBS. Occurrence of ITBS may be due to the lack of timely gait adjustment. The posture of excessive trunk inclination and anterior pelvic tilt may be a risk factor in the development of ITBS during running. This work was supported by the Project of Shandong Science & Technology Department (2017G006044).

Running related injuries to the foot and lower leg are pervasive and thought to be due to poor plantar intrinsic muscle (foot core) function. Previously injured runners have decreased cross sectional area (CSA) and thickness of the flexor hallucis brevis (FHB) and increased reliance on visual information while balancing relative to uninjured runners. However, it remains unknown if FHB morphology is associated with an increased reliance on visual information.

PURPOSE: To determine if visual reliance while balancing is associated with FHB morphology in those with a history of running related injuries.

METHODS: Twenty-four runners with foot and/or leg running injuries within the past three years but were currently asymptomatic volunteered. Three, 10-second eyes open and eyes closed single limb stance trials were collected. Center of pressure (cm²) for each condition was used to calculate %modulation (%modulation=(%eyes open-%eyes closed)/%eyes closed) and trended towards being associated with less relaxed FHB thickness (r=0.059, p=0.019). CONCLUSIONS: In previously injured runners decreased reliance on visual information is associated with an increased reliance on visual information while balancing. Short foot exercises, aimed at increased FHB strength may decrease reliance on visual information but future research is needed to confirm this hypothesis.
CONCLUSIONS:

Results:

between the injured and non-injured leg. An independent Mann-Whitney U-test was used to test for differences within patients in 4 runners diagnosed with mild unilateral AT (4M; 48.8 ± 7.5 yrs, 188.8 cm). Kinematic and kinetic data were collected during the final 30s of each condition using 17 cameras (Vicon) and an instrumented split-belt treadmill (Bertec). Joint moment contribution percentages at the hip, knee, and ankle were determined by dividing the peak, sagittal, external joint moments (N.m/kg) by the sum of all three joint moments during stance. A 2x3 (limb x condition) ANOVA was used to evaluate interlimb differences across conditions with post-hoc Bonferroni adjustments.

RESULTS: There was no significant limb x condition interaction or main effect of limb, but there was a significant main effect of condition. Knee joint moment contributions were 35% greater in decline running when compared to incline running (50-15%), and 31% greater when compared to flat running (50-19%). Ankle contributions were 39% less in decline running when compared to incline running (24-63%) and 26% less in decline running when compared to flat running (24-50%).

CONCLUSIONS: Knee and ankle joint moment contributions are altered with flat, incline, and decline running in persons with ACLR. Individuals with ACLR did not display asymmetries in joint moment contributions between the involved and uninjured limb.

Mid-portion Achilles tendinopathy (AT) is a common injury in runners. Overloading the tendon results in pain, swelling and impaired running performance. Recovery involves rest and a gradual build up. Determining whether patients can resume training is difficult and currently rather qualitative. To provide quantitative data to the physician to assist clinical decision-making, we studied the between leg differences in running kinematics for AT patients using inertial sensors in the clinical setting.

PURPOSE: To investigate lower limb kinematics in AT patients during 5 minute treadmill running in the clinic, using inertial magnetic measurement units (IMUs).

METHODS: 4 runners diagnosed with mild unilateral AT (4M; 48.8 ± 7.5 yrs, 188.8 ± 11.2 cm, 82.5 ± 11.1 kg) performed a 5 min. treadmill run in the sports medicine clinic, as part of a larger study, with 8 IMU’s at the feet, tibia, upper legs, sacrum and sternum. Ankle and knee angles were determined at initial contact (IC) and mid stance (MS). Additional parameters that were calculated were the vertical lower leg angle at IC (VLL), peak tibial impact (PTI), peak sacral impact (PSI), push-off power (POP) (lin. velocity at toe off, TO) and internal rotation (IR) of the tibia (at TO).

CONCLUSIONS: Knee and ankle joint moment contributions are altered with flat, incline, and decline running in persons with ACLR. Individuals with ACLR did not display asymmetries in joint moment contributions between the involved and uninjured limb.

Medial tibial stress syndrome (MTSS) is a common overuse running injury. While numerous studies have reported abnormal ankle kinematics in runners with MTSS, to date, no studies have evaluated ankle kinetics in this population. PURPOSE: To compare ankle kinematics in runners with and without MTSS. METHODS: Participants included eight runners with MTSS (age: 35 ± 11.3 years) and eight matched controls (CON; sex: 7M/1F; age: 35 ± 8.7 years). Kinematics and ground reaction forces were recorded while participants ran overground. Sagittal plane kinetics were calculated about an axis connecting the malleoli while frontal plane kinetics were calculated about an axis approximating the 23° medially deviated and 42° inclined orientation of the subtalar joint. Joint work was calculated by integrating the joint power curves. Paired t-tests were used to compare peak moments, powers, and work between MTSS and CON groups.

RESULTS: Neither peak plantar flexor (MTSS: 2.14 ± 0.53, CON: 2.24 ± 0.57 Nm/kg) nor peak inverter (MTSS: 1.04 ± 0.34, CON: 1.16 ± 0.32 Nm/kg) moments were different between groups (p = .720, p = .472, respectively). There were no differences in sagittal plane powers or work between groups. In the frontal plane, the MTSS group demonstrated lower peak positive power (MTSS: 1.97 ± 0.38, CON: 3.05 ± 1.2 W/kg, p = .021), and performed less negative (MTSS: -0.09 ± 0.02, CON: -0.16 ± 0.07 W/kg, p = .032), positive (MTSS: 1.14 ± 0.03, CON: 0.22 ± 0.07 W/kg, p = .039), and total (MTSS: 0.23 ± 0.06, CON: 0.37 ± 0.15 W/kg, p = .032) work. CONCLUSIONS: Compared to healthy individuals, runners with MTSS are not able to generate as much energy to invert their foot during late stance. This may explain why previous studies have observed runners with MTSS have prolonged rearfoot evasion during stance.

The Y-balance test is commonly used to screen for injury risk in athletic settings. However, much of the research evaluating the predictive ability of this test focuses on multidirectional sports such as football or basketball. To date there is little evidence regarding the utility of the Y balance test for unidirectional sports such as running. PURPOSE: Determine whether performance on the Y-balance test predicts running variables previously linked to running injury. METHODS: 23 Division-I collegiate distance runners (9M/14F; age: 19.6 ± 1.0 years; weekly mileage: 59.4 ± 14.6 miles) participated in this study. Whole body kinematics during the Y-balance and while running were recorded using 10 and 6 camera motion capture systems, respectively. Ground reaction forces for running were measured using an instrumented treadmill. Maximum reach in the anterior (A), posterior lateral (PL), and posterior medial (PM) directions were used to calculate Y-balance composite scores (CS). Eleven specific kinematic and kinetic running gait variables which have previously linked to running injuries were calculated (Table 1). Linear regressions were used to determine whether Y-balance CS predicted each running gait variable. RESULTS: Mean Y balance CS was 0.87 ± 0.09 with maximum reach distances of 0.84 ± 0.06, 0.93 ± 0.11 and 0.84 ± 0.06 % of leg length in the A, PL, and PM directions, respectively. Of all 11 variables, Y balance CS only significantly predicted peak positive knee work (Table 1). CONCLUSION: Performance on the Y-balance test may not be useful for
predicting injury risk in runners as the test does not predict variables previously linked to running injuries. However, further prospective studies tracking occurrence of actual injuries as well as internal loading at common running injury sites are required to fully clarify whether the Y balance test is suitable for screening runners.

Table 1. Linear regression modeling Y balance ZC to get variables previously linked to running injuries, R2 = 0.047

<table>
<thead>
<tr>
<th>Variable</th>
<th>p-value</th>
<th>R²</th>
<th>Lower 95%</th>
<th>Upper 95%</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip adduction (°)</td>
<td>0.08</td>
<td>0.004</td>
<td>-14.81</td>
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<td>Hip Internal Rotation (°)</td>
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<td>0.035</td>
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<td>7.97</td>
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<td>Knee Flexion (°)</td>
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<td>34.44</td>
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<td>Knee Adduction (°)</td>
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<td>0.01</td>
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<td>11.37</td>
<td>-6.47</td>
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<tr>
<td>Peak Eversion (°)</td>
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<td>-13.18</td>
<td>14.31</td>
<td>0.57</td>
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<tr>
<td>Eversion ROM (°)</td>
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<td>0.035</td>
<td>-20.73</td>
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<tr>
<td>Peak Eversion Velocity (°/sec)</td>
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<td>Vertical loading rate (nm•kg•m−1)</td>
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<td>-51.76</td>
<td>101.61</td>
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<td>Hip Abductor Moment (Nm•kg)</td>
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<td>0.009</td>
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<td>Hip Abductor Impulse (Nm•kg•sec)</td>
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<tr>
<td>Knee Abductor Moment (Nm)</td>
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<tr>
<td>Knee Abductor Impulse (Nm•sec)</td>
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<td>0.007</td>
<td>-0.29</td>
<td>0.52</td>
<td>0.11</td>
</tr>
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</table>

METHODS: Fifty-two collegiate soccer players (mean±SD, age, 20±2y; body mass, 77.3±6.7kg; height, 179.9±6.4cm; VO2max, 54.0±4.7ml•kg•min−1) participated in this study. The 2016 and 2017 NCAA soccer seasons, the Pittsburgh Steelers Sports Injury Research and Prevention (POMS), Sports Anxiety Scale (SAS), and Disabiliy in the Physically Active Scale (DPA) questionnaires were administered at various timepoints throughout the season. Groups were classified as those who reported good sleep quality (PSQI< 4) and those who reported poor sleep quality (PSQI ≥ 5). Multi-level linear mixed models were used to assess differences between sleep quality factor. Individual and time point were added as random intercepts to account for variance associated with these factors. Statistical significance was set a priori p<0.05. Results are reported as mean difference (MD) and effect size (ES).

RESULTS: A prospective multi-site approach to improve the collegiate athlete experience.

PURPOSE: To examine differences in mood, anxiety and physical health measurements between individuals who reported good sleep quality and individuals who reported poor sleep quality. METHODS: 110 male collegiate soccer players (mean±SD, age, 20±2y; body mass, 77.1±6.6kg; height, 179.9±6.3cm; VO2max, 54.0±4.7ml•kg•min−1) participated in this study. During the 2016 and 2017 NCAA soccer seasons, the Pittsburgh Steelers Sports Injury Research and Prevention (POMS), Sports Anxiety Scale (SAS), and Disability in the Physically Active Scale (DPA) questionnaires were administered at various timepoints throughout the season. Groups were classified as those who reported good sleep quality (PSQI< 4) and those who reported poor sleep quality (PSQI ≥ 5). Multi-level linear mixed models were used to assess differences between sleep quality factor. Individual and time point were added as random intercepts to account for variance associated with these factors. Statistical significance was set a priori p<0.05. Results are reported as mean difference (MD) and effect size (ES). RESULTS: 47.4% of PSQI results yielded scores ≥ 5. Individuals with good sleep quality had significantly lower levels of depression (MD=-2.68, ES=-0.29; p<0.001), tension (MD=-1.36, ES=-0.33; p<0.001), anger (MD=-2.09, ES=-0.33; p<0.001), fatigue (MD=-1.95, ES=-0.56; p<0.001), confusion (MD=-1.26, ES=-0.38; p<0.001) and total mood disturbance (MD=-9.11, ES=-0.39; p<0.001) than those who reported poor sleep quality. Individuals who reported good sleep quality had significantly less concentration disruption (MD=-0.45, ES=-0.25; p<0.01) than those who reported poor sleep quality. Individuals who reported good sleep quality scored significantly lower on the DPA (MD=-2.73, ES=-0.26; p<0.01), indicating improved physical function and well-being, compared to those who reported poor sleep quality. CONCLUSION: Poor sleep quality is prevalent (almost 50%) in this sample of collegiate soccer players. Athletes with poor sleep quality appear to have increased negative mental health outcomes and higher ratings on a disability scale. Establishing student-athlete wellness monitoring programs may provide a tailored approach to improve the collegiate athlete experience.

The impact of match congestion, training load (TL), perceived stress, fatigue and soreness on the odds of injury remains unclear. PURPOSE: To examine the influence of: 1) days rest between matches on injury rate (IR) and odds of injury and; 2) TL on injury, perceived stress, fatigue and soreness. METHODS: A prospective multi-site study tracked daily exposures, TL (distance and duration), injury and perceptual data from six Division I NCAA men’s soccer teams in one season. Overall and non-contact (NC) IRs expressed per 1000 athlete exposures (AEs), and odds ratios (OR) were determined by days before and after matches. Associations between injury and changes in both TL and perception were analyzed using a multilevel logistic regression.

RESULTS: 132 players experienced 116 injuries in 125 matches and 75 injuries in 301 practices. Overall match and practice IRs (per 1000AEs [95%CI]) were 47.9 [39.1, 54.0] for men’s soccer.
The intervention. Results: During the entire season 123 young soccer players sustained a total of 145 lower extremity injuries (INT 10: 55; INT 20: 90). (INT 10: 55; INT 20: 90). No significant group difference was found between INT10 (6.37 per 1000 hrs) and INT20 (7.20 per 1000 hrs) for the relative risk of injuries of the lower extremities (RR = 1.05, 95% confidence interval 0.59, 1.79), nor for the distribution of injury location, type, severity, mechanism or conditions. Conclusion: The results suggest that performing preventive exercises for 10 minutes is just as effective as a performance of 20 minutes. Consequently, the implementation of a neuromuscular training for 10 minutes twice a week seems to be sufficient to reduce injuries of the lower extremities in young male football players.

The importance of sports-specific cognitive and perceptual skills in soccer has already been examined in various studies (Ward & Williams, 2003). However, the role of general perceptual-cognitive abilities and the relation of position is not clarified in detail (Schumacher et al., 2018).

PURPOSE: To analyze the relation of position to peripheral perception, selective attention and reaction abilities in higher and lower skilled soccer players.

METHODS: 147 highly talented male soccer players (14.8 ± 2.6 yrs, age range 11 to 23 years) were involved. The subjects performed computer-based selective attention, peripheral perception and reaction tests (using Vienna Test System). In the peripheral perception test stimuli were presented left and right sided. The soccer players were divided into offensive player group (OPG: striker, midfielder) and defensive player group (DPG: goalkeeper, defender). They were recruited from a youth academy of a professional soccer club and played at the highest and 2nd highest national soccer competition for their age. Group differences were tested using the student t-test.

RESULTS: Significant differences for position groups were observed, with regard to correct catchers (OPG: 216.0 ± 5.1 sec; DPG: 231.3 ± 26.0 sec) in selective attention (t(140) = 3.05, p < 0.01) and peripheral reaction time left (OPG: 0.71 ± 0.09 sec; DPG: 0.67 ± 0.10 sec) in peripheral perception test (t(141) = 2.32, p < 0.01). No differences were found for variables in the reaction test.

CONCLUSIONS: Our results indicate that defender and goalkeeper outperform striker and midfielder in general selective attention tasks and in peripheral reaction tasks left sided. Additional research is needed to further clarify position-specific differences between left and right peripheral reaction time of highly talented soccer players.

The regular execution of neuromuscular training has been shown to reduce injuries of the lower extremities in youth athletes. However, to date there are inconsistent results on the dose-response relationship of neuromuscular training. The purpose of this study was to evaluate the optimal duration of neuromuscular training to prevent injuries of the lower extremities in young soccer players. METHODS: 342 (15.4±1.7 years) male soccer players were included in the study, and cluster-randomized into two intervention groups. Both groups completed the same soccer specific warm-up program (FIFA 11+) twice a week, but for a different duration: one intervention group (INT= 57.9 [30.0, 76.3]) and one control group (CON= 40.0 [21.7, 73.7]) in practice with 1 vs. 6 days since the last game. For each additional 3500m covered on a day, odds of NC injury, stress, soreness and fatigue increased (OR = 1.70 [1.38, 2.10], 1.16 [1.02, 1.31], 1.55 [1.40, 1.72], 1.69 [1.52, 1.89], respectively. For each additional hour of activity on a day, odds of NC injury, stress, soreness and fatigue increased (1.83 [1.59, 2.12], 1.08 [0.97, 1.26], 1.28 [1.17, 1.39], 1.34 [1.22, 1.47], respectively). CONCLUSION: Days between games and acute TL increases on a given day had a negative impact on odds of injury and perception. The odds of getting injured in a match were greater with 1 to 5 days vs. 6+ days between matches. These data may be used to inform and guide the NCAA in determining optimal scheduling and recovery.

Speed is one of the most important factors dictating athletic performance especially in field based team sports including soccer. Sports performance coaches continue to develop training programs to enhance this ability. One method to lower body resistance training and plyometrics, one method that is frequently employed is resisted sprinting (RS). However, data concerning the efficacy of RS is equivocal and there is much debate over the proper resistance to prescribe. Previous research has been conducted at loads near 10% of body weight (BW), but recent studies suggest the optimal load for lower extremity injuries in young athletes. However, to date there are inconsistent results on the dose-response relationship of neuromuscular training. The purpose of this study was to evaluate the optimal duration of neuromuscular training to prevent injuries of the lower extremities in young soccer players.

The Dose-Response Relationship of Neuromuscular Training to Prevent Lower Extremity Injuries in Young Soccer Players. A Cluster Randomised Controlled Trial

Patrick J. Mara, Erik Blekeberg, Dr. Todd Astorino. California State University San Marcos, San Marcos, CA.

Email: mara001@cougars.csusm.edu

(No relevant relationships reported)

Board #4
May 30 1:30 PM - 3:30 PM
Effect of Two Regimes of Sled Sprinting on 40m Sprint Performance in Collegiate Soccer Players

Patrick J. Mara, Erik Blekeberg, Dr. Todd Astorino. California State University San Marcos, San Marcos, CA.

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The regular execution of neuromuscular training has been shown to reduce injuries of the lower extremities in youth athletes. However, to date there are inconsistent results on the dose-response relationship of neuromuscular training. The purpose of this study was to evaluate the optimal duration of neuromuscular training to prevent injuries of the lower extremities in young soccer players. METHODS: 342 (15.4±1.7 years) male soccer players were included in the study, and cluster-randomized into two intervention groups. Both groups completed the same soccer specific warm-up program (FIFA 11+) twice a week, but for a different duration: one intervention group (INT= 57.9 [30.0, 76.3]) and one control group (CON= 40.0 [21.7, 73.7]) in practice with 1 vs. 6 days since the last game. For each additional 3500m covered on a day, odds of NC injury, stress, soreness and fatigue increased (OR = 1.70 [1.38, 2.10], 1.16 [1.02, 1.31], 1.55 [1.40, 1.72], 1.69 [1.52, 1.89], respectively. For each additional hour of activity on a day, odds of NC injury, stress, soreness and fatigue increased (1.83 [1.59, 2.12], 1.08 [0.97, 1.26], 1.28 [1.17, 1.39], 1.34 [1.22, 1.47], respectively). CONCLUSION: Days between games and acute TL increases on a given day had a negative impact on odds of injury and perception. The odds of getting injured in a match were greater with 1 to 5 days vs. 6+ days between matches. These data may be used to inform and guide the NCAA in determining optimal scheduling and recovery.

The importance of sports-specific cognitive and perceptual skills in soccer has already been examined in various studies (Ward & Williams, 2003). However, the role of general perceptual-cognitive abilities and the relation of position is not clarified in detail (Schumacher et al., 2018).

PURPOSE: To analyze the relation of position to peripheral perception, selective attention and reaction abilities in higher and lower skilled soccer players.

METHODS: 147 highly talented male soccer players (14.8 ± 2.6 yrs, age range 11 to 23 years) were involved. The subjects performed computer-based selective attention, peripheral perception and reaction tests (using Vienna Test System). In the peripheral perception test stimuli were presented left and right sided. The soccer players were divided into offensive player group (OPG: striker, midfielder) and defensive player group (DPG: goalkeeper, defender). They were recruited from a youth academy of a professional soccer club and played at the highest and 2nd highest national soccer competition for their age. Group differences were tested using the student t-test.

RESULTS: Significant differences for position groups were observed, with regard to correct catchers (OPG: 216.0 ± 5.1 sec; DPG: 231.3 ± 26.0 sec) in selective attention (t(140) = 3.05, p < 0.01) and peripheral reaction time left (OPG: 0.71 ± 0.09 sec; DPG: 0.67 ± 0.10 sec) in peripheral perception test (t(141) = 2.32, p < 0.01). No differences were found for variables in the reaction test.

CONCLUSIONS: Our results indicate that defender and goalkeeper outperform striker and midfielder in general selective attention tasks and in peripheral reaction tasks left sided. Additional research is needed to further clarify position-specific differences between left and right peripheral reaction time of highly talented soccer players.
Elite professional soccer players have high aerobic requirements throughout a game and extensive anaerobic demands during periods of a match leading to major metabolic and thermodynamic changes. Assessing skin temperature (Tsk), blood lactate concentration ([La]−), fat and carbohydrate oxidation (FATox; CHOox) might provide an indirect method to assess metabolic flexibility and oxidative capacity during exercise. 

**Purpose:** To study the relationship between Tsk, [La]−, and substrate oxidation patterns. 

**Methods:** We used indirect calorimetry and [La]− measurements, and monitored the Tsk to study the metabolic and thermodynamic response to exercise in twenty professional male soccer players (age 24.5±3.4 yrs, VO2peak 53.2±4 ml/kg/min) during a maximal incremental treadmill test. 

**Results:** The maximal FATox rate was 0.47±0.16 g/min, reached at 62.5±6.5% of the VO2peak. A significant inverse correlation was found between the average values of Tsk and FATox rates (ρ=0.006). Maximum values reached of FATox and CHOox rates were 0.80±0.005. A significant correlation was found between the average values of Tsk and [La]− (ρ=0.003) among men, but not among women (ρ=0.048) and WC (ρ=0.003) among men and in BMI (ρ=0.414), followed by sleeping (0.344), in LPA (0.195), and in MVPA (0.047). The values of the different variables were as follows: VO2peak, 53.2±4 ml/kg/min; [La]− peak, 4.85±0.80 mmol/L; Tsk peak, 37.25±0.56 °C; FATox peak, 0.80±0.005 g/min; CHOox peak, 0.54±0.39 g/min; VE peak, 48.0±1.87 L/min; RER peak, 0.80±0.05.

**Conclusion:** These results indicate that FATox rates are inversely associated with blood lactate production; which may be due to a higher adrenergic activation that limits the increase of Tsk and the FATox capacity. Our data also show relationships between the Tsk and FATox rates, which may be associated to an increase of tissue blood flow. More research is required to determine the thermodynamic and metabolic responses to affect performance in soccer.

---

**Table 1. Subjects’ characteristics**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age (years)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>BMI (%)</th>
<th>Body fat (%)</th>
<th>Fat free mass (%)</th>
<th>Max speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=20</td>
<td>24.5±3.4</td>
<td>180.6±5.5</td>
<td>76.7±6.2</td>
<td>23.5±1.54</td>
<td>10.29±1.85</td>
<td>46.58±2.14</td>
<td>16±1</td>
</tr>
</tbody>
</table>

**Table 2. Maximal cardiorespiratory and metabolic data**

<table>
<thead>
<tr>
<th>VO2 peak (ml/min/kg)</th>
<th>HR peak (bpm)</th>
<th>RER</th>
<th>VE (L/min)</th>
<th>FATox peak (g/min)</th>
<th>CHOox peak (g/min)</th>
<th>Tsk peak (°C)</th>
<th>[La]− peak (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>53.25±3.98</td>
<td>180.3±7.9</td>
<td>1.06±0.05</td>
<td>145.5±24.13</td>
<td>0.47±0.16</td>
<td>4.97±0.62</td>
<td>37.12±0.69</td>
<td>6.6±1.7</td>
</tr>
</tbody>
</table>

**Table 3. Average of fat and carbohydrate oxidation rates, blood lactate levels, skin temperature response and oxygen uptake in an incremental exercise test until volitional exhaustion in professional soccer players**

<table>
<thead>
<tr>
<th>Load (km/h)</th>
<th>FATox (g/min)</th>
<th>CHOox (g/min)</th>
<th>[La]− (mmol/L)</th>
<th>Tsk (°C)</th>
<th>VO2 (ml/min/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.21±0.10</td>
<td>1.14±0.27</td>
<td>1.22±0.37</td>
<td>34.87±0.95</td>
<td>6.87±1.87</td>
</tr>
<tr>
<td>9</td>
<td>0.47±0.16</td>
<td>4.04±0.41</td>
<td>1.25±0.30</td>
<td>35.18±0.92</td>
<td>30.88±2.66</td>
</tr>
<tr>
<td>10</td>
<td>0.38±0.18</td>
<td>4.26±0.46</td>
<td>1.32±0.30</td>
<td>35.54±0.98</td>
<td>34.53±2.16</td>
</tr>
<tr>
<td>11</td>
<td>0.34±0.17</td>
<td>4.53±0.43</td>
<td>1.59±0.54</td>
<td>36.07±0.95</td>
<td>38.12±2.47</td>
</tr>
<tr>
<td>12</td>
<td>0.25±0.19</td>
<td>4.67±0.53</td>
<td>1.88±0.81</td>
<td>36.48±0.86</td>
<td>41.38±2.19</td>
</tr>
<tr>
<td>13</td>
<td>0.20±0.19</td>
<td>4.79±0.53</td>
<td>2.65±1.32</td>
<td>36.78±0.70</td>
<td>44.15±2.39</td>
</tr>
<tr>
<td>14</td>
<td>0.14±0.19</td>
<td>4.81±0.64</td>
<td>3.76±1.64</td>
<td>36.93±0.65</td>
<td>47.19±2.59</td>
</tr>
<tr>
<td>15</td>
<td>0.08±0.13</td>
<td>4.75±0.66</td>
<td>4.80±1.87</td>
<td>37.13±0.62</td>
<td>49.58±2.38</td>
</tr>
<tr>
<td>16</td>
<td>0.06±0.12</td>
<td>4.80±0.74</td>
<td>5.53±1.89</td>
<td>37.13±0.56</td>
<td>52.64±2.38</td>
</tr>
<tr>
<td>17</td>
<td>0.03±0.10</td>
<td>4.85±0.80</td>
<td>6.52±1.57</td>
<td>37.25±0.56</td>
<td>54.13±3.93</td>
</tr>
</tbody>
</table>

Abbreviations: BMI (body mass index); Max speed (maximal speed); VO2 peak (peak oxygen consumption); HR (heart rate); RER (respiratory exchange ratio); VE (ventilation); FATox peak (peak fat oxidation); CHOox peak (peak carbohydrate oxidation); Tsk peak (peak skin temperature)
sleep constant was associated with a one-year BMI decrease of 0.26 kg/m², while the replacement of SED with LPA and sleep were associated with smaller decreases in BMI (0.06 kg/m² and 0.12 kg/m², respectively).

CONCLUSION: Findings suggest that targeting all movement behaviors throughout the day may be an effective approach for weight loss, especially among men.

1632 May 30 1:45 PM - 2:00 PM
Cardiorespiratory Fitness and Years Lived Free of Cardiovascular Disease: Cardiorespiratory Lifetime Risk Pooling Project
Amanda E. Paluch¹, Hongyan Ning¹, Mercedes R. Carnethon², Kelley Petee Gabriel, FACSM², Norrina B. Allen¹, Donald M. Lloyd-Jones³, John T. Wilkins⁴, Northwestern University, Chicago, IL. ¹University of Texas Health Science Center at Houston and School of Public Health – Austin Campus, Austin, TX. (Sponsor: Kelley Petee Gabriel, FACSM)
Email: amanda.paluch@northwestern.edu

(REMIND relationship reported)

PURPOSE: Quantifying cardiorespiratory fitness (CRF) with years lived free of cardiovascular disease (CVD) allows for contextualization of the population burden of CVD and provides a metric for clinician-patient communication.

METHODS: CRF was measured with graded exercise treadmill tests in 8,129 adults in the Coronary Artery Risk Development in Young Adults and Framingham Offspring studies. Individual-level data were pooled. Cohort-specific z-scores for CRF were categorized into sex- and age-specific quintiles. We defined low fit as quintile 1, moderate (mod) fit as quintiles 2-3, and high fit as quintiles 4-5. Rates (person-years) of incident CVD and death were summed for participants up to age 85 years, or the oldest age of observation. Irwin’s restricted mean was used to calculate years lived free from CVD and overall survival stratified by sex.

RESULTS: At baseline the mean age was 32.5±11.6 years, 43.6% women, and 30.8% black. Over 219,812 person-years of follow-up, 762 CVD events were observed. For total survival time, high fit men lived 2.1 years longer and mod fit men lived 1.4 years longer vs low fit men. Additionally, high fit men lived 3.3 more healthy years and mod fit men lived 2.3 more healthy years free of CVD vs the low fit group. Among men, relative follow-up time spent with CVD was 5.0% for high fit, 5.7% for mod fit, and 9.0% for low fit groups. While high and mod fit women were similar, both had greater longevity and health span than low fit women. Mod fit women lived 1.9 total years longer and lived 1.7 more healthy years CVD-free vs the low fit women. Time spent with CVD was similar across fitness groups in women, ranging from 2.8-3.2% of follow-up time.

CONCLUSIONS: The benefits of higher fitness appear to extend multiple decades into older ages. Higher fitness in early adulthood is associated with longer overall and CVD-free survival. Men with higher fitness levels as young adults live less of their life with CVD, suggesting a compression of morbidity at older ages.

1634 May 30 2:15 PM - 2:30 PM
Cardiorespiratory Fitness Incidence and Mortality from Lung Cancer in Male Smokers
Baruch Vainselboim¹, Ricardo M. Lima², Peter Kokkinos, FACSM², Jonathan Myers, FACSM², ¹Saint Francis University, Loretto, PA. ²University of Brasilia, Brasilia, Brazil. ³Washington DC Veterans Affairs Medical Center, Washington, DC. ⁴Veterans Affairs Palo Alto Health Care System/ Stanford University, Palo Alto, CA.
Email: baruch.v1981@gmail.com

(REMIND relationship reported)

Cardiorespiratory fitness (CRF) is an established prognostic marker for many chronic diseases including lung cancer but, this association has not been assessed among smokers. PURPOSE: To evaluate the association between CRF, lung cancer incidence and cancer mortality in former and current male smokers. METHODS: Maximal treadmill exercise testing was performed in 2,979 men [former smokers (n=1,602), current smokers (n=1,377), 39.6±25 pack/years and current smokers (n=1,377), 43±27 pack/years] aged 59.2±17.3 years, who were free from malignancy at baseline. Cox hazard models adjusted for cancer risk factors were analyzed. Population attributable risks (PAR%) of low CRF (<5 METs) for lung cancer outcomes were also determined. RESULTS: During 11.6±7 years follow-up, 99 lung cancers were diagnosed [46 (2.9%) among former smokers and 53 (3.8%) among current smokers]. Seventy-nine of those died from cancer (40 in former and 39 in current smokers) after 3.6±4.6 years from diagnosis. Among former smokers each 1-MET increase and categories of moderate and high CRF were associated with 16% (p=0.002), 60% and 83% (p trend<0.001) reductions in lung cancer incidence, respectively. Among current smokers who were later diagnosed with lung cancer, 1-MET increase and categories of moderate and high CRF were associated with 18% (p=0.008), 81% and 82% (p trend<0.001) reductions in cancer mortality, respectively. The PAR% for lung cancer incidence was 12.5% among former smokers and 21.5% for cancer mortality among current smokers. CONCLUSIONS: Higher CRF is associated with lower lung cancer incidence in former smokers. Current smokers who were diagnosed with lung cancer and were more fit exhibited reduced cancer mortality. These results suggest potential protective benefits of higher CRF for prevention of lung cancer outcomes among both former and current smokers. Eliminating low CRF as a risk factor could potentially reduce considerable lung cancer morbidity and mortality.
1635 May 30 2:30 PM - 2:45 PM
Is Leisure-time Physical Activity Before Pregnancy Associated With Risk Of Hyperemesis Gravidarum During Pregnancy?
Katrine M. Owe1, Nathalie Stuer2, Borgny H. Wold3, Maria C. Magnus3, Wenche Nystad2, Åse V. Vikanes3. 1Oslo University Hospital, Oslo, Norway. 2Norwegian University of Science and Technology, Trondheim, Norway. 3Norwegian Institute of Public Health, Oslo, Norway.
Email: owekam@outlook.com

Hypermnesis gravidarum (HG) is characterised by excessive nausea and vomiting often leading to maternal weight loss, dehydration, electrolyte imbalance, and vitamin deficiencies. HG is the most common reason for hospitalisation in the first half of pregnancy and its prevalence varies depending on maternal country of birth. Women who experience excessive nausea and vomiting in early pregnancy are less likely to participate in leisure-time physical activity (LTPA) during pregnancy. Whether LTPA before pregnancy is associated with hyperemesis gravidarum has not yet been studied. Prepregnancy LTPA may lessen the risk of gestational diabetes, pelvic girdle pain, and hypertensive disorders including preeclampsia, all of which are associated with HG.

PURPOSE: To estimate associations between prepregnancy LTPA and HG in pregnancy.

METHODS: We present data from 37,442 primiparous women with singleton pregnancies enrolled in The Norwegian Mother and Child Cohort Study. Prepregnancy LTPA was self-reported by questionnaire in pregnancy week 17. HG was defined as prolonged nausea and vomiting in requiring hospitalisation before the 25th gestational week. We estimated the crude and adjusted associations between LTPA and HG using multiple logistic regression. We assessed effect modification by prepregnancy BMI or smoking by stratified analysis and interaction terms.

RESULTS: A total of 398 (1.1%) women developed HG. Before pregnancy 76.4% conducted LTPA at least 3 times weekly, while only 7.3% of women conducted LTPA less than once a week. Compared to women reporting LTPA 3 to 5 times weekly, no LTPA or a frequency of 1 to 3 times a month had an increased risk of HG (adjusted odds ratio [aOR] 2.58; 95% confidence interval [CI], 1.29 to 5.18, and aOR 1.35; 95% CI, 0.91 to 1.92, respectively). LTPA-HG associations differed by prepregnancy BMI but not by prepregnancy smoking. The increase in risk of HG was more than 4-fold for women with BMI ≥25 kg/m² reporting no LTPA pregnancy (aOR 4.89; 2.13 to 11.22, test for trend, P<0.05).

CONCLUSIONS: Lack of LTPA before pregnancy was associated with an increased risk of HG. Inactive women with overweight or obesity before pregnancy may have the highest risk of HG during pregnancy.

1636 May 30 2:45 PM - 3:00 PM
Is Midlife Quadriceps Muscular Strength Protective Against Later Life Osteoarthritis and Subsequent Total Joint Replacement?
Andjelka Pavlovic, Benjamin L. Willis, David S. Leonard, Stephen W. Farrell, FACSM, Carolyn E. Barlow, Laura F. DeFina. The Cooper Institute, Dallas, TX. (Sponsor: Stephen W. Farrell, FACSM)
Email: apavlovic@cooperinst.org

Purpose: The purpose of this study was to examine the relationship between midlife quadriceps muscle strength and the likelihood of developing OA and undergoing a HJR later in life.

Methods: We linked strength and clinical data from 3944 (3431 men and 513 women) participants in the Cooper Center Longitudinal Study from 1981-1989 to Medicare claims from 1999-2009 (13% women, mean age 49 years). Quadriceps muscular strength was measured via 1-repetition maximum (1-RM) leg press assessment and expressed individually relative to body weight. Outcome measures for OA and HJR were obtained using Medicare administrative data. Proportional hazards regression was used to estimate the risk of incident OA and subsequent risk of HJR after developing OA.

Results: During 20,672 person years of Medicare follow up, 1100 OA events (913 events in men, 187 events in women) were observed. After controlling for age, sex and year of muscle strength assessment, a significant relationship was observed between 1-RM leg press and the likelihood of developing OA later in life (HR 0.76, 95% CI 0.59 - 0.98). Among those who developed OA, we observed 293 hip/knee total joint replacements (244 joint replacements in men, 49 joint replacements in women) during 4947 subsequent person years of observation. When adjusted for the same covariates, higher 1-RM leg press suggested a protective role against HJR, but the findings were not statistically significant (HR 0.80, 95% CI 0.49 - 1.29).

Conclusion: Midlife quadriceps muscular strength may play a protective role against onset of OA later in life. More research is needed to determine if increasing quadriceps muscle strength leads to a reduction in risk of undergoing HJR.

1637 May 30 3:00 PM - 3:15 PM
Measures Of Adiposity And Its Association To Physical Activity In Adults: The Tromso Study
Edvard H. Sagelv1, Ulf Ekelund, FACSM2, Jonas Johansson2, Boye Welde2, Camilla Grimsgaard1, Nina Emans2, Anna Nordstrøm1, Soren Brage1, Alexander Horsch1, Laila A. Hopstock1, Bente Morsbo1. 1UiT the Arctic University of Norway, Tromsø, Norway. 2Norwegian School of Sport Sciences, Oslo, Norway. 3Umeå University, Umeå, Sweden. 4University of Cambridge, Cambridge, United Kingdom.
Email: edvard.h.sagelv@uit.no

Purpose: The purpose of this study was to examine the pattern and magnitude of associations between moderate-to-vigorous physical activity (MVPA) and three different methods for assessing adiposity: body mass index (BMI), waist circumference (WC) and dual-energy x-ray absorptiometry (DXA).

Methods: In the seventh wave of the Tromso Study 2015-2016, 2790 participants (mean age 49 years) wore an accelerometer (ActiGraph wGT3X-BT) on the hip for eight consecutive days. Of these, 6125 participants provided valid accelerometer data, of which 5925 participants also provided data on BMI (kg/m²) and WC (cm), and 2741 participants attended DXA measurement, providing data on total body fat (%). MVPA (min/d) was estimated from the vector magnitude (the square root of the sum of squared activity counts) of triaxial acceleration counts and defined as ≥2600 counts per minute. In order to compare the magnitude of the association between MVPA and the three adiposity measures, the associations were considered significantly different if the 95% CI of the standardized β’s overlapped by <50%.

Results: After adjustment for age, sex, body height, smoking and educational level, for every 10-minute increase in MVPA, BMI decreased with -2.29 kg/m² (95% CI: -2.55 to -3.33 kg/m²), WC decreased with -0.94 cm (95% CI: -0.83 to -1.04 cm) and percentage total body fat decreased with -0.81% (95% CI: -0.72 -0.90%). The association between MVPA and percentage body fat (standardized β=0.270, 95%CI: -0.236-0.296) was considered significantly larger than for WC (standardized β=0.200, 95%CI: -0.163-0.214) and BMI (standardized β=0.200, 95%CI: -0.163-0.214) (p<0.05). MVPA explained 6%, 20%, and 44% of the variance in BMI, WC and percentage total body fat, respectively, after adjustment for potential confounders.

Conclusions: Adiposity measured with DXA, explained more of the variation in the association with MVPA than WC and BMI, indicating that the association between adiposity and physical activity depends on the accuracy of the measurement. As DXA distinguishes between fat and fat-free mass, whereas BMI and WC acts as proxy measures of adiposity, DXA may be the best choice for expressing adiposity. Due to the cross-sectional design of our analyses, we cannot establish causality in the association between MVPA and adiposity.
with reduced mobility, poor/very poor health condition, and excluding the first two years of follow-up. NIHANES population sample weights and adjustments for the complex survey design were employed. RESULTS: A total of 1,165 deaths occurred during follow-up (406 from CVD, and 283 from cancer). The relation between steps/day and mortality was non-linear (p<.01). When compared to our reference —4000 steps/day, an increase of 2,000 steps/day was associated with 36% lower risk for all-cause mortality (HR=0.64, 95% CI: 0.59, 0.70), 46% lower CVD mortality (HR=0.54, 95% CI: 0.20, 1.43), and 21% lower cancer mortality (HR=0.79, 95% CI: 0.69, 0.91). There were negligible reductions in risk beyond 10,000-12,000 steps/day. Results from sensitivity analyses did not alter the activity-mortality associations. CONCLUSIONS: Modest increases in steps/day (2000 steps/day) are associated with reduced risk for mortality with no extended benefits beyond 10,000-12,000 steps/day. The step/step-mortality associations described here can help setting public health/clinical goals.

D-14 Free Communication/Slice - Physical Activity/ Exercise in Clinical Populations

Thursday, May 30, 2019, 1:30 PM - 3:15 PM
Room: CC-105B

1639 Chair: Cemal Ozemek, FACSM. University of Illinois Chicago, Chicago, IL.

(Sponsor: Peter Brubaker, FACSM)

Purposes: Heart Failure (HF) is a major cause of morbidity and mortality worldwide. Ventilatory responses to acute exercise have important prognostic value in HF patients. This study examined baseline ventilatory measures to determine if obesity further impacts ventilatory responses in normal subjects and heart failure patients with preserved ejection fraction (HFrEF). Methods: All participants performed a cardiopulmonary exercise test to maximal effort to quantify ventilatory responses (tidal volume (VT), breathing frequency (BF), and minute ventilation (VE)) at submaximal (25 watts) and peak exercise. Ventilation efficiency was determined by assessing VE/VCO2 at the submaximal workload and VE/VCO2 slope. Obese vs. non-obese HFrEF participants were categorized based on BMI ≥25 kg/m2. One-way ANOVA was performed to determine if there were significant (p<0.05) differences between groups. Results: The obese HFrEF group had higher VE during peak exercise than the non-obese group (p<0.05), which was mainly due to greater BF (p=0.08) versus TV (p=0.24). The VE/VCO2 at submaximal workload and VE/VCO2 slope were significantly higher in the non-obese HFrEF group. Conclusion: As hypothesized, obese HFrEF participants exhibited worse ventilatory function than the non-obese HFrEF patient at similar levels of exercise. However, obese HFrEF participants demonstrate a similar degree of ventilatory inefficiency compared to normal weight HFrEF participants. Since ventilatory efficiency was not abnormal in obese HFrEF it appears that their prognosis is no worse than normal weight HFrEF participants.

1640 May 30 1:30 PM - 1:45 PM
Examining the Impact of Obesity on Ventilatory Responses During Acute Exercise in Patients with HFpEF

Brittany L. Christensen1, Peter H. Brubaker, FACSM1, Georgina Triakis1, J Thomas Becton2, Dalane Kitzman2. 1Wake Forest University, Winston-Salem, NC. 2Wake Forest Baptist Medical Center, Winston-Salem, NC. (Sponsor: Peter Brubaker, FACSM)

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(Sponsor: Peter Brubaker, FACSM)

PURPOSE: To compare the effects of A-HIIT and R-HIIT to that of a control group (CON) on physical characteristics, cardiometabolic health, and self-reported well-being in women employees attending a worksite wellness program. METHODS: A total of 48 overweight/obese women possessing one or more MetS risk factors were randomly assigned to one of three groups with 31 women completing all testing and training procedures: A-HIIT (n=10), R-HIIT (n=10), and CON (n=11). A-HIIT and R-HIIT groups trained 3x/wk for 25 minutes in an 8-week program at an average training intensity of 81.0±14 %HRmax and 81.9±12 %HRmax, respectively. ANCOVA was used to determine differences among groups on all dependent variables at post-testing after adjusting for baseline values. Post-hoc analyses were performed using Bonferroni adjustments. RESULTS: Both A-HIIT (MDE=-23.9 m, p=0.029) and R-HIIT (MDE=-23.8 m, p=0.029) had higher aerobic fitness than CON (MDE=-19.0 m SEM=6.3) using the 2-minute walk test following training. Only R-HIIT (MDE=-45.3 W, p=0.002) showed increased in upper body power over CON (MDE=949 W SEM=8.2) while displaying lower fasting insulin (MDE=-5.6 μU/mL p=0.036) compared to CON (MDE=-17.4 μU/mL SEM=1.4). R-HIIT also showed greater reductions in HOMA2-IR (MDE=-0.7, p=0.046) than CON (MDE=2.2, SEM=0.2). Furthermore, HOMA2-IR was lower in R-HIIT compared to both CON (MDE=-159.3%, SEM=8.8, p=0.017), and CON (MDE=-38.5%, p=0.017), and A-HIIT (MDE=-172.2%, SEM=9.4, p=0.014, p=0.002). Finally, R-HIIT had significantly higher scores on the physical function domain of Patient Reported Outcome Measurement System (PROMIS)®-57 well-being questionnaire compared to the CON group (MDE=50.8 SEM=1.4, MDE=5.7, p=0.035). CONCLUSIONS: Our study showed that R-HIIT can be considered as part of a risk reducing worksite-wellness strategy for improving physical characteristics, cardiometabolic health, and well-being in women possessing one or more components of the MetS. Supported by UMC Citizens Board Grant

1641 May 30 1:45 PM - 2:00 PM
Comparison of Two High-Intensity Interval Training Modalities on Cardiometabolic Health in Overweight/ Obese Women

Ozgur Alan, Emily W. Flanagan, Lafayette T. Watson, Andrew N.L. Buskard, Demet Tekin, Arlette Perry, FACSM. University of Miami, Coral Gables, FL. (Sponsor: Arlette Perry, FACSM)

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(Sponsor: Arlette Perry, FACSM)

High-intensity interval training (HIIT) has been used to reduce risk factors for diabetes, obesity, cardiovascular diseases and metabolic syndrome (MetS). Few studies have compared resistance-HIIT (R-HIIT) to aerobic-HIIT (A-HIIT) in a worksite wellness program designed to reduce risk factors for the MetS. PURPOSE: To compare the effects of A-HIIT and R-HIIT to that of a control group (CON) on physical characteristics, cardiometabolic health, and self-reported well-being in women employees attending a worksite wellness program. METHODS: A total of 48 overweight/obese women possessing one or more MetS risk factors were randomly assigned to one of three groups with 31 women completing all testing and training procedures: A-HIIT (n=10), R-HIIT (n=10), and CON (n=11). A-HIIT and R-HIIT groups trained 3x/wk for 25 minutes in an 8-week program at an average training intensity of 81.0±14 %HRmax and 81.9±12 %HRmax, respectively. ANCOVA was used to determine differences among groups on all dependent variables at post-testing after adjusting for baseline values. Post-hoc analyses were performed using Bonferroni adjustments. RESULTS: Both A-HIIT (MDE=-23.9 m, p=0.029) and R-HIIT (MDE=-23.8 m, p=0.029) had higher aerobic fitness than CON (MDE=-19.0 m SEM=6.3) using the 2-minute walk test following training. Only R-HIIT (MDE=-45.3 W, p=0.002) showed increased in upper body power over CON (MDE=949 W SEM=8.2) while displaying lower fasting insulin (MDE=-5.6 μU/mL p=0.036) compared to CON (MDE=-17.4 μU/mL SEM=1.4). R-HIIT also showed greater reductions in HOMA2-IR (MDE=-0.7, p=0.046) than CON (MDE=2.2, SEM=0.2). Furthermore, HOMA2-IR was lower in R-HIIT compared to both CON (MDE=-159.3%, SEM=8.8, p=0.017), and CON (MDE=-38.5%, p=0.017), and A-HIIT (MDE=-172.2%, SEM=9.4, p=0.014, p=0.002). Finally, R-HIIT had significantly higher scores on the physical function domain of Patient Reported Outcome Measurement System (PROMIS)®-57 well-being questionnaire compared to the CON group (MDE=50.8 SEM=1.4, MDE=5.7, p=0.035). CONCLUSIONS: Our study showed that R-HIIT can be considered as part of a risk reducing worksite-wellness strategy for improving physical characteristics, cardiometabolic health, and well-being in women possessing one or more components of the MetS. Supported by UMC Citizens Board Grant
1643 May 30 2:15 PM - 2:30 PM
Optimizing Utilization Of A Cardiac Rehabilitation Facility For Chronic Disease Prevention.
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(No relevant relationships reported)

PURPOSE: Cardiac rehabilitation (CR) involves delivery of structured exercise, education and risk reduction, in a cost-effective manner. Despite its benefits, and clinical practice guideline recommendations, CR programs are grossly underused due to multiple barriers. A large study of 2,674,427 patients showed that CR was used in 13.9% of patients hospitalized for AMI and in 31.0% of those who underwent CABG surgery. To help optimize utilization of resources, at our hospital, we utilised our cardiac rehabilitation facility to include other disease groups such as cancer, respiratory and stable cerebrovascular diseases, since the principles of exercise prescription for these disease groups are similar to CR and require similar infrastructure. The purpose was to utilise a cardiac rehabilitation centre as a chronic disease prevention centre for oncology, and pulmonary patients. To also assess the effects of the comprehensive program on physical fitness levels of these patients using the 6-minute walk test.

METHODS: 319 patients, which included those with cardiac disease (185), pulmonary disease (36) and cancer (98) were assessed as part of this study over a period of 3 years. The program comprised aerobic exercises, resistance training, yoga, and disease specific rehabilitation. The aerobic capacity was assessed before and after one month of rehabilitation by means of the 6 Minute Walk Test (6MWT).

RESULTS: The 6-minute walk test distance (6MWT) in the cardiovascular group improved from 331.56 (± 99.68) to 413.99 (± 104.43) meters, 24.86% increase from baseline (p<0.0001), pulmonary group improved from 313.17 (± 100.90) to 393.91 (± 116.92) meters, 8.35% increase from baseline (p<0.0002) and oncology group improved from 380.29 (± 97.24) to 431.20 (± 96.44) meters, 13.39% increase from baseline (p<0.0001).

CONCLUSIONS: A comprehensive CR facility can be successfully used to include other chronic disease group patients. It helps to improve overall aerobic capacity as indicated by significant increase in 6-minute walk test distance in cardiac, pulmonary and oncology patients. This can help hospitals deploy their rehabilitation services in an efficient and cost-effective manner.

1644 May 30 2:30 PM - 2:45 PM
Bidirectional Relationships of Daily Physical Activity and Sleep Among Patients with Heart Failure and Insomnia
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(No relevant relationships reported)

Physical activity is associated with better sleep quality across a wide range of populations, but the causal direction of this relationship is unclear due to lack of longitudinal and experimental studies. Patients with heart failure (HF) bear particular risk of poor sleep and low physical activity.

PURPOSE: Examine the relationships between within-person day-to-day fluctuations in physical activity and sleep quality among patients with stable NYHA Class I-V HF and insomnia (insomnia severity index > 7).

METHODS: Patients wore a uniaxial wrist accelerometer (Actiwatch) for 14 consecutive days and nights to measure total daytime activity counts, total sleep time, sleep onset latency and sleep continuity (sleep efficiency and wake time after sleep onset) (WASO)). Two-level multilevel models with daily and individual variation predicted daytime activity outcomes and sleep outcomes, separately. We adjusted for covariates within (day of the week) and between subjects (age, Charlson Comorbidity Index (CCI), NYHA HF Class, and body mass index (BMI)). Significance p < 0.05.

RESULTS: Participants (n=114, M = 62.4 ± 12.1 years, female 43%, black 22%, white 75%, NYHA Class 1.9 ± 0.8) on average obese (BMI 31.4 ± 7.6 kg/m²) with multiple comorbidities (CCI 3.2 ± 2.0). Daytime activity (177 ± 82 x 10³ counts/day) was associated with younger age (β = -1.32 ± 0.50), fewer comorbidities (β = -10.57 ± 3.26), lower NYHA class (β = -17.99 ± 7.30), and a tendency for lower BMI (β = -1.58 ± 0.83, p = 0.06). Comorbidity was associated with poorer sleep efficiency (β = -0.98 ± 0.48) and more WASO (β = 5.94 ± 2.05). After adjustment for all significant covariates, daytime activity was not associated with sleep characteristics the next night, but every minute less total sleep time (β = -0.075 ± 0.015) or WASO (β = -0.114 ± 0.042) was associated with ~70 - 100 more activity counts the next day.

CONCLUSIONS: Similar to studies in other populations, less WASO and less total sleep time both was associated with more activity the next day, but these were not bidirectional relationships since activity the previous day was not associated with sleep characteristics. Future research should confirm these results by polysomnography and hip accelerometry and evaluate mechanisms.

1645 May 30 2:45 PM - 3:00 PM
Measuring Physical Activity in People with Heart Failure - An Accelerometer Calibration Study
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PURPOSE: To estimate acceleration values corresponding to light and moderate to vigorous intensity physical activity (PA) in people with heart failure via calibration with oxygen consumption (VO2). METHODS: 21 adults with heart failure undertook a range of typical lifestyle activities (including laying down, and walking at different speeds) whilst wearing three accelerometers (each wrist and the left hip) and a portable gas analyser. Resting metabolic rate (RMR) was established and participants also undertook an incremental shuttle walk test (ISWT) to estimate fitness. Location specific activity intensity thresholds were established via Receiver Operator Characteristic (ROC) curve analysis. RESULTS: Participants had an average age of 71.1±14.3 years, the majority were male (24% female) and average BMI was 29.2±4.4 kg/m². Average distance walked during the ISWT was 279±192 m, and average RMR was 0.76±0.19 METS. The measured metabolic cost of slow paced walking (average pace 2.6 kph) was 4.09±1.08 METS - higher than estimates based on standard methods i.e. VO2/3.5 ml/kg/min (3.03±0.63 METS) or the Compendium of PA (2.0 METS). Similarly, moderate paced walking (average pace 3.5 kph) averaged 4.46±1.08 METS using measured RMR compared to 3.46±0.78 METS via the standard methods and 2.8 METS via the Compendium. ROC curve analysis will be used to estimate acceleration values corresponding to light and moderate to vigorous intensity PA.

CONCLUSIONS: Using single accelerometer values for estimating PA intensity assumes energy expenditure is the same for specific activities irrespective of fitness level, which risks understimating the PA levels of low fit populations such as people with heart failure. It may also risk prescribing PA intensities that are too high for this population. Results of this study indicate that the measured metabolic cost of activities such as walking at a light pace are much higher than estimated METs reported in the PA compendium. Population specific accelerometer thresholds for estimating light and moderate to vigorous intensity PA will permit more precise measures of the prevalence of PA in people with heart failure.

1646 May 30 3:00 PM - 3:15 PM
The Effect Of A Personalized Multi-component Lifestyle Intervention Program In Stage 3 & 4 Ckd Patients.
Samuel A. Headley, FACSM1, Jasmin Hutchinson1, Brian Thompson1, Marissa Ostroff2, Courtney Doyle-Campbell1, Allen Cornelius3, Kristen Denmpey1, Jennifer Siddall1, Emily Miele1, Elizabeth Evans1, Brianna Wood1, Cherilyn Sirois1, Brett Winston1, Michael Germaine1. Springfield College, Springfield, MA. 2Western New England University, Springfield, MA. 3University of the Rockies, Denver, CO. 4Renal and Transplant Associates of New England, Springfield, MA.
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(No relevant relationships reported)

PURPOSE: We studied the effect of a comprehensive lifestyle intervention (nutrition, physical activity, pharmacy, and behavioral counseling) on health related outcomes in 42 stage 3 & 4 (eGFRs 15-59 ml/min/1.73m2) CKD patients (age 60.2 ± 9.2, BMI 34.5 ± 7.8). METHODS: Patients were assigned randomly to a treatment (T, n= 27) or usual care (UC, n= 15) group, and asked to attend four test sessions: baseline (BL), month 1 (M1), month 3 (M3) and month 6 (M6). Anthropometrics, medication use, three-day nutritional intake, central (SBP/DBP) & brachial blood pressures (SBP/DBP), augmentation index (Alx@75), Short Physical Performance Battery (SPPB) test, the six-minute walk test (6MWT), leg strength & power, self-efficacy to adhere to diet and physical activity (PA) recommendations, and the KDQOL were assessed at each visit. PA levels and inflammatory markers (IL6 & hsCRP) were assessed at BL, M1, M3 and M6. Patients in T received individual counseling at BL, M1, M3 & M6 with bimonthly follow-up phone contact. Patients in UC were asked to follow the instructions of their nephrologist. RESULTS: All data are presented as means ± SD. Primary outcome variables were analyzed by 2 x 2 mixed factor ANOVAs. See table for some of the findings:

Support: NIH-R01NR016191; Yale Center for Sleep Disturbance in Acute and Chronic Conditions.
Abdomen was soft and non-distended, though he was tender to palpation in the left upper quadrant. No lower extremity edema; calves were symmetric and non-tender to palpation.

DIFFERENTIAL DIAGNOSIS:
- Pulmonary Embolus
- Pericarditis
- Mononucleosis

Sickle cell crisis in a patient with sickle cell trait

TEST AND RESULTS:
- A CT angiography chest, chest radiograph, and abdominal ultrasound were obtained and were notable for splenomegaly (14.3cm); otherwise unremarkable. An EKG revealed sinus bradycardia with sinus arrhythmia. Labs were obtained including CBC/PD, CMP, CK, haptoglobin, LDH, and hemoglobin electrophoresis, and notable for a mild anemia (hemoglobin 12.2). thrombocytopenia (platelets 52), mild transaminitis (AST 42, ALT 37), and evidence of hemolysis (hemoglobin < 10, LDH 486, CK 348). Hemoglobin electrophoresis was consistent with sickle cell trait.

FINAL WORKING DIAGNOSIS:
- Sickle cell crisis in a patient with sickle cell trait

TREATMENT AND OUTCOMES:
1. Tended labs for 2 weeks.
2. Avoided strenuous activity until pain resolved.
3. Provided counseling regarding hydration, heat illness, and training especially at altitude.
4. Follow up with hematology.
5. Consider screening NCAA coaches/athletic trainers given NCAA athletes are screened for sickle cell.

CONCLUSION: In conclusion, this program led to reductions in bSBP, cSBP and cDBP at M3 which were attenuated at M6. Patients in T felt less restricted by their disease than the UC group. This home-based program resulted in no improvements in functional outcomes (SPPB or 6MWT). Supervised, in-center programs are preferred when working with CKD patients.

1651 May 30 1:50 PM - 2:10 PM
Rib Pain - Football
Christopher Hicks. University of Virginia, CHARLOTTESVILLE, VA. (Sponsor: John M. MacKnight, M.D., FACSM)
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(No relevant relationships reported)

HISTORY: 21-year-old collegiate football defensive lineman complained of rib pain after a road game in Tennessee. Aside from a mild ankle sprain, he denied any specific injury to his torso/ribs. Pain began on the left side and then migrated to the right side with radiation to flank and sternum areas bilaterally. Had pain with deep breathing and sensation of tightness in the rib area. Took naproxen with some relief of his symptoms. Denied chest pressure, shortness of breath, palpitations, fevers or chills.

PMH: HTN, ADD
Medcs: Amlodipine, Adderal
SH: No tobacco, social ETOH, no illicit drugs
FH: Non contributory

PHYSICAL EXAMINATION:
- Well gentlemen in mild distress due to pain
- SH: No tobacco, social ETOH, no illicit drugs
- No true focal pain noted.
- Ext: DP and PT +2. No edema.
- Heart: Rate 108, RRR, normal heart sounds. No gallop or rub. No murmur.
- CV: RRR, normal heart sounds. No gallop or rub. No murmur.
- Neck- No JVD

TEST AND RESULTS:
- Blood pressure 140/90, pulse 72, RR 14.
- CV: RRR, normal heart sounds. No gallop or rub. No murmur.
- CT: No JVD

DIFFERENTIAL DIAGNOSIS:
1. Costochondritis
2. Rib fracture
3. Chest wall strain
4. Pneumothorax
5. Pulmonary Embolism

INTERIM HISTORY: Treated for chest wall injury with varying response over the next 4 days. Re-presented 2 hours before the next home game with shortness of breath, tachypnea, and worsening chest discomfort. Transferred to ER.

TEST AND RESULTS:
- Chest x-ray: focal right lower lobe opacification

CT: CT PA- acute bilateral segmental and sub-segmental pulmonary emboli, without evidence of right heart strain

Factor V Leiden, Anti-Cardiolipin, and Prothrombin negative
Lupus anticoagulant, Protein S, Protein C and Antithrombin III pending

FINAL/WORKING DIAGNOSIS: Acute bilateral segmental and sub-segmental pulmonary emboli, unclear etiology.

TREATMENT AND OUTCOMES:
1. Anticoagulation therapy with Apixaban for minimum of 3 months with considerations for lifetime treatment.
2. No contact sports or activities while on anticoagulation.
3. Avoid strenuous activity until pain resolved.
4. No contact sports or activities while on anticoagulation.
5. Continued hematology follow-up of coagulation workup.
6. Ongoing discussion of importance of inclusion of PE on the differential for chest pain even in healthy athletes with no discernible risks.

Abstracts were prepared by the authors and printed as submitted.
**HISTORY:** A 51-year-old male marathon runner presented with pleuritic chest pain and increasingly progressive shortness of breath at the end of his runs. At baseline, he was running a marathon in 3 hours, but his runs were reduced to less than 15 miles. He completed 15k in 1 hour and 30 minutes but with severe dyspnea on exertion. Patient was referred to the Sports medicine clinic for further evaluation.

**PHYSICAL EXAMINATION:**
- Vitals within normal limits
- NAD, speaking in full sentences, no chest wall tenderness. CV: regular rate and rhythm. no edema. Pulmonary: normal respiratory effort without distress, absent of wheezes or rales.

**DIFFERENTIAL DIAGNOSIS:**
1. Overtraining syndrome
2. Asthma/Exercise induced bronchospasm
3. Viral syndrome
4. Pulmonary embolism

**TESTS AND RESULTS:**
- 8/2017: EKG nonspecific/chest X-ray reported small bilateral pleural effusion
- 8/2017: Non contrast chest CT - no pleural effusion
- 8/2017: TTEcho: EF 60-65%, unremarkable valves & chambers
- 8/2017: Treadmill test unspecific, high exercise tolerance
- 9/2017: CXR - persistence of bilateral pleural effusion.
- 1/2018: Myocardial perfusion scan - no evidence of stress induced ischemia
- 3/2018: Non Contrast chest CT - Diminished right lung pleural opacity, probably represented inflammatory change
- 9/2018: D-dimer 564
- 9/2018: CT-A - small embolus in a subsegmental branch of the pulmonary artery to the left lower lobe. Second pulmonary embolus in a segmental branch of the pulmonary artery to the right lower lobe.

**FINAL WORKING DIAGNOSIS:**
Bilateral unprovoked pulmonary embolism

**TREATMENT AND OUTCOMES:**
- Unremarkable CBC, ESR and CRP
- Further rheumatological workup for inflammatory markers
- Bone resorption on both sides of the MSJ, and soft tissue swelling anterior to the joint.
- Chest MRI
- Irregularity at the sternal and manubrial articular surfaces, along with a small effusion, compatible with osteoarthritis.
- Full painless range of motion at the shoulder, with strength intact to manual muscle testing throughout

**DIFFERENTIAL DIAGNOSIS:**
1. Strain of pectoralis major
2. Costochondritis
3. Inflammatory arthritis
4. Osteoarthritis of the MSJ
5. Pulmonary embolism
6. Pneumothorax
7. Pericarditis

**TEST AND RESULTS:**
Prior cardiology work-up did not reveal an eliciting cause.

Lateral x-ray of the chest (sternal view)
- Bone resorption on both sides of the MSJ, and soft tissue swelling anterior to the joint.
- Chest MRI
- Irregularity at the sternal and manubrial articular surfaces, along with a small effusion, compatible with osteoarthritis.

**FURTHER WORKUP:**
- Unremarkable CBC, ESR and CRP

**FINAL WORKING DIAGNOSIS:**
Mammothsternal osteoarthritis

**TREATMENT AND OUTCOMES:**
1. Referred from rugby for several months
2. Started on regular daily meloxicam 7.5mg for 1 month
3. Significant improvement in symptoms
D-16 Clinical Case Slide - Foot and Ankle
Thursday, May 30, 2019, 1:30 PM - 3:10 PM
Room: CC-305

1655 Chair: Stephen M. Simons, FACSM. Saint Joseph Regional Medical Center, South Bend, IN.
(No relevant relationships reported)

1656 Discussant John Fraser. Naval Health Research Center, San Diego, CA.
(No relevant relationships reported)

1657 Discussant Kirk McCullough. Ortho Sports Medicine Kansas City, Kansas City, KS.
(No relevant relationships reported)

1658 May 30 1:30 PM - 1:50 PM
Recurrent Foot Pain - A Case Series of Two Division 1 College Football Athletes
Elizabeth L. Albright. Penn State Health, State College, PA.
(Sponsor: Peter Seidenberg, MD, FACSM)
(No relevant relationships reported)

HISTORY: Patient 1 (P1) is a 21 y/o white male who presented for pain over lateral aspect of his right foot after twisting on it during scrimmage. He had immediate pain with ambulation. He denied hearing/feeling a pop or stress fractures. Patient 2 (P2) is a 21 y/o African-American male who presented after feeling a pop in his lateral foot during cutting maneuver at practice. He had significant pain with ambulation and denied stress fractures. Both were 5 months status post percutaneous screw fixation of Jones fracture of the ipsilateral foot. After initial injury, Vitamin D levels were 24 and 27 ng/ml respectively. They were started on Vitamin D supplementation and provided a bone stimulator. They remained non-weightbearing in CAM boot for 4 weeks followed by weightbearing in CAM boot for 2 weeks. At 6 weeks, they progressed back into regular shoes. They completed rehab with athletic trainer and had returned to full activity at time of remission.

PHYSICAL EXAMINATION:
- Both: Skin intact. Full ankle ROM. TTP of Base of 5th metatarsal. Neurovascularily intact. No TTP of navicular, bilateral malleoli, ankle ligaments, Lisfranc joint, peroneal tendons, bifurcate ligament, calcaneus, or cuboid. Both had flexible, forefoot induced, inverted varus positioning of calcaneus with positive Coleman block test. P1 had equivocal fullness test and pes cavus. P2 had mild edema of lateral foot and pes planus.
- DIFFERENTIAL DIAGNOSIS: Repeat Jones Fracture, 5th Metatarsal shaft or Avulsion fracture, Peroneal Tendon Rupture, Bifurcate Ligament Sprain, Cuboid Subluxation, Avascular Necrosis TESTS AND RESULTS: P1: New luency at previously healed fracture site on XR. No hardware issues P2: Initially improved compared to previous XR but bone resorption evident at 2 weeks. No hardware issues
- FINAL WORKING DIAGNOSIS: Recurrent Jones Fracture TREATMENT AND OUTCOMES: Non-weight bearing in CAM boot. Restart bone stimulator. Continue Vitamin D. At 1 week, transitioned to weightbearing in CAM boot. At 4 weeks, P1 transitioned into regular shoe with custom clamshell orthotic to correct hindfoot deformity and started return to play progression. At 6 weeks, he returned to full activity with orthotic in cleats. P2 required an additional 2 weeks in boot for slow fracture remodeling but then started RTP with full return by 8 weeks.

PHYSICAL EXAM:
- Hi 4’ 6” (1.372 m) | Wt 69 lb (31.3 kg) | BMI 16.64 kg/m2 (56 percentile), Healthy and NAD. Accompanied by her mother.
- Inspection: Neutral foot type. Normal alignment of lower extremities. There was no redness, swelling, or skin changes.
- Palpation: moderate tenderness on the right plantar mid foot.
- Range of motion: there was full active range of motion of the ankle, without significant pain.
- Strength: Muscle strength (ankle plantarfexion, dorsiflexion, inversion, eversion) full.
- Special tests: Fracture test (tap, percussion, bump) negative, squeeze test negative, anterior drawer test negative, Talar tilt test negative, Stress test negative, Thompson test negative.

DIFFERENTIAL DIAGNOSIS:
1. Navicular bone stress injury
2. Tarsal coalition
3. Anterior tibialis tendinopathy
4. Posterior tibialis tendinopathy
5. Bone tumor
6. Nerve entrapment
7. Heel pad syndrome
8. Sever disease

TEST AND RESULTS:
1. Ankle X-ray: No obvious fracture or callus
2. MRI: Ankle: bone marrow edema in the neck of the calcaneus
3. DXA: Normal bone density

FINAL DIAGNOSIS: Calcaneus bone stress injury
TREATMENT AND OUTCOMES:
1. Decreased activity level
2. Non-weight bearing on crutches for 2 weeks
3. Walking boot for 3 weeks with partial weight bearing on crutches
4. PT 1-2x/ week for 2-3 weeks
5. Vitamin D 2000 IU everyday
6. Partial weight bearing to full weight bearing as tolerated
7. Gradual return to sports after 8 weeks of injury, when she did not have pain with ambulation, and repeat MRI showed no evidence of residual bone marrow edema.

1660 May 30 2:10 PM - 2:30 PM
Ankle Pain - Basketball
Mary Lynch, David Soma. Mayo Clinic, Rochester, MN.
(Sponsor: Karen Newcomer, FACSM)
(No relevant relationships reported)

HISTORY: Our patient is a healthy 17 year old female basketball and softball player who had been treated for bilateral Achilles tendinitis. Two weeks prior to presentation, she jumped and created a moment of extreme plantar flexion of her left foot. She had immediate posterior ankle pain without edema or erythema. A physical therapist recommended heel cups. She did not consistently rest. Her basketball performance was poor over the next two weeks.

PHYSICAL EXAMINATION: Normal gait and inspection. Tender to palpation. No redness, swelling, or skin changes.

DIFFERENTIAL DIAGNOSIS:
1. Achilles tendinitis
2. Retrocalcanear bursitis
3. Fracture of os trigonum
4. Tendinitis of flexor hallucis or flexor digitorum tendon
5. Posterior facet arthritis of the subtalar joint

TEST AND RESULTS:
1. X-ray: Originally radiologist read as normal, but sports medicine interpretation was that there appeared to be a luency extending through the lateral aspect of the talus. Normal MRI and no evidence of bone marrow edema.

1659 May 30 1:50 PM - 2:10 PM
Heel Injury-Figure Skate
Naoko Onizuka, Suzanne Hecht, FACSM. University of Minnesota, Minneapolis, MN.
(Sponsor: Suzanne Hecht, FACSM)
(No relevant relationships reported)

HISTORY: A nine year old female figure skater presented with 6 weeks of atraumatic right foot pain. She recently started training double jumps prior to the onset of pain. Pain was located on the plantar side of the right midfoot and she initially noticed it following practices. Weight bearing increased her pain and eventually it hurt during practice as well as after practice. No changes in training time or frequency. She has been figure skating for two years. No history of previous foot injuries or bone stress injuries. No family history of osteoporosis. Her past medical history is significant for chronic Lyme’s disease.
Patient: A 16-year-old female ice hockey player was referred for an acute right foot injury sustained during an ice hockey game. The patient sustained an atypical ankle injury while blocking a slap shot.

**History:** The patient was a senior at a boarding school who sustained the injury during a game. She reported immediate pain and swelling, which persisted despite ice therapy. She was referred to the emergency department for further evaluation.

**Physical Exam:**
- **Vascular:** Normal
- **Sensory:** Intact
- **Motor:** 5/5 in all planes
- **Range of Motion:** Normal in all planes but painful at ankle and metatarsophalangeal joints
- **Palpation:** TTP over navicular
- **Stress Test:** Negative

**Diagnosis:** Initial diagnosis was Stress fracture Bipartite navicular.

**Treatment:** The patient was managed with ice, non-weight-bearing, and referral to orthopedics. X-ray examination revealed no fracture.

**Follow-up:** At 6 weeks, the patient reported resolution of pain and returned to full activity with ongoing surveillance.

**Final Diagnosis:** Atypical ankle pain with weight-bearing but no TTP at follow-up. Her treatment plan was modified to accommodate knee abnormalities resulted in pain reduction, and in 2 months was able to return to full activity with ongoing surveillance.
malleolus, decreased left dorsiflexion range of motion, decreased left plantarflexion and inversion strength, a flexible flatfoot deformity, and pain with any attempt to run recreationally.

DIFFERENTIAL DIAGNOSIS:
1. Posterior Tibialis Tendon Dysfunction
2. Eversion Ankle Sprain
3. Foot/ankle fracture

TEST AND RESULTS:
Strength: Manual muscle testing 3+/5 with pain on left foot plantarflexion and inversion

Range of motion: Left talocalcaneal dorsiflexion 2° with knee extended and 5° with knee flexed to 90°

Ligamentous testing: Negative external rotation test, anterior drawer, and talar tilt
Neural testing: Negative sciatic nerve tension test with tibial nerve sensitization
Foot fracture: Negative Ottawa ankle rules

Functional Outcomes:
- LEFS 49/80
- Single leg Heel Rise Test: 0 reps

FINAL WORKING DIAGNOSIS: Stage II posterior tibialis tendon dysfunction

TREATMENT AND OUTCOMES:
1. Strengthening
   a. Barefoot short-foot exercise - 3 sets of 10 reps 1x/day
   b. Inversion strengthening with red resistance band - 150-600 reps for 3 sets per day
c. Double heel rise with unilateral descent - 3 sets of 10 reps 1x/day
d. Gluteal Strengthening
2. Stretching
   a. Barefoot gastroc and soleus stretches. 3 sets of 30 seconds 1x/day
3. Joint Mobilization
   a. Modified Mulligan technique into dorsiflexion for 3 sets of 30 seconds
4. Outcomes
   a. LEFS score improved from 49/80 to 71/80
   b. Single knee heel rise test increased from 0 to 16 reps
c. Range of motion with left dorsiflexion improved from 2° to 10° with full knee extension and from 5° to 15° with 90° of knee flexion
d. Strength improved from 3+/5 to 5/5 with PF and inversion
e. Patient reported 3 consecutive days of running 2 miles without pain

HISTORY
43 yr old F runner training for her 1st half marathon had an amputation of all 10 toes distal to MTP on October 2014 due to a systemic infection. By October 2016, she started a run/walk program and began to develop L lateral ankle pain, due to increased inversion during gait. After undergoing surgery to remove scar tissue from her lateral foot and re-align the EHL tendon to resist inversion, the lateral ankle pain decreased. However, when she attempted to run or walk long distances, she experienced medial lower leg pain. L>R, that progressed to a 7/10 on the L. Despite being told she wouldn’t be able run anymore, her goal was train for another half-marathon.

PHYSICAL EXAM:
1. Callus formation L 5th metatarsal, suggesting increased lateral loading
2. Pain/tenderness noted on the medial lower leg BIL, L>R
3. Limited calcaneal eversion on the L and ankle DF on the R
4. Weakness of the inverters, everters, and plantarchloxors BIL
5. Weakness of the Hip ABD, EXT and ER L>R. Lower abdominals were also very weak
6. Running Gait (w/custom orthotics and a cushioned running shoe)
    Rearfoot striker BIL.
    Increased hip ADD, IR and pelvic drop BIL.
    L inverted and toed-in at foot strike
    Increased L arch drop during mid support

Pain was 3/10 on the L. When cued to toe out on the L, symptoms reduced and shifted to the calf.

WORKING DIAGNOSIS
Posterior tibialis tendinosis L>R due to weakness and reduced mobility in foot/ankle, along with medialization of the leg due to Hip ADD and IR.

TREATMENT AND OUTCOMES
1. Weaned pt. slowly out of orthotics to reduce lateral loading
2. Transition to minimal shoes for walking to promote foot/ankle strength
3. Increase mobility of foot/ankle
4. Transition to minimal shoes for walking to promote foot/ankle strength
5. Increase mobility of foot/ankle
6. Promote foot/ankle function and control with balance and plyometrics
7. Increase hip/core strength to improve dynamic alignment
8. Gait retraining to reduce toe in, inv at foot strike and improve alignment proximally

OUTCOME: Pt was discharged March 2018 running 30 min 3x/wk pain-free in a low profile partial cushion shoe W/Orthotics. She exhibited improved foot alignment and reduced hip add, IR and CPD. Pt continued to wear full minimal shoes during her cross-training. She was able to wear high heels for the first time since her amputations without pain. In Sept 2018, she completed her half marathon pain-free.

TREATMENT:
1. Strengthening L>R due to weakness and reduced mobility in foot/ankle
2. Transition to minimal shoes for walking to promote foot/ankle strength
3. Increase mobility of foot/ankle
4. Promote foot/ankle function and control with balance and plyometrics
5. Increase hip/core strength to improve dynamic alignment
6. Gait retraining to reduce toe in, inv at foot strike and improve alignment proximally

OUTCOME: Pt was discharged March 2018 running 30 min 3x/wk pain-free in a low profile partial cushion shoe W/Orthotics. She exhibited improved foot alignment and reduced hip add, IR and CPD. Pt continued to wear full minimal shoes during her cross-training. She was able to wear high heels for the first time since her amputations without pain. In Sept 2018, she completed her half marathon pain-free.
Purpose:
1) To determine in a cohort of highly trained athletes whether the integrated ventilatory response to progressive hypoxia at rest (HVRREST) and during exercise (HVREX) are comparable, and 2) to determine whether HVREX is related to the degree of performance impairment in hypoxia.

Methods:
Sixteen endurance-trained men (VO2peak: 62.6 ± 6.2 ml·kg⁻¹·min⁻¹) and ten healthy young women walked on a treadmill at seven speeds (4.2-6.2 mph) and two inclines (0° and 2°). A Hypoxico 5570 Everest Summit II Altitude training system was used to simulate hypoxic conditions. Each condition was performed three times with no more than 5 minutes between trials. Hyperventilation (ΔV̇E, ΔHR, ΔSPO2, ΔpE) was measured during hypoxic exercise and compared to normoxic exercise. The contribution rate of EE, VE, and HR in response to changes in SpO2 would be different between the sexes. We hypothesized that women would experience greater EIAH, and that the contribution rate of EE, V̇E, and HR to predict ΔSpO2, (hypoxia-induced reduction), we obtained a very strong fit model both for men (r² = 0.907, P < 0.001) and for women (r² = 0.957, P < 0.001).

Results:
1) HVRREST may not be an appropriate or applicable measure to predict the degree of performance impairment in hypoxia and normoxia. Using a multivariate model that combined EE, V̇E, and HR to predict ΔSpO2, we obtained a very strong fit model both for men (r² = 0.907, P < 0.001) and for women (r² = 0.957, P < 0.001). We also tried to estimate the relative contributions of AEE, ΔV̇E, and ΔHR to predict ΔSpO2, but the proportion of explained variance was lower.

Conclusions: These findings suggested that high-altitude adaptation in response to hypoxia has different underlying mechanisms between men and women. Our results can help to explain how men and women adapt high-altitude environments.
Hypoxic Exercise Performance with an Antihistamine: Influence of Aerobic Fitness

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May 30 2:10 PM - 2:20 PM

Hypoxic Exercise Performance and Hypoxic Exercise Performance with an Antihistamine: Influence of Aerobic Fitness

At altitude, impairments in pulmonary oxygen diffusion and oxygen delivery have a detrimental effect on endurance exercise tolerance. Analogues of over-the-counter antihistamines have been shown to improve oxyhemoglobin saturation ($\dot{O}_{2}$) and oxygen delivery during heavy exercise, but hypoxic performance outcomes have not been studied. Purpose: To determine the effect of the antihistamine, cetirizine (Zyrtec®) on hypoxic exercise performance in recreationally active subjects. Methods: Eight subjects [6 men, 2 women; age = 22 ± 1 yr; VO$_{2max}$ = 44.3 ± 8.3 ml·kg$^{-1}$·min$^{-1}$ (range: 32.0-55.2 ml·kg$^{-1}$·min$^{-1}$)] completed constant load exercise at 45% and 65% of normoxic VO$_{2max}$ and an 8 km time trial in conditions of normoxia (NORM), hypoxia with placebo (HYP+P), and hypoxia with cetirizine (HYP+C). Subjects inspired 15% oxygen to simulate an altitude of 2.500m for HYP+P and HYP+C and were given a 10mg fixed-dose of cetirizine one hour prior to exercise for HYP+C. Measures of S$_{O_{2}}$ via pulse oximetry and muscle tissue oxyhemoglobin concentration ([$OxyHb+Mb$]) of the vastus lateralis via near infrared spectroscopy were continuously measured throughout exercise. Results: There was no significant difference ($P > 0.232$) in S$_{O_{2}}$ between HYP+P and HYP+C during the 45% (89 ± 6% vs. 89 ± 4%) and 65% (87± 6% vs. 85 ± 5%) constant loads. The cetirizine intervention had a significant effect ($P = 0.005$) on S$_{O_{2}}$ [$OxyHb+Mb$ (%) during the 65% constant load with a difference between HYP+P and HYP+C (28 ± 45% vs. +1 ± 16%). There was no difference in 8km time trial times between HYP+P and HYP+C (18.08 ± 2.87 min vs. 17.03 ± 1.92 min, $P = 0.112$, $d = 0.63$). However, co-varied by VO$_{2max}$, cetirizine had a significant effect ($P = 0.047$) on 8km time trial performance with a difference of 1.06 min [95% CI [0.01, 2.11]] between HYP+P and HYP+C. VO$_{2max}$ accounted for 53% of the variance in time trial performance changes between interventions. Conclusion: Cetirizine improves endurance exercise performance in hypoxia with a larger effect on individuals with lower VO$_{2max}$. The cetirizine intervention resulted in greater skeletal muscle oxygenation at 65% VO$_{2max}$ with hypoxia. These results would suggest that cetirizine does not improve S$_{O_{2}}$, but improves hypoxic exercise performance perhaps through enhanced oxygen delivery to the skeletal muscles.
1741 Chair: Robin Queen, FACSM, Virginia Tech, Blacksburg, VA. 
(No relevant relationships reported)

1742 Board #1 May 30 3:45 PM - 5:45 PM 
**Effect of Lower Extremity Static Alignment on Dynamic Valgus in Adolescents Following ACL Reconstruction**

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PURPOSE: Knee abduction moments may lead to valgus collapse, potentially causing ACL rupture. The contribution of static lower extremity alignment to knee abduction moments is unknown. This study assessed relationships among lower extremity static alignment and dynamic kinematics and kinetics during side-step cutting in uninjured adolescent athletes.

METHODS: This retrospective study included 8 adolescents with recent unilateral ACL reconstruction (mean age 14.8 yr, SD 1.2; 3/8 female). Frontal plane hip to ankle imaging (EOS) was used to measure mechanical axis deviation (perpendicular distance from the center of the femoral condyles to the mechanical axis line connecting the center of the femoral head to the center of the talar dome) and tibial-femoral angle. 3D motion capture provided lower extremity kinematics and kinetics during quiet standing and loading (initial contact to peak knee flexion) of an anticipated 45° side-step cut; 2-3 trials per limb were averaged for analysis. Relationships among imaging, static motion capture and dynamic motion capture measures were investigated using correlation, and backward stepwise linear regression was used to evaluate potential predictors of average dynamic knee abduction moment.

RESULTS: Regardless of surgical status, standing knee abduction angle was correlated with standing hip abduction (r=0.60, p<.002) and ankle eversion (r=0.85, p<.0001) along with longer mechanical axis deviations (r=0.83, p=0.0001) and higher knee abduction on EOS (r=0.44, p=0.09). Dynamic knee abduction moment was best predicted by a combination of EOS knee abduction angle, standing ankle eversion, standing knee abduction, standing knee rotation, ankle eversion during cutting, along with ground reaction force and age (R²=0.94, p<.0004). There was no significant relationship between knee abduction moment and side (surgical vs. contralateral) (p=0.63).

CONCLUSIONS: In this small group of adolescent athletes with recent ACLR, knee abduction moment during side-step cutting was related to age and anatomic lower limb alignment in addition to dynamic factors such as ankle positioning and ground reaction force. Anatomic alignment or standing posture with greater hip abduction, knee abduction, and ankle eversion may indicate a higher risk for injury during dynamic activities.

1743 Board #2 May 30 3:45 PM - 5:45 PM 
**Wearable Sensor-based Classification Of ACL Reconstructed Limbs During Exercise In Male And Female Patients**

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Purpose: Early identification of subtle, sub-clinical, aberrant motion characteristics in patients with ACL reconstructed knees can inform rehabilitation and return to sports decision making. Wearable sensors enable characterization of movement in native sport and activity environment. The purpose of the study was the ability of a machine learning algorithm to accurately classify male and female participants’ reconstructed limb from the contralateral healthy limb using inter-limb movement variability from sensor data during walking and jogging. Methods: We evaluated 109 patients (23.5±10.2 yr, 172.6±9.6 cm, 73.4±16.7 kg) with primary, unilateral and uncomplicated ACLR at approximately 6 months from index surgery. All participants walked for 5 minutes at 3 mph and jogged for 3 minutes at 6mph on a treadmill. Subjects were fitted with 5 wireless sensors (Shimmer3 IMU Unit, Dublin, Ireland) secured bilaterally on the wrists and ankles and around the waist at the sacrum. Accelerations from the sensors were continuously monitored during the walking and jogging trial. The multi-dimensional time-varying biomechanical data captured by the sensors were processed to generate a graphical model and matrices to represent the cause-and-effect relationship in inter-limb movement. The matrices extracted from the sensor data were used to train machine learning algorithms and then these trained algorithms were evaluated to classify participants’ ACLR limb from their contralateral healthy limb. The performance of these trained algorithms was calculated to generate the individual classification accuracy. Results: While walking, the trained algorithms were able to classify the ACLR limb in males with 81.5% accuracy and females with 73.7% accuracy. While jogging, ACLR limbs were classified with 76.7% accuracy in males and 83.0% accuracy in females. Conclusion: Cause-and-effect analysis of inter-limb movement variability demonstrated a high level of accuracy in classifying an injured ACLR limb from a healthy contralateral limb during exercise. The accuracy of classification may be influenced by gait speed and sex.

1744 Board #3 May 30 3:45 PM - 5:45 PM 
**The Impact of a Functional Knee Brace on Sports Performance Following ACL Reconstruction.**

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Reported Relationships: W.E. Garrett: Industry contracted research; Don Joy Orthopadics.

Up to 250,000 anterior cruciate ligament (ACL) injuries occur in the United States annually with most athletes undergo an ACL reconstruction. No literature has examined physical performance during return to sport (RTS) and the impact of a functional knee brace. Braces have been shown to improve mechanics, but compliance remains an issue due to performance concerns.

PURPOSE: To determine differences in performance between braced (B) and non-braced (NB) tasks across time (RTS and six weeks following RTS (RTS+6)). We hypothesize that performance will improve across time with no differences between brace conditions.

METHODS: ACL patients (n=40; 20 male, 20 female) were enrolled after being RTS. Participants were provided a custom fit knee brace and instructed to wear the brace for all activities more dynamic than walking. A series of tasks (40 yard dash, 5-10-5 shuttle run, vertical jump, broad jump, and a triple hop) were completed at RTS and RTS+6. Each participant completed three practice trials and two recorded trials. Task and brace condition order was randomized. The ACL-RSI, IKDC and a VAS pain scale were completed. A 2X2 (time: RTS, RTS+6 by brace: B, NB) repeated measure ANOVA for performance measures and a paired t-test for patient reported outcomes were performed.

RESULTS: Participants (height: 1.7±0.1 m; weight: 75±15 kg; age: 18.6±3 yr) demonstrated improvements in ACL-RSI (p<0.003) and IKDC (p<0.001) with no difference in VAS pain (p=0.297). Performance declined during the 40yd Dash, vertical jump, and broad jump in the B condition. Performance improved across time for the broad jump and triple hop (Table 1).

CONCLUSIONS: Brace condition differences were small (40yd Dash: 0.1 sec, Vertical Jump: 0.5 in, Broad Jump: 0.9 in) and nonexistent and would not likely lead to noticeable sport deficits. Performance concerns should be minimal in ACL patients looking to RTS when wearing a knee brace.

ACKNOWLEDGMENTS: This work was supported by a DonJoy Orthopadics grant.
Abnormal lower extremity (LE) biomechanics post-anterior cruciate ligament reconstruction (ACLR) may increase re-injury risk and reduce sports performance. Although most athletes return to sport (RTS) within 1 year from ACLR, the timeline for recovery of LE kinetics and kinematics during athletic tasks is not well defined. Identifying specific movement deficiencies will guide rehabilitation efforts to promote successful RTS and reduce re-injury risk. Purpose: To evaluate vertical ground reaction forces (vGFR) and hip, knee, and ankle kinematics during running and jumping in elite collegiate athletes 4, 6, and 9 months post-ACLR.

Methods: Twelve Division 1 athletes (age 20.5 ± 1.2, BMI 24.9 ± 3.6, 6 female) performed maximal countermovement jumps (CMJ) and treadmill running at a maximally comfortable speed 4.0 ± 0.3, 6.1 ± 0.5 and 8.9 ± 1.5 months post-surgery while whole body kinetics were recorded. vGFR impulses, knee flexion excursion, and peak sagittal plane hip, knee, and ankle joint angles were obtained during the stance phase of running (RUN) and the eccentric, concentric (CON), and landing (LAND) phases of running. Measurements of vGFR impulses were computed for all variables and effect sizes (ES) were calculated. LSIs at each interval were evaluated using the Wilcoxon Signed-Ranks test.

Results: At 4 months post-surgery, all CMJ and RUN asymmetries were significant (LSI: 69.5-95.9%, p < .023, ES: 46-62). Involved limb CMJ CONC phase and RUN vGFR impulses were significantly less than uninvolved limb values at all intervals (LSI: 85.7-94.2%, p < .005, ES: .58-63). RUN peak joint angle and knee flexion excursion asymmetries were significant at all intervals (LSI: 69.5-94.7%, p < .013, ES: .51-62). Involved limb CMJ CONC phase knee (LSI: 90.6-98.6%, p < .041, ES: .42-62) and ankle (LSI: 80.2-86.1%, p < .010, ES: .53-62) angles were reduced throughout, while no CMJ LAND phase asymmetries were detected 9 months post-surgery.

Conclusions: Despite excellent surgical care and high volumes of rehabilitation, elite collegiate athletes present with LE kinetic and kinematic asymmetries 9 months post-surgery, after or close to typical RTS. In particular, knee joint kinematics during the stance phase of running and the CONC phase of the CMJ are categorically asymmetric and should be addressed with targeted interventions.

Purpose: The aim of this study was to identify strength, power and biomechanical differences between male athletes who made a pain free return to play (RTP) and those that did not at 9 month post ACL reconstruction.

Methods: Nine months after ACLR 158 males athletes who had returned to pre-injury sport participation (64 reporting knee symptoms/94 reporting none) carried out strength and power testing and planned and unplanned 30° change of direction (CoD) as well as an IKDC questionnaire. Differences in IKDC, strength and jump height measures on the ACLR side and in symmetry between groups were analysed. Paired t-tests were employed to compare vGFR and vertical jump height between the two limbs by four groups (1-2 years, 2-5 years, 5-10 years, >10 years) separately.

Results: Based on available data (N=38, 30 males, 8 females; 1-2 years: N=8; 2-5 years: N=10; 5-10 years: N=10; >10 years: N=8), paired t-tests showed no statistically significant differences in peak knee moment (sagittal plane: p=0.613, frontal plane: p=0.340, horizontal plane: p=0.284) and peak vGFR (p=0.166) in drop vertical jump test. Also, no statistical significant difference was detected in peak knee moment (sagittal plane: p=0.101, frontal plane: p=0.955 horizontal plane: p=0.341), peak vGFR (p=0.384) and peak vertical jump height (p=0.876) in single-limb hops. The findings were consistent when the data was analyzed based on the 4 follow-up time groups. CONCLUSIONS: The biomechanical function of knees undergoing this procedure appears to be no different compared to the uninjured side at 1-2 years, 2-5 years, 5-10 years, and >10 years following ACLR-ITB procedure. The current data support a long-term safety of the ACLR-ITB procedure for skeletally immature athletes with complete ACL tears.

Purpose: Five Division 1 athletes returned to sport following anterior cruciate ligament injuries and had undergone ACLR in the past. The purpose of this study was to examine LE symptomatic differences in strength and jump measures on the ACLR side and in symmetry between groups.

Methods: Nine months after ACLR 158 males athletes who had returned to pre-injury sport participation (64 reporting knee symptoms/94 reporting none) carried out strength and power testing and planned and unplanned 30° change of direction (CoD) as well as an IKDC questionnaire. Differences in IKDC, strength and jump height measures on the ACLR side and in symmetry between groups were analysed. Paired t-tests were employed to compare vGFR and vertical jump height between the two limbs by four groups (1-2 years, 2-5 years, 5-10 years, >10 years) separately.

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Purpose: The aim of this study was to identify strength, power and biomechanical differences between male athletes who made a pain free return to play (RTP) and those that did not at 9 month post ACL reconstruction. Methods: Nine months after ACLR 158 males athletes who had returned to pre-injury sport participation (64 reporting knee symptoms/94 reporting none) carried out strength and power testing and planned and unplanned 30° change of direction (CoD) as well as an IKDC questionnaire. Differences in IKDC, strength and jump height measures on the ACLR side and in symmetry between groups were analysed. Paired t-tests were employed to compare vGFR and vertical jump height between the two limbs by four groups (1-2 years, 2-5 years, 5-10 years, >10 years) separately.

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Athletes demonstrate neuroplastic changes and altered neuromuscular control after anterior cruciate ligament reconstruction (ACL-R). Conflicting reports of impaired balance and cognitive performance exist for dual-task balance following ACL-R. Thus, significant gaps remain in understanding altered postural control strategies in this population. PURPOSE: To understand altered postural control strategies in ACL-R individuals in the presence of sensory, motor, and cognitive challenges. METHODS: Fourteen ACL-R (20.7±2.0 yr, 76.9±19.1 kg, 1.7±1.4 m, 6.7±1.9 Tegner) and 14 matched healthy control participants (CON) (21.2±1.4 yr, 75.4±15.3 kg, 1.7±1.5 m, 7.4±1.4 Tegner) were analyzed. Three 20-second trials of single-leg balance (ACLR limb, matched side for CON) were performed under the following conditions: eyes open (EO), eyes closed (EC), dual cognitive (DC), and dual motor (DM). DC involved mental addition every two seconds and DM required participants to catch a ball from a ball machine every 2 seconds. Traditional center of pressure (CoP) measures of 95% confidence ellipse area (EA) and medial-lateral root-mean-squared error (RMS_ml) were calculated after a 5 Hz 4th-order Butterworth low-pass filter. These measures were log transformed to satisfy model assumptions. Sample entropy (SEn) and approximate entropy (EA) were also observed. RESULTS: The ACLR group had increased CoP dispersion (e.g., ln(EA); ACLR: 7.74± 0.78 mm², CON: 7.47± 0.91 mm², P<0.003) and increased CoP signal regularity (SEn; ACLR: 0.78 ± 0.20, CON: 0.86 ± 0.23, P<0.001). Significantly interactions were also observed for SEn, EA, and RMS_ml that suggest the ACLR group impairments are most pronounced during the DC condition (e.g., 95% confidence interval for CON – ACLR for DC SEn: (0.03, 0.35), P<0.01). CONCLUSION: Altered postural control is present following ACLR compared to healthy controls. A cognitively-challenging task resulted in greater ACLR-specific balance alterations compared to closing eyes or a motor dual-task. These findings are consistent with ACLR individuals adopting a more intentionally-focused approach to postural control.

Altered Center of Pressure Dispersion and Regularity during Dual-Task Balance following Anterior Cruciate Ligament Reconstruction

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(No relevant relationships reported)

RESULTS: When performed to failure, low-load training with and without BFR have similar muscle strength and hypertrophy despite differences in perceived pain. Supported by NSERC, CFI and ERA

Investigating the Use of Vibration Platform And Blood Flow Restriction As A Warm-up Procedure

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(No relevant relationships reported)

PURPOSE: To determine if low-load resistance training to repetition failure with/without BFR elicits similar muscular strength, hypertrophy and perceived pain.

METHODS: Seven young (25±1 yr) males were recruited to perform single-leg Smith-machine squats 3 d/wk for 6 wk. Each leg was randomly assigned to perform 30% 1-RM with (BFR) or without BFR (RT) for 3 sets to repetition failure with 100% of rest after each set. Tourniquet pressure was set at 60-70% of the lowest occlusive pressure and remained inflated throughout the 3 sets. Leg strength (1-RM), muscle hypertrophy (leg lean mass; LLM) by dual-energy X-ray absorptiometry, and ultrasound derived vastus lateralis (VL) muscle thickness (MT), were measured before and after the 6-weeks. A visual analog scale (1000 point) was used to assess pain after each set and rest period for the 1st, 4th, 8th, 11th and 15th training session. RESULTS: 1-RM increased similarly in both groups after training (BFR 79±13 to 95±13 kg vs. RT 82±13 to 100±13 kg, P<0.002) and VL MT (BFR: 2.69±0.08 to 2.98±0.1 vs. RT: 2.75±0.16 to 2.96±0.1 cm, P<0.016) with non-significant changes in LLM (BFR 7.29±0.38 to 7.40±0.39 vs. RT 7.28±0.37 to 7.34±0.36 kg, P=0.243). There was an increase in perceived pain with BFR training compared to the RT group across all sessions following the first rest period (BFR: 288±25 vs. RT: 155±9 a.u., P<0.05) and second rest period (BFR: 433±31 vs. RT:160±10 a.u., P<0.05). While there was a trend for a decrease in pain over time with repeated training, this effect was non-significant. CONCLUSIONS: When performed to failure, low-load training with and without BFR have similar muscle strength and hypertrophy despite differences in perceived pain. Supported by NSERC, CFI and ERA

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Altered Center of Pressure Dispersion and Regularity during Dual-Task Balance following Anterior Cruciate Ligament Reconstruction

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(No relevant relationships reported)
POURPOSE: Hypoxia (HYPER) increases O2 delivery to the working muscles together with an improved lactate metabolism, power output and endurance compared to normoxia (NORM) (Cardinale & Ekblom, 2017). Considering the O2 delivery limitation and the exercise induced hypoxemia at exercise intensities near to maximum it was hypothesized that muscle mitochondrial oxidative phosphorylation (OXPHOS) capacity would be upregulated along with a higher endurance performance following endurance interval training with HYPER compared to NORM. METHODS: 23 trained cyclists, age 35.3±6.4 years (mean ± standard deviation (SD)) body mass 75.2±9.6 kg, height 179.2±7.9 m, and VO2max 4.5±0.7 L min⁻¹ performed 6 weeks endurance training on a cycle ergometer consisting of supervised HIT sessions 3 days/week (3x 8 min) and additional long slow distance training 2 days/week. Cyclists were randomly assigned to either HYPER (FI02 0.30, n=12) or NORM (FI02 0.21; n=11) breathing condition during training in a single blinded study design. VO2max, OXPHOS capacity in permeabilized fibers and in isolated mitochondria, and 20 min cycle performance were tested pre and post intervention. RESULTS: Over the intervention change in VO2max (HYPER 1.1±3.8%, NORM 0.0±3.7%; p = 0.55, ES= 0.08), mass-specific mitochondrial respiration (HYPER 27.3±46.9%, NORM 16.5±49.1%; p = 0.21, ES=-0.06), intrinsic mitochondrial respiration (HYPER 26.1±80.1%, NORM 15.9±73.3%; p = 0.66, ES= 0.69) and mean power output during 20 min trial (HYPER 6.0±3.7%, NORM 2.4±5.0%; p = 0.073, ES= 0.32) did not statistically significantly differ between the groups. CONCLUSIONS: These data showed that 6 weeks hypoxia-supplemented high-intensity interval-training on a cycle ergometer was not superior to conventional training at sea level in improving VO2max, intrinsic and mass-specific mitochondrial respiration and cycle performance in already trained cyclists. Therefore, despite the small meaningful positive effect in cycling performance that might be relevant in sport, considering the cost/benefit of performing hypoxia-supplemented HIT, it is questionable whether this strategy is worthwhile in maximizing endurance performance in already trained cyclists.

POURPOSE: This investigation measured local microcirculation, neuromuscular activation and systemic metabolic in women during bilateral knee extension exercise in five conditions: high load [80% of one repetition maximum (1RM)] without blood flow restriction (BFR), (HL), low load (30%1RM) without BFR (LL) and low load (30%1RM) with 40% (BFR40%), 60% (BFR60%), 80% (BFR80%) of arterial occlusion pressure. METHODS: 18 healthy young women (17.6±0.6 kg/m²) performed four sets of extension exercise with 60 s rest in five conditions. Variables of microcirculatory function [Oxygen saturation (SO₂), relative hemoglobin (rHb), blood flow (flow) and blood velocity (velo)] and neuromuscular activation of the vastus lateralis (VL) and the whole blood lactate (WBL) were measured across different time points. Finally, calculating the repetitions of five conditions. RESULTS: SO₂ in HL and LL were similar during whole process (HL: 79.2±19.1%, LL: 72.4±18.20%) which were significantly higher than the other conditions (P<0.05). Flow was highest in BFR80 with the other conditions were similar (e.g., set1: 213.1AU for BFR vs–196.3 AU for other conditions). After exercise, velo in BFR80 (56.8±1.2AU) was higher than the other conditions (51.8±1.3AU, P<0.005). HB did not change in all conditions. L resulted in greatest activation during the first two sets when exercise is taken to failure (e.g., set1: 69.3%MVIC in LL vs~47.9%MVIC in other conditions). After exercise, WBL was highest in BFR80, and lowest in HL (BFR80=LL>BFR40>BFR60=HL). Changes in SO₂ and muscle activation were similar between pressures, while higher pressure led to fewer repetitions during exercise. CONCLUSIONS: Low-load exercise to failure results in a greater neuromuscular response to that of high-load exercise in underweight women. When different pressures are applied to low-load exercise, there are considerable changes in microcirculation and metabolism, among which BFR80 has the characteristics of greater perfusion and blood metabolic conditions.

POURPOSE: The purpose of this study was to examine the effects of blood flow restriction (BFR) and whole-body vibration (WBV) on hemodynamics, muscle temperature, flexibility, and explosive power. METHODS: Twenty-five subjects (14 females (age = 24±2.7 years) and 11 males (age = 24±3.5 years) completed the study, which involved following 6 sessions: a 5-min (5-WBV) and a 10-min (10-WBV) lower-body warm up on a vibration platform, a 5-min (5-BFR) and a 10-min (10-BFR) lower-body warm up using blood flow restriction cuffs, and a 5-min (5-CYC) and a 10-min (10-CYC) warm up on a cycle ergometer. For the BFR session, cuffs were placed on the uppermost portion of the thigh. Inflation began at 120 mmHg and was progressively increased to 240 mmHg, which was based on the subject’s thigh circumference and capillary perfusion. Squat exercises were performed between the knee angle of 90-180 degrees for 5 or 10 sets (each set lasted 60 s with a 60 s rest in between sets) on a vibration platform at 30 Hz with low amplitude or a flat surface while wearing BFR cuffs. Pre and post-exercise data included hemodynamics, quad and hamstring temperature, flexibility, and explosive power index were recorded. Explosive power was measured using a jump mat, where 60 maximum exertion jumps were performed, with mean ground contact time (GCT), mean vertical jump height (MVJ), and explosive power index (EPI) for the first 15 and last 15 jumps. Hemodynamics, muscle temperature, and flexibility were again recorded following the explosive power index test. RESULTS: There was no condition*time interaction or condition main effect for GCT, MVJ, and EPI, but there was a time main effects for all three variables (p<0.01). There were significant condition and time main effects and condition*time interaction for heat rate (p<0.01), time main effect for systolic blood pressure (p<0.01) and flexibility (p<0.01). Significant time main effect and condition*time interaction were detected for quadricep (p<0.01) and hamstring muscle temperatures (p<0.01). CONCLUSIONS: Our findings indicate that all the conditions and durations investigated resulted in similar responses in flexibility and jump performance. Future studies should examine different pressure settings of BFR and/or frequency/amplitude setting of WBV on the variables tested in the study.
compared to the non-BFR conditions (70% = +4.3 ± 20.2, 80% = +11.8 ± 5.5, 90% = +7.25). No differences in TOI between A50 (-36.93 ± 0.8) and any BFR conditions were observed. RPE was greater during 90%BFR (18.0 ± 0) and 80%BFR (17.1 ± 1.1) compared to 70% (11.3 ± 0.6) and 90% (13.0 ± 0). No differences were observed between 70%BFR (14.6 ± 0) and non-BFR conditions. Conclusion: This study demonstrated that cycling with the addition of BFR at an intensity equivalent to 70% of VT may provide a balance between physiological strain and perceived exertion.

**METHODS**: Well-trained cyclists (n=9) (VO_{2\text{max}} = 55.4±10.4 ml∙kg^{-1}∙min^{-1}). During the mission, decrements in PO due to shorter rest times were associated with lower SmO2. Kinetics responses were assessed by maxima of the cross correlation (CCFmax) and CCFmax(HR) at MD-8 (r = -0.839, P < 0.001), changes in CCFmax(HR) at MD-8 correlated significantly with CCFmax(V'O_2musc) at MD-8 (r = -0.641; P = 0.014) and the difference in V'O_2peak correlated with V'O_2peak at MD-8 (r = -0.614; P = 0.019).

**CONCLUSIONS**: Exercise training during forty-five days of confinement in combination with sleep restrictions, may prevent from losses in cardio-muscular kinetics. Those individuals who started with slow kinetics or a low V'O_2peak benefited from the exercise training during the mission. The volume and/or intensity of the exercise training intervention might have been higher during the HERA C4 missions compared to most of the crew members’ everyday life activities.

**PURPOSE**: To date, fourteen healthy individuals (5 females, 9 males, 37±7 y, 173±11 cm, 67±7 kg) participated. They conducted a 60 min pedaling exercise at 60% of VO_{2\text{max}} under either “heat and hypoxic condition (H+H)” (FiO₂ :14.5%, 33℃), “hypoxic condition (HYPO)” (FiO₂ :14.5%, 23℃) or “normoxic condition (NOR)” (FiO₂ :21%, 23℃). After completing the exercise, subjects remained in the chamber for 3 h to evaluate metabolic and endocrine responses during post-exercise. We evaluated changes in muscle oxygenation (using NIRS) during exercise, blood variables, percutaneous oxygen saturation (SpO₂), muscle temperature during exercise and 3 h of post-exercise.

**RESULTS**: SpO₂ was significantly decreased both under H+H and HYPO (P<0.01). Blood lactate level increased during exercise (P<0.05), but with no difference between the three conditions. Serum growth hormone level significantly increased (P<0.01), and H+H showed significantly higher level compared with HYPO (P<0.05). Serum EPO level was significantly increased in both H+H and HYPO 3 h after exercise, but no difference was observed between the two conditions.

**CONCLUSIONS**: Serum EPO level was significantly increased with endurance exercise under hypoxic conditions. However, heat stress during endurance exercise in hypoxia (heat and hypoxic condition) did not augment the EPO response.

**Thematic Poster - Combined Environmental Stressors**

**PURPOSE**: This study revealed that the imposed sprints caused reciprocal changes in the extent of SmO2 and PO that are larger than the changes in a self-paced weekday and 8 h at the weekends. Differences in V'O_2 restricted to below 85% of the age-related maximum. Sleep was restricted to 5 h per day during the mission, decrements in PO due to shorter rest times were associated with lower SmO2. Kinetics responses were assessed by maxima of the cross correlation (CCFmax) and CCFmax(HR) at MD-8 (r = -0.839, P < 0.001), changes in CCFmax(HR) at MD-8 correlated significantly with CCFmax(V'O_2musc) at MD-8 (r = -0.641; P = 0.014) and the difference in V'O_2peak correlated with V'O_2peak at MD-8 (r = -0.614; P = 0.019).
contribute to apparent task-specific responses. PURPOSE: To examine the isolated and combined effects of ambient temperature [cool (18°C, 20% rh) vs hot (35°C, 20% rh)] and inspired oxygen content [normoxia (FiO₂: 0.21) vs hypoxia (FiO₂: 0.16)] on neuromuscular function in response to a cycling TT. METHODS: Five physically active male participants (23 ± 6 years) performed four 20-km cycling TTS in different environmental conditions [cool/normoxia (COOL); hot/normoxia (HOT); cool/hypoxia (HYPO); hot/hypoxia (H-H)]. Neuromuscular responses of the soleus, as indicated by changes in rectified EMG (RMVC), M-wave (p=0.007, 1.03 ± 0.09 mV), and voluntary activation (VA), were assessed prior to and following each time-trial. Linear mixed model analyses were used to examine the neuromuscular responses, with fixed effects for each condition and a random intercept for participants. RESULTS: Time-trial performance was impaired during HOT (2211 ± 85s; 192±18W), HYPO (2311 ± 122s; 192±27W), and HH (2214 ± 117s; 192±27W) compared to COOL (2090 ± 54s; 221±14W, p=0.02). Similar reductions in MVC (-0.12 ± 0.06%) and VA (-14.0 ± 9.6%) were observed across all conditions (p=0.05); however, no significant differences were observed in M-wave (p=0.09) or Qtw (p=0.43). CONCLUSION: Neuromuscular impairments following 20-km cycling TT are attributed to central mechanisms (i.e., VA); however, neuromuscular adaptations were similar in conditions where heat stress and hypoxia were combined, to conditions where each environmental stressor was examined in isolation.

During sprint exercise in hypoxia, anerobic energy supply is increased with augmented blood volume in muscle. Exposure to heat stress also increases anaerobic energy supply and blood volume in the muscle. Therefore, the combined treatments of “hypoxic exposure” and “heat stress” may cause further increases in anaerobic responses. PURPOSE: To determine the effect of combined heat and hypoxic conditions on physiological responses to repeated sprint exercise. METHODS: Ten male athletes (19.6 ± 0.3 yrs, 173.3 ± 2.2 cm, 71.6 ± 1.8 kg) completed repeated sprint exercise (three sets of 3 × 10 s maximal pedaling exercise) under four different conditions: [1] control condition (CON), [2] hypoxic condition (HYPO, 20 °C, FiO₂: 14.5 %), [3] hot condition (HOT, 35 °C, FiO₂: 20.9 %), [4] combined hot and hypoxic conditions (HH, 35 °C, FiO₂: 14.5%). Power output, muscle oxygenation in vastus lateralis (evaluated by near infrared spectroscopy (NIRS)), respiratory variables and arterial oxygen saturation (Sao₂) were continuously monitored throughout the exercise. We also measured skin and muscle temperature, heart rate, and blood variables (blood lactate, glucose, pH, PO₂, PCO₂, levels). RESULTS: HYP and HH showed significantly lower average oxygen uptake (CON: 2.3 ± 0.1 L/min, HOT: 1.9 ± 0.1 L/min, HYP: 2.4 ± 0.1 L/min, HH: 2.0 ± 0.1 L/min) and average Sao₂ (CON: 94.8 ± 0.6 %, HYP: 89.5 ± 0.5 %, HOT: 94.8 ± 0.5 %, HH: 89.5 ± 0.4 %) compared with CON and HOT (p=0.05). Muscle temperature was significantly higher in HOT and HH compared with CON and HYP throughout the exercise (p=0.05). Furthermore, HOT and HH presented significantly greater peak power output in the first set of the exercise compared with CON and HYP (p=0.05). No significant difference among trials was observed for changes in blood variables, and muscle oxygenation in vastus lateralis. CONCLUSIONS: Peak power output was higher in HOT and HH, although HH showed lower oxygen uptake and S ao₂. These results suggest that combined heat and hypoxic conditions (HH) would cause greater power output than control condition in spite of decreased aerobic energy supply.

Exercise stress that results in increased expression of heat shock protein 72 (Hsp72) is linked to physiologic adaptations. Adaptations to one environmental stressor, such as heat, increase Hsp72 and induce cross adaptations to other stressors (i.e., hypoxia). Previously, two bouts of downhill running (DHR) conferred classic markers of heat acclimation (lower TC, earlier onset of sweating). We sought to increase Hsp72 through repeated DHR to potentially expedite the acclimation process. PURPOSE: To analyze the effect of DHR on exercise performance in normoxic and hypoxic conditions. METHODS: 8 males (23.8 ± 5.8 years, VO₂max 54.1 ± 5.1 ml kg⁻¹ min⁻¹, 13.6 ± 5.2% body fat) performed two 45-minute DHR bouts (-12.5% grade) separated by 5-7 days in the speed that elicited V̇E, while running downhill. Pre and post blood samples were collected to quantify monocyte Hsp72. Muscle soreness (DOMS) was assessed 24 and 48 hours after each downhill bout using a Likert scale. Two normobaric hypoxic (10% FiO₂) 5 km time trials (TT) were performed: one before any DHR and one 5-7 days after the last bout. Hydration was assessed before the TT while blood lactate was measured pre and post TT. During the TT, heart rate, RPE and O₂ saturation (SaO₂) were recorded every 1 km. RESULTS: Monocyte Hsp72 showed no change across time (p=0.53). Specifically, basal concentration from DHR 1 to DHR II were not different (3.5 ± 2.3 to 2.9 ± 1.5 AU). TT performance was similar between conditions (1377 ± 192; 1364 ± 174 sec). Hydration (1.018 ± 0.007; 1.013 ± 0.009 urine specific gravity), RPE (14.9 ± 1.1; 14.6 ± 1.3), HR (178 ± 818 ± 8), and blood lactate (post TT 11.6 ± 1.8; post TT 12.0 ± 3.1 mM) were similar in both TTs. However, SaO₂ significantly increased from TT1 to TT2 (84.5 ± 4.0; 87.2 ± 2.3%, p=0.05). DOMS was significantly lowered (24 (5.1 ± 0.8 to 3.5 ± 1.4, p = 0.00) and 48 (4.6 ± 1.0 to 2.6 ± 1.5, p = 0.00) hours following the second DHR trial when compared to the first trial. CONCLUSIONS: While no change in Hsp72 or TT time were observed, this could be due to large variations found in the data with these variables. The increase in SaO₂ after DHR may improve exercise capacity at elevation during moderate exercise intensities.
D-41 Thematic Poster - Energy Metabolism and Health

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-104B

1765 Chair: Tanya M. Halliday, University of Utah, Salt Lake City, UT. (No relevant relationships reported)

Board #1
May 30 3:30 PM - 5:45 PM
Pre-intervention Endothelial Function and Hyperglycemia Modifies Flow-mediated Dilatation Following Short-term Exercise Training in Adults with Prediabetes
Stephanie L. Miller, Natalie Z.M. Eichner, Nicole M. Gilbertson, Emily M. Heistion, Arthur Weltman, FACSM, Steven K. Malin, FACSM, University of Virginia, Charlottesville, VA. (Sponsor: Steven K Malin, FACSM)
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Purpose: Impaired glucose tolerance (IGT) elevates type 2 diabetes and cardiovascular disease (CVD) risk above and beyond impaired fasting glucose (IFG) alone. Hyperglycemia can impair endothelial function through increased inflammatory responses. However, it is unknown whether exercise training vascular function differently among prediabetes phenotypes. We examined whether improvements in endothelial function following 2-wks of aerobic training is affected different in adults with IFG+IGT compared to those with IFG alone. Methods: Middle-aged, obese adults with IFG (n=11), IFG+IGT (n=13) and IFG (n=15) were randomized to LCD or LCD+INT training program in inactive, middle-aged men with overweight/obesity.

RESULTS: Regardless of modality, exercise training for 6 weeks induced improvements in total glucose and insulin AUC measures in response to an OGTT (P=0.04, respectively). Pre AIx0min correlated with increased Si after treatment (r=-0.44, P=0.03). Conclusion: Independent of exercise, LCD reduces post-prandial aortic waveform and MetS severity in obese women. Decreased systemic arterial stiffness appears to be related to insulin sensitivity following reduced energy availability, given no effect on cPWV.

1766 Board #2
May 30 3:30 PM - 5:45 PM
Low-Calorie Diet With or Without Interval Exercise Reduces Post-Prandial Aortic Waveform in Obese Women
Emily M. Heistion, Nicole M. Gilbertson, Natalie Z.M. Eichner, Steven K. Malin, FACSM, University of Virginia, Charlottesville, VA. (Sponsor: Steven Malin, FACSM)
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Purpose: Arterial stiffness is considered a strong predictor of cardiovascular disease (CVD). Women have higher values of arterial stiffness than men, suggesting that females are at a greater risk of heart-related complications. While a low calorie diet (LCD) reduces arterial stiffness, in part through lowering metabolic syndrome (MetS) risk factors and/or increasing insulin sensitivity, no study has tested if interval exercise (INT) adds to the benefit of LCD on arterial stiffness in obese women. Methods: Twenty-four obese women (42.2 ± 4.7yrs; 70.9 ± 2.3 kg/m2) were randomized to LCD (n=12; mixed meals of -1290 kcal/d) or LCD+INT (n=12; 60 min/d of supervised INT at 90% HRpeak for 3 min and 50% HRpeak for 3 min). An additional 350kcal was provided to LCD+INT post-exercise to equate energy availability between groups.

Augmentation index (AIx, systemic aortic waveform adjusted for heart rate of 75 bpm) and carotid-femoral pulse-wave velocity (cPWV, central index) were measured during a 75g OGTT before and after the intervention to assess arterial stiffness. MetS risk severity (z-scores) and insulin sensitivity (Si; simple index of insulin sensitivity) were also measured. Results: LCD+INT increased V02peak (L/min) and HDL compared to LCD (P=0.03 and P=0.04, respectively). However, both interventions decreased body fat, fasting SHP, TG, total cholesterol, MetS severity and LDL (all P<0.01) as well as improved Si (P<0.03). Despite no effect on fasting AIx (LCD: -3.2 ± 3.2 vs. LCD+INT: -2.7 ± 3.8% P=0.32) or cPWV (LCD: -0.22 ± 0.54 vs. LCD: -0.73 ± 0.83 P=0.76), LCD and LCD+INT decreased AIx correlated with pre fasting DBP (r=0.4, P=0.04) and decreased AIx0min (r=-0.45, P=0.03). Further, this decreased AIx0min correlated with increased Si after treatment (r=-0.44, P=0.03).

Conclusion: These data highlight that impaired endothelial function and increased FMD adaptation was linked to decreased circulating VCAM after training. Further work is warranted to determine how dietary manipulation, with and without exercise, impacts fasted vs. post-prandial arterial stiffness to optimize CVD risk reduction.

1767 Board #3
May 30 3:30 PM - 5:45 PM
Effects of Exercise Modality on Glycemic Control After 6 Weeks of Training in Middle Aged Men
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Purpose: To investigate changes to glycemic control after a 6 week exercise training program in inactive, middle-aged men with overweight/obesity. METHODS: Thirty-five men (39.6 ± 2.4 y, BMI: 28.8 ± 3.7 kg/m2; mean ± SD) enrolled in a 6-week training study and were randomly stratified (by lean body mass) to one of three training groups (endurance cycling (END, n=12); high intensity interval training (HIIT, n=12); resistance training (REX, n=11)) in a parallel groups design. Two-hour OGTTs were conducted as secondary analyses on two occasions (pre and post intervention) and total AUC (trapezoid method) was calculated. Statistical analyses were performed using linear mixed models (group × time), with significance set at P<0.05.

RESULTS: For glucose variables, there were no differences between groups at baseline (fasting glucose: 5.2 ± 0.6 mmol/L; AUC: 13.7 ± 3.2 mmol/L). A main effect of time for lower post-intervention total AUC glucose was observed (t= 0.7 ± 2.0 mmol/L; P=0.043). Fasting glucose concentrations showed a group × time interaction (P=0.008) where REX training increased fasting glucose levels post-training (+0.4 ± 0.5 mmol/L; P=0.005). Training modality had a similar effect on fasting insulin or total insulin AUC. However, a main effect of time was observed for the reduction in total AUC insulin from pre to post intervention (+15 ± 42 mU/mL/h; P=0.046).

CONCLUSIONS: Regardless of modality, exercise training for 6 weeks induced improvements in total glucose and insulin AUC measures in response to an OGTT in middle-aged men with overweight/obesity. The small improvements in glycemic control are likely related to the normal glycemic tolerance at baseline. Future investigations of exercise modality should be performed in individuals with abnormal glucose tolerance to determine if exercise modality is an important factor in improving glycemic control.

ACKNOWLEDGEMENTS: This study was funded by ACURF grants to Dr Camera and Dr Parr.

1768 Board #4
May 30 3:30 PM - 5:45 PM
Effect of Exercise Training Intensity on Glycemic Control in Older Adults with Prediabetes
Jennifer Blankenship, PhD, Edward L. Melanson, FACSM,a Victoria A. Catacci,b Kenneth P. Wright,c Jane E.B. Reusch,b Kerrie Hildreth,b Seth Creasy,b 1University of Colorado Anschutz Medical Campus, Aurora, CO. 2University of Colorado Boulder, Aurora, CO. 3Australian Catholic University, Melbourne, Australia.
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INTRODUCTION: Older adults have the highest rates of prediabetes and diabetes in the US. Exercise is a well-established method to improve glycemic control, however, the optimal dose (duration and intensity) of exercise required to improve glycemic control among older adults is unclear. PURPOSE: To compare the effect of 12 weeks of moderate vs. high intensity exercise training on daily glycemic control in older adults with prediabetes. METHODS: 15 older adults (66.4 ± 5.1 yrs) with prediabetes (HbA1c 5.7-6.4% or fasting glucose 100-125 mg/dl) participated in a 12-week supervised aerobic exercise training intervention. Participants were screened prior
to being randomized to the moderate (MOD: 60-65% HRmax) or vigorous (VIG: 80-85% HRmax) intensity training group. During the intervention, participants exercised 4 days per week (45 minutes/session) in their target heart rate range. Continuous glucose monitors (CGM) were worn for 1 week at baseline and during the 12th week of supervised exercise training. Daily glycemic control was quantified over 24 hour periods (00:00 to 23:29) for each day the CGMs were worn during the week at baseline and after exercise training. We calculated mean, total area under the curve (trapezoidal method), and duration of hyperglycemia (percent time glucose ≥340mg/dL). Using linear mixed models with repeated measures, we determined the effect of exercise training and whether the effect of training varied by exercise intensity group. Significance was set at p < 0.05. Data are reported as mean/SD. SUMMARY OF RESULTS: There were no significant differences in any baseline participant characteristics (e.g., sex, age, BMI) between exercise training groups. At baseline, VIG had significantly lower mean (MOD: 136.0 ± 11.4; VIG: 122.6 ± 7.4 mg/dL), total area under the curve (AUC) (MOD: 2342 ± 505.1; VIG: 2873.4 ± 226.2 mg•h/μL), and duration of hyperglycemia (MOD: 38.5 ± 28.6%; VIG: 19.9 ± 9.6%). After the intervention, there were no significant changes in mean glucose, AUC, or duration of hyperglycemia in either group. CONCLUSION: Regardless of exercise intensity, 12 weeks of aerobic exercise training did not significantly change daily glycemic control in older adults with prediabetes, suggesting that changing other lifestyle factors may be needed to improve glycemic control in this population.

**1770 Board #5 May 30 3:45 PM - 5:45 PM Nutritional Intervention Increases the Likelihood of Menses in Exercising Women with Menstrual Disturbances**

Rebecca J. Mallinson1, Nancy I. Williams, FACSM1, Emily A. Southmayd1, Daniel J. Mallinson1, Mary Jane De Souza, FACSM1. 1Penn State University, University Park, PA. 2Penn State Harrisburg, Middletown, PA.

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Exercising women in whom energy intake is inadequate for energy expenditure develop low energy availability (EA) and are at risk for menstrual disturbances and poor bone health. The first line of treatment is an increase in energy intake to reverse low EA. REFUEL is the first randomized controlled trial (RCT) to assess the effectiveness of 12 months of increased energy intake on menstrual function and bone health in women with exercise-associated menstrual disturbances (EAMD). Purpose: To determine if an intervention of increased energy intake improves menstrual regularity among women with EAMD.

Methods: Young, exercising women with EAMD were randomized into two groups. The treatment group (EAMD+Cal) received increased energy intake 20–40% above baseline energy needs; whereas, the EAMD Control group (n=30) maintained exercise and eating habits. Menstrual function was tracked throughout the intervention with menstrual calendars and daily urine samples for reproductive hormones. A conditional recurrent events Cox Proportional Hazards model tested the effects of the intervention.

Results: The EAMD+Cal women (21.6 yrs, BMI: 20.2 kg/m²) increased energy intake by 353 kcal/day (p=0.001 vs. Control) and gained 1.9 kg of body weight (p=0.035 vs. Control), which corresponded with a 1.2 kg increase in fat mass (p=0.080 vs. Control) and 64% increase in leptin (p=0.074 vs. Control); whereas, the EAMD Controls (20.9 yrs, BMI: 21.3 kg/m²) experienced no changes in body weight (0.8 kg), fat mass (0.4 kg), and leptin (21% increase). After controlling for BMI and menstrual status at baseline, the intervention had a positive effect on the likelihood of experiencing menses vs. the Control group (p<0.001). Women in the EAMD+Cal group were twice as likely (104% increase) to experience menses during the intervention than those in the EAMD Control group. Conclusions: Exercising women with EAMD who moderately increased energy intake were twice as likely to experience menses vs. EAMD women who maintained their usual exercise and eating habits. The intervention was associated with a modest increase in body weight. This study is the first RCT to demonstrate the effectiveness of a nutritional intervention for the improvement of menstrual function in women with EAMD. Supported by US DoD (PR054531)

**1771 Board #6 May 30 3:45 PM - 5:45 PM Sensitivity And Specificity Of Resting Metabolic Rate Measures To Predict Exercise Associated Menstrual Disturbances**

Nicole C.A. Stock, Kristen J. Koltun, Emily A. Southmayd, Nancy I. Williams, FACSM, Mary Jane De Souza, FACSM. Pennsylvania State University, University Park, Pa.

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Energy deficiency in exercising women can lead to menstrual disturbances (MD). There is no gold standard to accurately estimate energy deficiency. Ratios of measured to predicted resting metabolic rate (RMR) have been used as a proxy to categorize women as energy deficient. PURPOSE: To evaluate whether measured to predicted RMR ratios as a proxy for energy availability were better at identifying amenorrhea or other MD. METHODS: We performed a cross-sectional comparison of 223 exercising women (≥2 hrs/wk, age 18-35 yrs, BMI 16-30 kg/m²) who were ovulatory (OV), amenorrheic (AMEN), or subclinical MD (sMD) (including oligomenorrhea, anovulation, and luteal phase defects). Menstrual status was determined using urinary measures of reproductive hormones and menstrual calendars. Body composition was measured with DXA and RMR with the SensorMedics Vmax. Harris-Benedict, Cunningham, and DXA equations were used to calculate predicted RMR, RMR, and DXA-RMR and to calculate the measured to predicted RMR ratio. ANOVA and Kruskal-Wallis tests determined group differences and logistic regression determined predictors of AMEN or any MD. Calculations of sensitivity, specificity and positive predictive value (PPV) assessed accuracy of predictions. RESULTS: Groups did not differ in lean or fat mass. AMEN had lower body mass (p<0.01) than sMD, and lower BMI, percent body fat, mass (p<0.001) and measured MND (1172 ± 21 kcal/d) (p<0.05) than OV (1227 ± 20 kcal/d) and sMD (1233.6 ± 17 kcal/d). OV was lower in AMEN (1402 ± 8 kcal/d) vs sMD (1434 ± 9 kcal/d) (p<0.05). OV ratio was lower in AMEN vs OV (0.88 ± 0.01) vs OV (0.90 ± 0.01) (p=0.05), but only DXA-RMR ratio was predicted any MD (r=0.795, p<0.001). OV-RMR ratio correctly identified the most women with AMEN (ppv=0.5; specificity=0.49; sensitivity=0.74) and with any MD (AMEN+sMD; ppv=0.75; sensitivity=0.39; specificity=0.75). CONCLUSIONS: Each ratio may be used to predict energy deficit, but only DXA-RMR significantly predicts MD, regardless of severity. Similarly, DXA-RMR ratio correctly identified the most subjects. DXA-RMR ratio can be utilized to correctly identify women with AMEN or MD to secondary energy deficiency.

**1772 Board #7 May 30 3:45 PM - 5:45 PM Effect of Interval Exercise Plus a Low-Calorie Diet on Endothelial Function in Obese Women**

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PURPOSE: Low caloriized (LCD) and interval exercise (INT) both improve endothelial dysfunction, in part, by reducing hyperglycemia. Whether adding INT to LCD improves endothelial function in obese women (47.2±2.6y, 37.5±1.3kg/m²) was randomized to 2-wks of a LCD (n=12; mixed meals of 1000-1200kcal/d) or LCD+INT (n=13; 60min/d of supervised INT at 90% and 50% HRmax for 3 min each). LCD+INT subjects received 356kcal post-exercise to equate energy availability with LCD. A 75g OGTT was performed pre- and post-test to examine fasting, 1h and 2h large conduit artery endothelial function (FMD, flow mediated dilation) and substrate use (respiratory exchange ratio (RER) via indirect calorimetry) as well as glucose and insulin incremental area under the curve (iAUC) and insulin sensitivity (IS; Matsuda Index). Fitness (VO2peak), body composition (BioPod), and vascular inflammation (VCAM, ICAM, ICAM) were also determined.

RESULTS: LCD+INT increased VO2peak (P<0.002) compared to LCD, and both treatments improved fasted fat mass (P<0.001), IS (P<0.02), and ICAM (P<0.002). LCD+INT and LCD had no effect on fasting and iAUC FMD, but there was notable variation. In fact, low baseline fasting and iAUC FMD was linked to enhanced fasting and iAUC FMD post-treatment (r=0.71, P=0.001, r=0.89, P=0.001, respectively). When comparing subjects who increased fasting endothelial function after each treatment (>50%; LCD n=5, LCD+INT n=7), LCD+INT increased fasted FMD more than LCD (6.3 vs. 2.8%, P<0.04), and LCD+INT attenuated FMD iAUC compared to LCD (-499.3 vs. 64.6%, P<0.001). Enhanced fitness related to increased fasting FMD (r=0.43, P=0.03) and attenuated FMD iAUC (r=-0.44, P=0.05). Attenuated FMD iAUC correlated with reduced glucose iAUC (r=0.55, P=0.004), as well as increased fasting and 1h RER (r=-0.55, P=0.004 and r=-0.42, P=0.04, respectively). CONCLUSIONS: There was large FMD post-treatment variation. However, INT enhanced the effect of LCD on fasting FMD in those with low endothelial function, and this was mirrored by low post-prandial FMD stimulation. Low post-prandial FMD was linked to improved glucose tolerance and carbohydrate metabolism, suggesting INT enhanced nutrient delivery and utilization to lower type 2 diabetes and CVD risk.
**Purpose:** Postnatal exercise has been shown to reduce postprandial glucose (PPG) response to a greater degree than preprandial exercise, suggesting an important yet under-acknowledged role for exercise timing on glycemic control. Whether diurnal timing of exercise imparts additional benefits on PPG responses remains unclear. This study aimed to determine the diurnal effect of exercise on PPG response in individuals enrolled into a 12-week supervised multi-modal exercise training program.

**Methods:** Forty sedentary overweight individuals (17 males, 23 female; age: 51 ± 13 years; BMI: 30.9 ± 4.2 kg/m²) with (n = 20) or without T2DM diagnosis were randomly allocated to either a morning (amEX) or evening (pmEX) exercise training group. All participants completed the 12-week supervised multi-modal exercise training program (3 days per week), which consisted of 30 minutes of aerobic exercise (walking protocol) and 4 resistance-based exercises (3 sets of 12-18 repetitions). The amEX and pmEX training sessions occurred in the postprandial state between 0700-0900h and 1700-1900h, respectively. Changes in postprandial glucose (PGP) and insulin (PPI) responses, during a mixed meal tolerance test (MMTT) were the primary outcome measures of the study assessed at baseline and post-intervention at 12 weeks. All data is displayed as mean differences ± SD.

**Results:** Exercise training reduced (main effect of time, p < 0.01) PPG and PPI concentrations during the MMTT, with no group differences observed (p = 0.69). A significantly greater reduction in PPG (ΔAUC) was observed for the pmEX group (-75.56 mmol/L) compared to the amEX group (-33.22 mmol/L) at post-intervention (p = 0.03). Reductions in PPI aAUC (main effect of time, p = 0.01) were observed at post-intervention, with no group differences reported (p = 0.18).

**Conclusions:** Irrespective of the diurnal timing of exercise performance, 12-weeks of multi-modal exercise training significantly improved PPG and PPI responses in both overweight non-T2DM and T2DM individuals.

**Conclusion:** Female athletes in similar or same sports sustain more concussions than males. The reason for this is unclear. Few studies have directly compared the number of impacts and head acceleration in boys and girls sports at the high school level. One previous study compared boys and girls hockey and also found that boys had a higher number of impacts but girls had a slightly higher average PLA, which is similar to our findings.
Youth flag football has been proposed as a safe alternative to tackle football due to rising concerns of neurodegeneration from repetitive blows, but the true head impact (HI) burden in youth flag football is unknown.

**PURPOSE:** To examine overall and age-specific HI exposure and magnitude in youth flag football.

**METHODS:** Five youth flag football teams (n = 35, age = 8.5 ± 1.1 yrs, height = 138.5 ± 10.5 cm, mass = 35.3 ± 8.8 kg) comprised of two age groups (7-8Us and 9-10Us) wore HI sensors (Triax Sim-G) during practice and game sessions over one season. Sensors recorded HI frequency, linear (g), and rotational acceleration (rad/s²). Athlete exposure was calculated as one player participating in one practice or game session. Impact rates (IR) were calculated as impacts per 10 athlete exposures. Impact rate ratios (IRR) compared session type and age groups. Acceleration values were placed into low- and high-magnitude categories via median splits. Magnitude category frequencies were compared between age groups using χ² tests (*p<0.05*).

**RESULTS:** We observed 203 overall flag football HIs (127 game, 76 practice; 5.8 impacts/player, 0.6 impacts/exposure). Overall median linear acceleration was 32.7g (16.0g - 100.9g) and angular acceleration was 4,300 rad/s² (1,000 rad/s² - 12,500 rad/s²). 90th percentile accelerations were 63.0g and 8,400 rad/s² during games and 49.5g and 8,200 rad/s² during practices. Participants experienced significantly higher HIs during practices than games (IRR = 1.54, 95% CI: 1.16-2.05). There were no age group HI differences overall (IRR = 1.12, 95% CI: 0.83-1.51) or for games (IRR = 1.15, 95% CI: 0.80-1.64). Practices resulted in 1.80 times the IR in the 9-10Us compared to the 7-8Us. No significant associations between age groups were observed for low- and high-magnitude HIs for linear (p = 0.73) or angular acceleration (p = 0.32).

**CONCLUSIONS:** Flag football players experienced a low-frequency of HIs and relatively high-magnitude magnitudes, but whether high-frequency or magnitude HIs contribute to neurodegeneration is unknown. Practices had greater odds for HI frequencies than games, suggesting practice modifications can further decrease total HI. The 9-10Us experienced greater HI frequencies, potentially indicating more aggressive or risky game play with age.
Repetitive head impact exposure can result in brain injury, and impact sensors are increasingly being used to quantify head impact kinematics and patterns of risk in sports. Water polo is a contact sport that carries a risk of head impact from the ball and contact between players. However, monitoring head impacts presents a challenge since the sensors must be waterproof and small enough to be worn in a water polo cap. The SIM-G (Triax Technologies) sensor meets these criteria, but a validation of the SIM-G in a water polo cap has not yet been published.

**METHODS:**

A SIM-G sensor was placed in i) a water polo cap and ii) a headband. Each headgear was fitted to a 50th Percentile Male Hybrid III head and headform (HF). A linear impactor impacted the HF at seven sites and four velocities (1.7, 2.7, 4.7, and 6.4 m/s). Head impact accelerations were recorded for all impacts. SIM-G reliability was tested using a series of regression analyses to compare PLA, PRA, and PRV to HF values. Differences in the regression coefficients were tested by the interaction term (i.e., magnitude x headgear). Accuracy was tested using a mixed model ANOVA with sensor (HF, SIM-G) as a repeated measure and headgear (cap, headband) as a between-trial factor. Interactions were decomposed with post hoc Bonferroni-corrected t tests.

**RESULTS:**

The SIM-G sensor reliably quantified PLA, PRA, and PRV relative to the HF (β=0.599, t[151]=6.682, p<.001) independent of headgear (p=.191). Regarding accuracy, there were sensor x headgear interactions [F(1,153)=29.383, p<.001, η²=0.161]. Relative to the HF, the SIM-G overestimated PLA, PRA, and PRV when mounted in the water polo cap and underestimated PRV when mounted in the headband (p<.001).

**CONCLUSION:**

The SIM-G sensor demonstrated sufficient reliability for quantifying in the water polo cap and headband. However, due to sensor inaccuracy, relative metrics, rather than absolute impact magnitudes, are advised when calculating head impact exposure.
PURPOSE: To investigate whether physical exercise (PE) is differentially associated with global and domain-specific cognitive trajectories (memory, language, visuospatial skills, attention) among Apolipoprotein E (APOE) ε4 carriers and non-carriers.

METHODS: We included 2,060 community-dwelling individuals aged 70 years and older (50.5% males, 26.6% APOE ε4 carriers). Participants were cognitively unimpaired at baseline, and underwent serial cognitive testing and self-reported assessment of PE engagement in middle (between 50-65 years of age) and late-life (within one year prior to assessment). We calculated linear mixed-effect models comparing three PE groups (light intensity such as leisurely walking or slowly dancing; at least moderate intensity such as hiking or swimming; at least vigorous intensity such as jogging or tennis singles) versus a none PE reference group (defined as each level of PE carried out less than once per week). Models were adjusted for age, sex, education and medical comorbidities, and run separately for mid- and late-life PE.

RESULTS: Among APOE ε4 non-carriers, mild-moderate light PE was associated with less decline in memory (time x PE interaction coefficient 0.044, p < 0.01); mild-moderate vigorous PE was associated with less decline in memory (0.033, p = 0.05); and light-moderate vigorous PE was associated with less decline in visuospatial skills (0.020, p = 0.03). Among APOE ε4 carriers, light-moderate vigorous PE was associated with less decline in memory (0.067, p = 0.03), attention (0.083, p = 0.01) and global cognition (0.073, p = 0.02); and late-moderate moderate PE was associated with less decline in global cognition (0.048, p = 0.05).

CONCLUSIONS: Engaging in PE (light, moderate and vigorous) is associated with less decline in memory, attention, visuospatial skills and global cognition among community-dwelling older individuals, including those that are APOE ε4 genotype carriers who are at an increased risk of Alzheimer’s disease. Supported by NIH grants ROI AG07708, U01 AG066768, R01 AG034676; Robert Wood Johnson Foundation; Robert H. and Clarice Smith and Abigail Van Buren Alzheimer’s Disease Research Program; GHR Foundation; Editi Foundation; Arizona Alzheimer’s Consortium.

Steady-state aerobic exercise has been shown to improve information processing speed. However, the effects of high intensity interval training (HIIT) on information processing speed using surface electromyography (sEMG) is limited. Purpose: The purpose of this study was to compare the effects of a single session of either aerobic HIIT (HIIT-A) or aerobic/resistance HIIT (HIIT-AR) to a resting control group on information processing speed. METHODS: Participants (N=57, mAge = 23.1) provided consent and were randomly assigned into the HIIT-A (n=20), HIIT-AR (n=20), and control group (n=17).RESULTS: After 15EX on one trial to determine if HRmax was not related to carotid IMT (r = -0.16, p = 0.21), and cfPWV (r = -0.15, p = 0.26) were not significantly correlated with cognitive performance on the TMT-A and TMT-B. Age was correlated with cognitive performance on the TMT-A and TMT-B (r = -0.21, p = 0.05). Time to complete TMT-A (26±1 vs 23±1 seconds, F(1,57) = 7.15, p < 0.01) and TMT-B (57±2 vs 53±2, F(1,57) = 7.20, p < 0.01) increased after an acute bout of exercise compared to at rest. VO2max (r = -0.17, p = 0.21), and cfPWV (r = -0.15, p = 0.26) were not significantly correlated with cognitive performance on the TMT-A and TMT-B. Age was correlated with cognitive performance on the TMT-A and TMT-B (r = -0.21, p = 0.05). CONCLUSION: An acute bout of aerobic exercise may diminish cognitive performance among healthy older adults.
More competent decision makers report greater success in avoiding negative decision outcomes irrespective of general cognitive ability. While physically active young adults show more optimal executive functions, the relationship between daily moderate-to-vigorous physical activity (MVPA) patterns and decision-making competence (DMC) remains under-examined.

In this study, we assessed the relationship between accelerometer-measured sporadic and sustained MVPA to DMC in young adults. METHODS: We analyzed pre-intervention data from 220 participants (115 (52%) females, Mage = 24.3 ± 5.4 years, BMI = 24.4 ± 4.0 kg/m²) from the INSIGHT randomized controlled trial. MVPA was measured over 7 days with a hip-worn wGT3X-BT accelerometer. Valid wear time was defined as ≥4 days, ≥10 hr/d. Daily (min/d), bouts of sporadic (<10 consecutive min) and a MVPA ≥10 consecutive min; and frequency and min/d) were estimated using NHANES cut points. DMC was measured with the Adult-Decision Making Competence (A-DMC) battery and expressed as individual subtest scores and an A-DMC index (z-score). The relationships between MVPA and A-DMC variables were assessed with Spearman’s correlations for wear time, age, sex, education, intelligence, fat free VO2max, and extrinsic motives. Yet, overtraining and overreaching concerns exist. A promising monitoring method is heart rate variability (HRV), which tracks cardiac autonomic nervous system activity. PURPOSE: To examine differences in daily training cognitions for HIFT participants. Participants with workouts modulated based on HRV status were expected to report significantly better daily training cognitions.

METHODS: Participants included 55 healthy adults randomized to HIFT-HRV (intervention) or HIFT (comparison). HIFT-HRV participants (n = 26) were 23.7 ± 4.5 years, 46% female, body fat percentage (BF%) = 27.3 ± 9.8%, and VO2max = 44.4 ± 4.4 mL/kg/min. HIFT participants (n = 29) were 34.1 ± 4.1 years, 58.6% female, BF% = 32.4 ± 10.7%, and VO2max = 42.1 ± 6.8 mL/kg/min. The 11-week study included 2 weeks baseline waking HRV, baseline testing week, 3 HIFT weeks (5 sessions/week), mid-point testing week, 3 HIFT weeks (5 sessions/week), and post-intervention testing week. HRV was recorded daily via photoplethysmography using a smartphone app. Self-reported motivation to train and fatigue, during HIFT weeks, were collected prior to training with performance satisfaction (PS) and perceived effort (RPE) collected immediately following. The training-related cognitions were assessed using the Visual Analog Scale and RPE using Borg’s (6–20) scale.

RESULTS: No significant differences were found between groups at baseline. HIFT-HRV participants reported cognitions for 674 daily training sessions and HIFT participants reported cognitions for 763. Average motivation was significantly higher for the HIFT-HRV than the HIFT group, t(1435) = 2.41, p = .016. Average fatigue [t(1361) = 3.22, p = .001] and RPE [t(1271) = 5.68, p < .001] were significantly lower for the HIFT-HRV than the HIFT group. No significant differences were found for PS. CONCLUSIONS: HRV modulation during HIFT training resulted in greater daily motivation and lower daily fatigue and perceived exertion. HRV status is a promising method to monitor and modulate HIFT training and may facilitate adherence; future work could focus on applied interventions for existing HIFT populations.

Participants in group-based high intensity functional training (HIFT) maintain exercise enjoyment and intentions; those training ≥5 days/week report highest intrinsic and extrinsic motives. Yet, overtraining and overreaching concerns exist. A promising monitoring method is heart rate variability (HRV), which tracks cardiac autonomic nervous system activity. PURPOSE: To examine differences in daily training cognitions for HIFT participants. Participants with workouts modulated based on HRV status were expected to report significantly better daily training cognitions.

METHODS: Participants included 55 healthy adults randomized to HIFT-HRV (intervention) or HIFT (comparison). HIFT-HRV participants (n = 26) were 23.7 ± 4.5 years, 46% female, body fat percentage (BF%) = 27.3 ± 9.8%, and VO2max = 44.4 ± 4.4 mL/kg/min. HIFT participants (n = 29) were 34.1 ± 4.1 years, 58.6% female, BF% = 32.4 ± 10.7%, and VO2max = 42.1 ± 6.8 mL/kg/min. The 11-week study included 2 weeks baseline waking HRV, baseline testing week, 3 HIFT weeks (5 sessions/week), mid-point testing week, 3 HIFT weeks (5 sessions/week), and post-intervention testing week. HRV was recorded daily via photoplethysmography using a smartphone app. Self-reported motivation to train and fatigue, during HIFT weeks, were collected prior to training with performance satisfaction (PS) and perceived effort (RPE) collected immediately following. The training-related cognitions were assessed using the Visual Analog Scale and RPE using Borg’s (6–20) scale.

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CONCLUSIONS: Acute aerobic exercise improves cognitive performance in trained athletes. These effects are more pronounced when exercising for longer durations (~1hr), employing higher exercise intensities and/or more complex cognitive tasks.
activity (waist-worn ActiGraph GT3X-BT) were assessed in women for ≥4 days with ≥10 hours, in each trimester of pregnancy. This preliminary analysis (59% recruited) includes women with available birth records and valid activity data for ≥2 trimesters (n=56). Birthweight (BW) and GAD were abstracted from medical records. BW was categorized as LGA if ≥90th percentile (n=18, 31%). Mean (SD) percent time spent sedentary was calculated in each trimester and differences across trimesters were tested using linear mixed models. The association of SB with continuous GAD and odds of LGA were estimated in separate regression models for each trimester. All beta coefficients were standardized (std β) per SD and adjusted for pre-pregnancy body mass index. If SB was associated with outcomes, further models estimated the effect of replacing SB with light physical activity (LPA) or moderate to vigorous physical activity (MVPA).

RESULTS: Women spent a high percentage of time sedentary across trimesters: 1st (n=53) 64.0% (10.9); 2nd (n=56) 63.5% (9.5); and 3rd (n=47) 63.8% (10.4). SB did not differ across trimesters (p=0.792). Higher percent time spent sedentary in the first trimester was associated with lower GAD (std β=-0.45, p=0.038). Replacing first trimester SB with LPA (std β=0.48, p=0.037), but not MVPA (std β =-0.12, p=0.581), was associated with greater GAD. SB was not significantly associated with GAD in the 2nd (std β =-0.24, p=0.241) or 3rd (std β =-0.22, p=0.264) trimester. Odds of LGA was not significantly associated with SB in the 1st trimester. Odds of LGA was significantly lower in the second trimester compared to the first trimester. LPA was associated with lower odds of LGA (OR=0.53, 95% CI=0.31-0.91) and SB was associated with higher odds of LGA (OR=1.30, 95% CI=0.91-1.87).

CONCLUSIONS: Women in this study were highly and consistently sedentary across pregnancy. Higher LPA and lower SB during the first trimester may be advantageous for greater GAD, though risk for LGA offspring did not appear to be associated with SB.

1794 May 30 4:00 PM - 4:15 PM
Structured Exercise as a Potential Treatment Option for Prenatal Depression

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(No relevant relationships reported)

PURPOSE: To determine if there was a difference in post CES-D scores between the EG and CG.

RESULTS: There was no difference in post CES-D scores between the EG and CG (14.4±8.6 vs. 15.9±8.4, p=0.038). Replacing first trimester SB with LPA (std β=0.48, p=0.037), but not MVPA (std β =-0.24, p=0.241) or 3rd (std β =-0.22, p=0.264) trimester. Odds of LGA was not significantly associated with SB in the 1st trimester (OR=0.75, p=0.389), 2nd (OR=0.80, p=0.503), or 3rd (OR=1.03, p=0.932) trimester.

CONCLUSIONS: Women in this study were highly and consistently sedentary across pregnancy. Higher LPA and lower SB during the first trimester may be advantageous for greater GAD, though risk for LGA offspring did not appear to be associated with SB.
Differences of Plasma Metabolites in Prediabetes with Different Cardiorespiratory Fitness and the Effects of Exercise

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PURPOSE: To indentify the most significant plasma metabolites for higher and lower cardiorespiratory fitness (CRF) in pre-diabetes mellitus (PDM), and effect of aerobic exercise training on these metabolites. METHODS: All 80 PDM subjects were selected [age: (51.62±10.03) yrs; body mass index: (26.17±3.60) kg/cm²; 24 annual follow up]. CRF was measured directly with a graded exercise test. Exercise intervention program: 3 times/week, 50 min per session at 46%-64% VO2max, 3 month. Body composition was measured by dual-energy x-ray absorptiometry. Plasma metabolites were detected by ultra high performance liquid mass spectrometry (UPLC-MS), and metabolomics was measured by dual-energy x-ray absorptiometry. Plasma metabolites of 7 metabolites in different CRF groups, including PC (20:1/14:1), PC(18:3/16:0), lysoPC (16:0), Valine, isocitric acid, 3-hydroxyisocitric acid, Linoleyl carnitine. 3) After 3-month exercise training, the fasting and OGTT-2h glucose level of 61.11% of PDM subjects returned to normal; PDM subjects VO2max increased significantly (6.84%); but there was no significant correlation between the increase of VO2max and 7 metabolites. CONCLUSION: PC, lysoPC, Valine, isocitric acid and acylcarnitine were different in different CRF groups, they may be potential biological markers of CRF. Exercise intervention improved the glucose metabolism and CRF of prediabetes mellitus, but we hadn’t found the correlation between VO2max increase and 7 metabolites expression change after exercise, which needs more study. Supported by Key Projects of State General Sports Administration of China (2014B007), the National Key Technology Research and Development Program of Prevention and Control of Major Chronic Non-communicable Diseases(2016YFC1300202).

Longitudinal Associations of Physical Activity and Blood Lipid Levels in Midlife Women in SWAN

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RESULTS: Women were 46 years old, on average, at study entry. Forty-seven percent were non-Hispanic white; 29% were black; 9% were Japanese; 8% were Chinese, and 8% were Hispanic. Each additional one-unit increase in the sports and exercise physical activity index score was not associated with total cholesterol (mean difference=0.3; 95% CI: -0.4, 1.0) or LDL (mean difference=-0.2; 95% CI: -0.8, 0.4).

CONCLUSIONS: Moderate to vigorous physical activity is longitudinally associated with lower triglyceride levels and higher HDL levels in midlife women.

The Use Of Resistance Exercises To Interrupt Sitting: Acceptability And Impact On Sleepiness, Discomfort, And Fatigue

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Emerging research suggests cardiometabolic benefit from using simple resistance exercises to interrupt prolonged sitting, yet it is unclear if such programming is acceptable and can affect discomfort, fatigue, and sleepiness. Purpose: To examine the acceptability of hourly, brief resistance exercise bouts and the effects on subjective
ratings of discomfort, sleepiness, and fatigue. Methods: Fourteen adults (age 53.4±9.5 years, BMI 30.9±4.8 kg/m²) completed two 4-hour randomized simulated laboratory-based work conditions on separate days: prolonged sitting (SIT) and sitting with hourly resistance exercise breaks (REX). Acceptability was assessed after REX in 5 domains: 1) willingness to use REX, 2) confidence to use REX unsupervised, 3) co-worker acceptance of REX, 4) employer acceptance of REX, and 5) Feasibility of frequency and Amount of REX. During each 4-hr protocol, ratings of sleepiness (Karolinska Sleepiness Scale), discomfort, and fatigue (Physical Discomfort and Fatigue Questionnaire) were assessed at baseline and then hourly. Linear mixed models evaluated overall condition effects and differences at each hour following Bonferroni adjustment. Cohen’s d estimated magnitude of effects. Results: A majority of participants reported high to very high acceptability on the 5 domains of REX (Table). Overall physical discomfort (β=0.15 log-points, p=0.074, d=0.34), mental fatigue (β= 0.23 log-points, p=0.016, d=0.18), physical discomfort (β= -0.30 log-points, p=0.006, d=0.20), and sleepiness (β= 0.33 log-points, p=0.106, d=0.14) did not differ by condition. Mental fatigue was significantly lower (better) at 4 hours in favor of REX (β= -0.48 log-points, p=0.020, d=0.37). Conclusion: Hourly simple resistance breaks were rated as an acceptable method to interrupt prolonged sitting during work; however, REX did not improve discomfort, fatigue, or sleepiness compared to SIT. Investigating adaptations and acceptability with chronic usage are warranted.

### Table. Acceptability of Simple Resistance Exercise Breaks to Interrupt Sedentary Behavior

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<th>Frequency</th>
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<td>64.3%</td>
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**HISTORY:** A 56 year old female fell off of her horse, causing her to land on her right shoulder. She experienced immediate severe pain in her right shoulder and chest. She denied any head, neck or spine injury or pain, and denied numbness, weakness, paresthesia or headache. She reported no shortness of breath, abdominal pain or extremity injury or pain.

**PHYSICAL EXAMINATION:** The patient reported pain of 10/10 on arrival and had an elevated blood pressure. Other vital signs were normal. Primary survey was unremarkable. On secondary survey, head, neck and spine were normal. Ribs and abdomen were also normal. Examination of upper extremity revealed deformity of the right shoulder girdle with tenderness and swelling over the proximal right clavicle. The neuro-vascular exam of the upper extremities were normal and symmetrical. She was not able to move the right shoulder due to severe pain. The lower extremities were normal. Neurological examination was normal as was examination of the skin.

**DIFFERENTIAL DIAGNOSIS:**
1. Clavicle fracture
2. Sterno-clavicular (SC) dislocation
3. Rib fracture
4. Pectoralis muscle tear

**TESTS AND RESULTS:**
- Chest Xray, Clavicle Xray, Shoulder Xray - fracture medial right clavicle and possible dislocation of SC joint
- CT of Head and Cervical spine - unremarkable and without acute injury
- CT of Abdomen and Pelvis - unremarkable and without acute injury
- CT of Chest - fracture and posterior dislocation of the right SC joint with compression of the brachiocephalic artery and vein

**FINAL WORKING DIAGNOSIS:**
- Fracture and posterior dislocation of the right SC joint with compression of the brachiocephalic artery and vein

**TREATMENT AND OUTCOMES:**
- 1. Evaluation by Trauma Surgery, Cardio-Thoracic Surgery with admission to Orthopedics for operative repair
- 2. Taken to OR and under general anesthesia and fluoroscopic visualization, reduction of SC dislocation
- 3. Reduction was unstable and ORIF performed with trans-osseous sutures and reconstruction of capsule
- 4. Discharged next day on Xarelto for 8 weeks and no weight bearing of right upper extremity
- 5. Physical therapy for 8 weeks begun 2 weeks post op
- 6. Patient has returned to riding and experiences only minimal stiffness at right SC joint

**HISTORY:** 37 y/o African American female with history of anemia presented to ED with severe abdominal pain, tachycardia and rapidly progressive bilateral upper and lower extremity paralysis. She reported recently starting Boot Camp style workouts with intermittent fasting. She was admitted for 3 days initially and readmitted four days after being discharged with recurrence of symptoms.

**PHYSICAL EXAMINATION:** Vitals were within normal range. Normal respiratory effort but only able to speak 3-4 words per breath. Diffuse abdominal tenderness. She stated she had been taking diet pills and intermittent fasting. She was unable to move the right shoulder due to severe pain. The lower extremities were normal. Neurological examination was normal as was examination of the skin.


**TEST AND RESULTS:** MRI Head and Spine negative for lesions, nerve root compression or myelopathy. Creatine Kinase levels were mildly elevated. CT Abdomen/Pelvis was negative. CSF analysis and EMG testing suggested variant of Guillain-Barre Syndrome. Negative Inspiratory Force (NIF) testing remained within normal limits. No improvement with IVIG. Labs that were sent out during first admission came back during her second admission (4 weeks later) with dramatically elevated Urine porphobilinogens at 1529 mg/L (ref: <2mg/L). Stool porphobilinogens were also elevated.

**FINAL WORKING DIAGNOSIS:** Variegate Porphyria

**TREATMENT AND OUTCOMES:** The patient was started on high volume D10 IV (125mL/hr) for 2 days until IV Hemin was obtained from the only lab in the US that manufactures it. The patient showed mild improvement in motor function within one hour of starting IV Hemin drip. She required a full 7 day course of IV Hemin with gradual increase in motor function but not back to baseline. She underwent a second course of IV Hemin with further improvement in motor function. NGET was replaced by PEG tube for adequate nutrition. Four weeks later, she was discharged from Medicine Service to Acute Inpatient Rehab floor. She continued to improve and was able to return to oral diet and perform ADLs with assistance from family. She was discharged home after two months and moved out of town to live with family.

**THURSDAY, MAY 30, 2019**
History: A 50-year-old right-handed retired male boxer with no past medical history presented progressive weakness and muscle wasting of bilateral upper extremities. He denied any numbness, tingling or paresthesia, bowel or bladder incontinence, lower extremity weakness or dysphagia. Three weeks before symptoms started, he suffered a fall with impact in the forehead. The patient has a 17-year history of boxing career with a total of 250 combats.

Physical Examination: Generalized muscle atrophy and fasciculations observed in bilateral upper extremities. Full passive range of motion in bilateral upper extremities but limited active shoulder flexion and abduction and incomplete handgrip bilaterally. Strength was 2/5 in shoulder abduction, 3/5 in elbow flexion and extension, and in right wrist flexion and 0/5 in wrist extension. Sensation was intact to pinprick, soft touch and vibration. Deep tendon reflexes 1+ throughout upper and lower extremities.

Differential Diagnosis:
1. Cervical Polyradiculopathy
2. Central Cord Syndrome
3. Motor Neuron Disease: Brachial Amyotrophic Diplegia
4. Chronic Traumatic Encephalopathy

Tests and Results:

Electrodiagnostic Study: Normal sensory nerve conduction study (NCS). Motor NCS showed low amplitude in the right Median and Ulnar nerves. Electromyographic study revealed active denervation and reinnervation potentials in bilateral upper extremities. Fibrillation and positive sharp waves were observed in cervical and thoracic paraspinal muscles.

Brain MRI: Mild cerebral cortical atrophy. No other intracranial abnormality.

Final Working Diagnosis
- Motor Neuron Disease: Brachial Amyotrophic Diplegia.

Treatment and Outcomes:
1. Physical therapy for light strengthening and aerobic training.
2. Occupational therapy for assistive device and activities of daily living evaluation and training.
3. Referred to Neuromuscular Clinics for multidisciplinary management.
4. Started in Riluzole.
5. Referred to Speech and Swallow evaluation.
6. Followed up every 3 months to monitor neurological symptoms and remained stable with no signs of neurological deterioration.

1807 May 30 4:45 PM - 5:05 PM
Syncope On The Green - Golf
Noor Alzarka, Mark Chassay, FACSM. University of Texas Health Science Center at Houston, Houston, TX.

HISTORY: 22-year-old female collegiate Division I golfer presents with intermittent dizziness, palpitations, and pre-syncope symptoms. She reports a history of syncope as well. She also describes episodes of palpitations or subjective tachycardia at rest and in association with exertion. Symptoms worsen during strenuous weight training exercises. She does not use any prescription medications, supplements, or recreational drugs. Her father has a history of a cardiac arrhythmia and cardiac arrest. She seeks a history of syncope.

TREATMENT AND OUTCOMES: 1. Tangential skin stretch resolved the breathing distress and relieved most of the chest pain. 2. Manually patterned breathing allowed pain-free but apprehensive ROM spinal twisting and arm overhead reaching. 3. Symptom-free return to play 5 day post-injury. 1 month later, accepted 4-year athletic scholarship.

2. She was advised to self-monitor for pre-syncopal symptoms; to modify activities as needed, including using lighter weights, taking more breaks, and lying down to recover when needed; and to avoid pushing through symptomatic episodes.
3. The cardiac electrophysiologist also recommended optimizing hydration, including increased salt and electrolyte intake.
4. She was counseled about the possibility of serious injury resulting from syncope.

1808 May 30 5:05 PM - 5:25 PM
Assisted Breathing Manual Therapy for Soccer Chest-Trap Anterior Chest Wall Injury
John C. Hannon, private practice, San Luis Obispo, CA.

Email: feldenkrais.slo@gmail.com

Chest wall injury—Soccer
John C. Hannon, private practice, San Luis Obispo, CA

HISTORY: A17 year-old high school senior soccer left back, during the last quarter of a late-season game, chest-trapped a long and hard soccer ball experiencing instantaneous breathlessness and incapacitating anterior chest pain aggravated by deep breathing, head, spine and arm movement. At the ED, she experienced less intense symptoms. Later, she, and her parents, welcomed her continued chest pain (which increased with exertion, coughing, and difficulty breathing when running) would ruin her chances to be seen favorably by college soccer scouts. The next day she presented for manual therapy.

PHYSICAL EXAMINATION: Examination revealed a mild pectus excavatum with bilaterally painful 2nd and 3rd sterno-chondral joints and diminished respiratory excursion, accessory breathing muscle activity and elevated shoulders. Muscle splintering interfered with overhead reaching and spinal twisting. Interestingly, marked pain relief occurred with manual skin stretch tangentially applied in the left midaxillary line along the path of the 5th rib with the stretch directed posterior-to-anterior. Similar relief was obtained by firm pressure over the left costal diaphragm muscle attachments. Pain-free palpation of spinal, costo-chondral and costo-vertebral joints. SC, AC and GH joint play intact.


TEST AND RESULTS: Normal AP and Lateral chest-xray

FINAL WORKING DIAGNOSIS: Sternocostal sprain-Diaphragm strain

TREATMENT AND OUTCOMES: 1. Tangential skin stretch resolved the breathing distress and relieved most of the chest pain. 2. Manually patterned breathing allowed pain-free but apprehensive ROM spinal twisting and arm overhead reaching. 3. Reassurance, explanation of the mechanics of injury, breathing exercises.

4. Symptom-free return to play 5 day post-injury. 1 month later, accepted 4-year athletic scholarship.
Clinical Case Slide - Knee II

Thursday, May 30, 2019, 3:45 PM - 5:25 PM
Room: CC-105B

D-46

Title: Knee Pain - Swimming in Dangerous Waters

Authors: Lauren Nadkarni, MD and Kate Quinn, DO (sponsored by Heather Gillespie, MD, MPH, FACSM)

History:
A 17-year-old male with a non-contributory past medical history developed acute pain in his left knee while swimming 3 days prior to presentation. He experienced a popping sensation with hyperextension of his knee while treading water and throwing a rope swing to his friends on the bank of a river. He had immediate swelling and felt pressure on the lateral and posterior parts of his knee, associated with sharp and stabbing pain when straightening his knee. His pain was worse with flexion beyond 90 degrees, straightening his leg, or walking, but was improved with rest and ice. He did not have any give-way or locking episodes.

Physical Exam:
Office examination of his left knee was limited by guarding but demonstrated a very subtle posterior sag sign and a positive effusion. There were no overlying skin changes. His range of motion was 5 degrees of hyperextension to 110 degrees flexion actively and his flexion increased to 120 degrees passively. He also had mild posterior lateral joint line tenderness, negative patellar testing, and positive posterior drawer and lateral flexion pinch testing. His anterior drawer testing was negative, although he did exhibit guarding. His contralateral knee, ipsilateral hip/ankle, and neurovascular exams were unremarkable.

Differential Diagnosis:
- PCL injury
- ACL injury
- Lateral meniscus injury
- Posterior lateral corner injury
- Patellar subluxation
- Lateral tibial plateau contusion or fracture
- Lateral femur contusion or fracture

Tests and results:
- Left knee x-ray:
  - Normal anatomy with small effusion
  - No acute fracture

- Left knee MRI:
  - Isolated PCL rupture

Treatment and Outcomes:

- Isolated PCL rupture
- Physical therapy with initial avoidance of hamstring activation for the first 4 weeks
- Over the counter analgesics as needed
- Return to sports progression

Knee Pain and Effusion in a Medically Complex Patient

May 30 3:45 PM - 4:05 PM

Aubrey Armento. University of Colorado Denver; Denver, CO.
(Sponsor: John Hill, FACSM)
Email: aubrey.armento@childrenscolorado.org

HISTORY: An 8-year-old female presents with a chief complaint of left knee pain and swelling. The pain started one month ago with no acute inciting injury. The pain is located over the anterior knee and is exacerbated with running and bike riding and alleviated with rest and ice. The knee swelling worsens after activity. She has no warmth or erythema of the joint. She denies fever, rash, or other joint complaints. The patient has a history of isolated Langerhans cell histiocytosis of the pituitary stalk and diabetes insipidus, which was diagnosed a year ago. She takes an oral steroid burst and receives vinblastine for chemotherapy every three weeks.

PHYSICAL EXAMINATION: There is a palpable joint effusion of the knee without erythema or warmth. There is diffuse peripatellar tenderness to palpation. She has limited knee flexion to 110 degrees but full extension. Patellar grind test is negative. There is no patellar apprehension. The Lachman test, anterior and posterior drawer tests, varus and valgus stress testing, and McMurray’s test are all negative.


TESTS AND RESULTS: 1. X-rays of the knee showed no acute bony abnormality. 2. MRI of the left knee with and without contrast revealed a large joint effusion with enhancing synovitis but otherwise no abnormality. 3. Labs including a complete blood count (CBC), erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) were within normal limits other than the a slightly elevated CRP. 4. The patient had an ophthalmologic evaluation and was diagnosed with right anterior uveitis, so she was referred to Rheumatology.

FINAL WORKING DIAGNOSIS: Juvenile idiopathic arthritis

TREATMENT AND OUTCOMES: The patient underwent a steroid injection of the left knee. Hopefully, her arthritis can be managed with naproxen and intermittent steroid injections. If not, further discussion must be had between Rheumatology and the Oncology teams about the risk and benefits of disease modifying anti-rheumatic drugs (DMARDs).
MRI: Large osteochondral defect in the left lateral femoral condyle, measuring approximately 1 cm across, with apparent loose body in the posterior fossa. Smaller osteochondral defect seen in the medial femoral condyle which appeared stable. Associated bony edema on the lateral femoral lesion.

Final Working Diagnosis: Osteochondritis dissecans with loose body

**Treatment and Outcomes:**
- Patient was very active and wanted to return to playing golf. His daily activities were much improved but still limited compared to prior level of activity.
- Recommended modified activities and possible steroid injection if pain continued to limit activities.
- Repeat MRI to reassess bony edema and loose body with further consideration of knee scope and other procedures, based on clinical response and imaging.

**DIFFERENTIAL DIAGNOSIS:**
1. Complete tear of the proximal ulnar collateral ligament
2. Avulsion flexor tendon
3. Pronator Teres tendonitis
4. Pronator Quadratus tendinitis
5. Medial collateral ligament sprain
6. Medial collateral ligament disruption
7. Common flexor tendon pathology
8. Pronator Teres pathology

**TEST AND RESULTS:**
- Elbow AP/Lateral/Oblique Radiographs: WNL; MRI w/o contrast: Complete tear of the proximal ulnar collateral ligament, Avulsion flexor tendon with bone marrow edema, Nondisplaced fracture of the radial head associated joint
- Clinical examination by an ATC revealed no effusion or deformity, non-tender to palpation, full pain-free ROM, a positive Lachman’s and anterior drawer test, and no laxity of the MCL or LCL.

**FINAL WORKING DIAGNOSIS:** Isolated complete ACL tear

**TREATMENT AND OUTCOMES:**
- Initial inspection revealed no effusion or deformity, non-tender to palpation, full pain-free ROM, a positive Lachman’s and anterior drawer test, and no laxity of the MCL or LCL.
- Differential diagnosis: 1. Isolated ACL tear 2. ACL with collateral ligament and/or meniscal injury 3. Transient knee dislocation
- **TEST AND RESULTS:** Right Knee MRI: Full thickness ACL tear with intact collateral ligaments and menisci. Subchondral edema present in lateral femoral condyle and lateral tibial plateau
- **FINAL WORKING DIAGNOSIS:** Isolated complete ACL tear

**HISTORY:** A 21-year-old female NCAA Division 1 soccer defender sustained a non-contact right knee injury while chasing a ball in the 70th minute of an international season game. Her right foot caught on the turf and she felt a “pop” before falling. No previous history of knee injuries.

**PHYSICAL EXAMINATION:** Examination on the field by an ATC revealed no effusion or deformity, non-tender to palpation, full pain-free ROM, a positive Lachman’s and anterior drawer test, and no laxity of the MCL or LCL.

**DIFFERENTIAL DIAGNOSIS:**
1. Medical Collateral ligament sprain
2. Medical Collateral ligament disruption
3. Common flexor tendon pathology
4. Pronator Teres tendonitis
5. Pronator Quadratus tendinitis

**TREATMENT AND OUTCOMES:**
- ACL reconstruction with BTB Patellar Tendon graft. Full ROM was achieved by week 3 post-op. Rehabilitation progression included traditional rehabilitation models. Additional focus on neurological rehabilitation was initiated week 3 and maintained throughout. 3. Triphasic training and movement progressions with concurrent sensory inputs and cognitive interference were employed, resulting in a multidisciplinary 3-fold rehabilitation model designed to target 3 injury-associated areas (motor, sensory, neuroplastic). Triphasic training utilizes block periodization of multi-joint movements to target each action of the stretch shortening cycle. Isochronic movements increase motor unit recruitment and utilizes block periodization of multi-joint movements to target each action of the stretch shortening cycle. Isometric movements increase motor unit recruitment and utilizes block periodization of multi-joint movements to target each action of the stretch shortening cycle.
effusion. MSK Diagnostic Ultrasound Imaging: 1.07 cm widening of the medial joint space (MJS), 1.49 cm hypochoic disruption of the UCL, Discontinuity of the flexor pronator group.

**FINAL WORKING DIAGNOSIS:** Grade 3 UCL Strain with pronator muscle group avulsion. **TREATMENT AND OUTCOME:** Athlete underwent surgery to repair the Grade 3 UCL Strain medial collateral ligament and reattachment of the flexor pronator group avulsion at the medial epicondyte. The diagnosis of such injuries is evident in clinical examinations and the management of the case is common among athletes suffering from traumatic UCL strains, this case clearly illustrated the use of point of care ultrasound imaging in identifying these types of lesions. It further allowed for a more detailed examination when the physical examination was limited as a result of pain. The athlete has made a full recovery.

1821 May 30 4:05 PM - 4:25 PM

**Right Elbow Pain in a Teenage Softball Player**

Shelby E. Johnson, Edward R. Laskowski, FACSM. Mayo Clinic, Rochester, MN.
Email: johnson.shelby@mayo.edu
(No relevant relationships reported)

**HISTORY:**
A 16 year-old right-hand dominant softball player presented with right elbow pain after an overhead throw two months prior. During the initial throw she felt a pop and acute pain, swelling, and ecchymosis at her posteromedial elbow. Her pain improved with rest and range of motion exercises. However, two days prior to presentation, she performed an overhead throw and again felt a pop with immediate pain and recurrent ecchymosis. She had tingling in her fourth and fifth fingers immediately after the throw but denied ongoing sensory symptoms.

**PHYSICAL EXAMINATION:**
Inspection revealed ecchymosis at the medial elbow. She was tender to palpation over the ulnar nerve along the cubital tunnel and over the medial triceps with mild tenderness of the ulnar collateral ligament. Range of motion, strength, and sensation were normal. Resisted elbow extension reproduced her pain. Valgus stress testing was painful with slight asymmetric opening compared to the left. Dynamic elbow flexion and extension produced dislocation of the ulnar nerve and medial triceps. Tinel’s sign at the cubital tunnel was positive.

**DIFFERENTIAL DIAGNOSIS:**
1. Ulnar neuritis secondary to dislocating ulnar nerve
2. Snapping medial triceps
3. Ulnar collateral ligament injury
4. Medial epicondylitis
5. Triceps tendinopathy

**TESTS AND RESULTS:**
1. Elbow X-ray: Negative for effusion, fracture, or osseous abnormality.
2. Elbow MRI: Nonspecific increased T2 signal of the ulnar nerve within and just distal to the cubital tunnel. Collateral ligaments intact.

**FINAL WORKING DIAGNOSIS:**
Right elbow neuritis with a dislocating ulnar nerve and snapping medial triceps.

**TREATMENT AND OUTCOMES:**
The patient initially tried rest and physical therapy. Due to progressive pain the patient decided to pursue more definitive treatment and underwent a right ulnar nerve transposition with partial resection of the medial triceps. One month post-operatively her symptoms had largely resolved and she gradually returned to softball.

1822 May 30 4:25 PM - 4:45 PM

**Arm Injury - Crossfit**

Email: hrehaja@njms.rutgers.edu
(No relevant relationships reported)

**HISTORY:**
A healthy, thirty-year-old male without antecedent pain presented with anterior elbow pain and elbow flexion weakness in his dominant upper extremity. At the time of injury, the patient was performing the CrossFit “butterfly pull-ups” in which the forearm is pronated while the elbows are actively flexed to bring the body up to the bar with the body swinging to build momentum. During this movement, he felt immediate pain at his distal anterior brachium but did not hear a pop. Following the injury he noted swelling and pain exacerbated by motion of the elbow. Once the swelling had resolved, the patient noticed a cosmetic defect at the proximal lateral elbow. On presentation, two weeks after the initial injury, his chief complaint was weakness during elbow flexion without any weakness during supination.

**PHYSICAL EXAMINATION:**
On presentation, no edema or ecchymosis were present. There was a notable defect in the lateral aspect of the arm just proximal to the elbow joint. With flexion of his elbow, the biceps tendon was clearly visualized. No “reverse popeye deformity” was present. A Ruland biceps squeeze test demonstrated intact supination of the forearm, and a hook test demonstrated an intact biceps tendon. There was no appreciable weakness with elbow flexion or supination compared to the contralateral arm. He did not demonstrate fatigability in supination. His range of motion was symmetric to the contralateral side. Neurologic examination showed that there was intact motor function throughout the arm and no sensory deficits were noted.

**DIFFERENTIAL DIAGNOSIS:**
1. Brachialis muscle rupture
2. Distal Biceps Brachii muscle rupture
3. Proximal Biceps Brachii muscle rupture
4. MR imaging demonstrated edema at the brachialis consistent with intrasubstance muscle tear. The biceps tendon was intact.

**FINAL WORKING DIAGNOSIS:**
Isolated acute brachialis muscle rupture.

**TREATMENT AND OUTCOMES:**
1. No immobilization given subacute presentation
2. Physical therapy: Initially maintenance of range of motion, then strengthening starting at 8 weeks post injury
3. At 1 year follow up, patient was pain free with full range of motion and no appreciable weakness with elbow flexion

Abstracts were prepared by the authors and printed as submitted.
**1823**
May 30 4:45 PM - 5:05 PM
**Shoulder Pain-- Range of Motion**
Nicole Messenger, Kelly Estes. Washington University in Saint Louis, Saint Louis, MO.
Email: messengern@wustl.edu
(No relevant relationships reported)

History: 49-year-old female with rheumatoid arthritis on methotrexate and oral prednisone presents to the walk-in orthopedic injury clinic for acute severe sharp pain in left shoulder radiating into left elbow and hand. No injury or trauma. Symptoms are constant, worse with overhead movements. She reports associated muscle spasms. She has tried acetaminophen and ice with limited relief. She notes her preexisting pain was increased to 10mg daily for worsening hand arthralgias recently.

Physical Exam: Patient is well appearing in no distress. Range of motion at the bilateral shoulders is 120 on the right, 110 on the left. She has 5/5 strength with supraspinatus and external rotators, as well as normal belly press and bear hug. 5/5 strength to bilateral upper extremities distally. Full range of motion of her cervical spine with pain only with left side bending. The left posterior cervical paraspinal area has a well-defined erythematous area with overlying vesicular lesions. There are few scattered lesions overlying the left shoulder extending down into the left arm.

Differential Diagnosis:
1. Cervical radiculopathy
2. Shoulder impingement syndrome
3. Varicella zoster virus
4. Herpes simplex Virus
5. Rotator cuff tendinopathy

Tests/Results:
Shoulder X-ray
Final/working Diagnosis: Varicella zoster virus in C6 Dermatome

Treatment and Outcomes:
1. Valacyclovir prescription: 1g tablet by mouth TID for 7 days
2. Pain control with Hydrocodone-acetaminophen 5-325mg per tablet QID PRN for pain
3. Rheumatology follow-up for discussion of modification of her immunosuppression regimen
4. Primary Care follow-up

**1824**
May 30 5:05 PM - 5:25 PM
**Neck Pain and Arm Swelling in a Professional Dancer**
Shannon Powers, Leda Ghannah. Rush University Medical Center, Chicago, IL. Midwest Orthopaedics at Rush, Chicago, IL.
(No relevant relationships reported)

**HISTORY:** A 33-year-old female professional dancer presents to training room with three weeks of right-sided neck pain. The pain is located at base of the right neck and worsens with flexion. She denies an inciting trauma, but recently began performing new choreography involving repetitive overhead lifting. Associated symptoms include swelling in her right upper extremity and a prominence of her chest wall veins. She denies weakness or paresthesias. **PHYSICAL EXAMINATION:** Inspection reveals mild prominence of veins along the right side of the neck and chest wall, with mild swelling in the right forearm. There is full pain-free range of motion in the cervical spine, right shoulder, and right elbow. Spurling test is negative. Roos test is positive with venous engorgement in the right upper extremity after 30 seconds. Strength is 5/5, reflexes 2/4, and sensation is intact to light touch in the bilateral upper extremities.

**DIFFERENTIAL DIAGNOSIS:**


**FINAL WORKING DIAGNOSIS:** Vascular Thoracic Outlet Syndrome/Paget-Schroetter Syndrome

**TREATMENT AND OUTCOME:**
1. Prescribed Medrol Dosepak and NSAIDs. 2. Started physical therapy and restricted arm motions in practice. 3. Consultation with cardiothoracic surgeon; recommended right first rib resection. 4. Prior to surgery, developed new occlusive DVT in right subclavian and axillary veins. Apixaban initiated. 5. Underwent transaxillary first rib resection, subclavian tenolysis and arteriolysis, and right brachial plexus neurolysis. 6. Returned to sport 6 weeks post-operatively and completed physical therapy. 7. Undertook right upper extremity venogram with angioplasty for chronic occluded central right subclavian vein 3 months post-operatively.
Muscular adaptations in the upper limb from training are associated with hypertrophy, inflexibility, and diminished vascular perfusion. Despite these findings in upper extremity athletes, no studies have examined the relationship between peripheral vascular adaptations and muscle flexibility in the lower legs of runners. Through a better understanding of blood flow and muscle flexibility adaptations, clinicians can more accurately counsel patients about running injuries.

**Purpose:** To examine the relationship between blood flow in the posterior tibial artery and sagittal plane ankle range of motion (ROM) among a sample of collegiate runners.

**Methods:** Blood flow in the posterior tibial artery and sagittal plane ankle ROM were measured bilaterally on 25, asymptomatic collegiate track athletes (16 males, 9 females, age = 20.0 ± 1.2 years, height = 171.5 ± 10.2 cm, mass = 66.7 ± 13.7 kg). Pearson correlation analysis was used to analyze the relationship between blood flow in the posterior tibial artery and ROM of the talocurcal joint.

**Results:** Findings revealed no significant relationship between blood flow in the dominant leg’s posterior tibial artery and dorsiflexion (r = -0.14, P = .52) or plantarflexion (r = -0.32, P = .12) and no significant relationship between blood flow in the non-dominant leg’s posterior tibial artery and dorsiflexion (r = 0.02, P = .93) or plantarflexion (r = -0.2, P = .92).

**Conclusion:** Although muscle inflexibility contributes to compromised blood flow in other body regions, findings of this study demonstrated no relationship between flexibility of the plantarflexor muscles and blood flow in the posterior tibial arteries of competitive runners. Future research should continue examining blood flow in the lower limb as one, among many, physical adaptations runners may experience from training.

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**Board #2 May 30 2:00 PM - 3:30 PM**

**Effect of Increased Respiratory Muscle Activation on Blood Flow to Inactive and Active Limb Muscles**

Kana Shiozawa1, Kanako Gotō1, Kaori Shimizu1, Mitsuji Saito2, Koji Ishida1, Lilyu Zhang1, William Sheel, FACS, K, Keio Katayama1, Nagoya University, Nagoya-shi Chikusa-ku, Japan.

University of British Columbia, Vancouver, BC, Canada.
(Sponsor: A. William Sheel, FACS)

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(No relevant relationships reported)

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It is unclear whether blood flow to inactive and active limb muscles are altered when the respiratory muscle activation is increased during submaximal exercise. **Purpose:** The purpose of this study was to clarify the effect of increasing inspiratory muscle work on blood flow to inactive and active limbs. **Methods:** Healthy young men (n=7, 20.2 ± 2.0 yrs) performed two mild bilateral dynamic knee-extension and -flexion exercises for 10 min. The trials consisted of spontaneous breathing for 5 min followed by voluntary hyperpnea. Pearson correlation analysis was used to analyze the relationship between respiratory variables during isometric strength type exercise. **Results:** The presence of turbulent flow was determined by comparing Reynolds number (Re = ρυ/μ). ESS was calculated by Womersley’s approximation, ESS = ρυ/μ/ρμ2/2ρυ. A total of 26 young healthy subjects (15 females and 11 males) were asked to perform the 45° knee extension isometric contraction with a week interval. The isometric or isokinetic intensity of 100%, 90%, 80% and 70% MVC with 60 seconds during exercise. But, how %MVCEMG according to the increase of exercise intensity determined by %EMG-based maximal voluntary contraction (MVCEMG) during a static exercise test. How %MVCEMG induced-changes of CBFV might be associated with cardiac output (CO) and respiratory response remains unclear. **Purpose:** To evaluate the influence of %MVCEMG on middle cerebral artery velocity (MCA Vmax) CO and respiratory variables during isometric strength type exercise. **Methods:** Eight healthy male (21.3 ± 0.9yrs) were asked to perform the 45° knee extension isometric contraction during 60 seconds. All participants performed four times in random order at the isometric intensity of 100%, 90%, 80% and 70% MVC with a week interval. The intensity of %MVCEMG was determined by root mean square (RMS) of EMG at right rectus femoris muscle. Each participant was asked to conduct and maintain the predetermined intensity of %MVCEMG confirming the figures on a monitor. MCA Vmax was measured at rest, 30 and 60 seconds during exercise, 30 seconds recovery, 150 seconds recovery using transcranial-Doppler sonography. CO and respiratory variables were measured by electrical cardiometry monitor and gas analyzer. All data were analyzed using two-way ANOVA (4 intensities x 5 times) with repeated measures. **Results:** MCA Vmax in 100% MVCEMG significantly higher than MCA Vmax in 100% and 80% MVCEMG at 60 seconds during exercise (921 vs. 594 cm/s, p<.01). On the other hand, CO were not significant different between 100%, 90%, 80% and 70% MVCEMG, Vco2, in 70% MVCEMG was significantly lower than in 100% MVCEMG at 60 seconds during exercise (0.49 vs. 0.86 L/min, p<0.05) and had significantly negative correlation with the changes of MCA Vmax (r=-0.52, p<.01). **Conclusions:** These results suggest that MCA Vmax might have the tendency of decrement over the intensity of 70% isometric MVCEMG, and negatively relate to Vco2.

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**Board #3 May 30 2:00 PM - 3:30 PM**

**The Effects of Recumbent Angle on Cardiac Responses and Hemodynamics during Bicycle Ergometer Exercise in Patients with Atrial Fibrillation**

Ilyju Jeong1, Hee-Hyok Lee2, Myungwha Kim1, Jae-Hyun Lee1, Hongseong University, Daejeon, Korea, Republic of.

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(No relevant relationships reported)
During exercise, heat and metabolites (e.g., H⁺, etc.) attenuate sympathetically-mediated vasconstriction in contracting muscle, known as functional sympatholysis, remains poorly understood. Previous work has shown that activation of transient receptor potential vanilloid type 1 (TRPV1) channels in contracting muscle, known as functional sympatholysis, mediates vasoconstriction, but does not improve microvascular reactivity.

Given the high rates of cardiovascular disease morbidity and mortality in the United States, and worldwide, finding strategies that might mitigate CVD is paramount.

**CONCLUSIONS:** Peak dilation of the brachial artery during FMD testing in a young healthy population is triggered mostly by antegrade, high-ESS under turbulent flow conditions. Due to the pulsatile nature of blood flow and the appearance of a turbulent pattern during FMD, ESS should be estimated by Womersley's approximation rather than Poiseuille's law.

**Effect of Capsaicin on Leg Blood Flow in Response to Passive Limb Movement**

Robert M. Restaino1, Gaia Giuriato2, Alexs A. Matias1, Edgard Soares3, Stephen J. J. Ivcev1, 2Skidmore College, Saratoga Springs, NY. University of Verona, Verona, Italy. University of Brasilia, Brasilia, Brazil. (Support: Paul Arciero, FACSM) (No relevant relationships reported)

During exercise, heat and metabolites (e.g., H⁺, etc.) attenuate sympathetically-mediated vasconstriction in contracting muscle, known as functional sympatholysis, remains poorly understood. Previous work has shown that activation of transient receptor potential vanilloid type 1 (TRPV1) channels in contracting muscle, known as functional sympatholysis, mediates vasoconstriction, but does not improve microvascular reactivity.

**CONCLUSION:** Acute CAP does not affect resting hemodynamics or the response to sympathoexcitatory LBNP. During exercise, CAP seems to improve microvascular responses, but does not impact the response to LBNP, despite trends for CAP to mitigate the LBNP-induced reductions in both systemic and local conductance.

**Does Capsaicin Ingestion Affect Functional Sympatholysis And Vascular Functions?**

Gaia Giuriato1, Meaghan Lynch2, Brian Lora3, Massimo Vantorelli1, Stephen J. J. Ivcev1, University of Verona, Verona, Italy. Skidmore College, Saratoga Springs, NY. (No relevant relationships reported)

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**Relationship Between Increased Resting Muscle Blood Flow And Muscle Force Loss After Repeated Eccentric Contractions**

Hisashi MAEDA1, Mitsuji SAITO2, Koji ISHIDA1, Hiroshi AKIMA1, Nagoya University, Nagoya, Japan. Toyota Technological Institute, Nagoya, Japan. (Support: Dr. Katsumi ASANO, FACSM) Email: hisashi.gogo.tf@gmail.com (No relevant relationships reported)

Unaccustomed eccentric contractions (ECs) induce muscle force reduction and increased resting muscle blood flow. Whereas muscle force reduction has been well accepted as an index of exercise-induced muscle damage (EIMD), physiological meaning of increased resting muscle blood flow is not fully understood.

**PURPOSE:** The purpose of the present study was to assess the relationship between the increased resting muscle blood flow and muscle force reduction after repeated ECs in healthy individuals.

Methods: Eight young healthy men (age, 20.9 ± 1.7 years; height, 172.1 ± 3.9 cm; weight, 64.5 ± 5.2 kg; body mass index, 21.8 ± 1.7 kg/m²) participated in this study. Maximal voluntary contraction (MVC) force of isometric elbow flexion at elbow joint angle of 90°, heart rate, and blood pressure were measured before and after 24 h of repeated ECs task. Resting forearm blood flow as an index of muscle flow was also measured by plethysmography. Subjects performed five sets of 20 repetitions of eccentric contractions of elbow flexors (no contractions at concentric phase) with a load equal to 60% of MVC force with the use of dumbbells. Each action was performed through the same range of motion at a rate of 4-s.

Results: MVC force significantly decreased by 44% (17.4 ± 2.2 kg to 9.7 ± 3.2 kg, p<0.01) after 24 h of repeated ECs.

Resting forearm blood flow increased by 22% (5.8 ± 1.2 ml/min/100 g to 7.4 ± 1.9 ml/min/100 g, p<0.05) after 24 h of repeated ECs. Resting heart rate and blood pressure were not significantly different before and after 24 h of ECs.

The change of resting forearm blood flow was negatively correlated with the change of MVC force (r=-0.88, p<0.01).

Conclusion: Increased resting muscle blood flow was associated with muscle force reduction after repeated ECs.

**Effects of Capsaicin on Leg Blood Flow in Response to Passive Limb Movement**

Robert M. Restaino1, Gaia Giuriato2, Alexs A. Matias1, Edgard Soares3, Stephen J. J. Ivcev1, Skidmore College, Saratoga Springs, NY. University of Verona, Verona, Italy. University of Brasilia, Brasilia, Brazil. (Support: Paul Arciero, FACSM) (No relevant relationships reported)

Given the high rates of cardiovascular disease morbidity and mortality in the United States, and worldwide, finding strategies that might mitigate CVD is paramount.

**Vascular dysfunction is a critical component and likely precursor measure to CVD. Recently, the passive leg movement (PLM) method has been developed to assess nitric oxide (NO)-dependent vascular function. The nutraceutical Capsaicin has been shown to have cardioprotective effects, enhancing vasorelaxation and attenuating sympathetic vasoconstriction in an endothelium dependent manner via activation of transient receptor potential vanilloid type 1 (TRPV1) channels; however this has only been demonstrated using in vitro or animal models.**

**PURPOSE:** In this study, a single-blind, crossover design was used to examine the potential effects of capsaicin-induced improvement of leg blood flow in response to PLM. METHODS: Femoral artery blood flow and microvascular perfusion of the vastus lateralis were examined in 12 young, healthy men, using Doppler ultrasound and multi-distance frequency domain based near-infrared spectroscopy. Central hemodynamics (stroke volume, SV; heart rate, HR; cardiac output, CO; and mean arterial pressure, MAP) were measured using finger photoplethysmography. Hemodynamic measurements were continuously taken at rest and during a single bout of PLM (sPLM), a variant of PLM which minimizes the central hemodynamic response. RESULTS: A significant hyperemic response was recorded in response to PLM under both conditions (Capsaicin and Placebo); however the microvascular perfusion response to PLM was not significantly altered (p > 0.05) following ingestion of Capsaicin compared to Placebo (HbO²+MbO², r=0.54 ± 0.13 at Baseline; 36.5 ± 4.6 %, Placebo: 30.1 ± 5.7 % at Baseline; 32.5 ± 5.4 %, Placebo: 29.3 ± 5.9 % at Baseline).

Conclusion: Capsaicin does not further augment hyperemia in response to sPLM in young healthy males. Further study of this nutraceutical is warranted in populations at high risk, or prevalence, of cardiovascular disease.

**Does Capsaicin Ingestion Affect Functional Sympatholysis And Vascular Functions?**

Gaia Giuriato1, Meaghan Lynch2, Brian Lora3, Massimo Vantorelli1, Stephen J. J. Ivcev1, University of Verona, Verona, Italy. Skidmore College, Saratoga Springs, NY. (No relevant relationships reported)
**CONCLUSIONS:** Movement speed and ROM have a profound impact on PLM-induced hyperemia, as well as the feasibility of the test. When using PLM to assess vascular endothelial function, it is recommended to perform the test at the traditional 180°/s with 90° ROM, which offers a large hyperemic response, while maintaining test-induced hyperemia, as well as the feasibility of the test. When using PLM to assess role in this attenuation.

**RESULTS:** Movement speed generally exhibited positive linear relationships with the hyperemic response to PLM, eliciting ~20-30% increase in hyperemia and conductance, which peaked at 90°, such that a 30° increase or decrease in ROM from 90° resulted in a 10-40% attenuation (P<0.05) in the hyperemic response. Alterations in the balance of antegrade and retrograde flow appear to play a role in this attenuation.

**METHODS:** 11 healthy adults underwent multiple bouts of PLM, in which either movement speed (60-240°/s) or ROM (30-120° knee flexion) were varied. Femoral artery blood flow (Doppler Ultrasound) and mean arterial pressure (MAP; photoplethysmography) were measured throughout.

**RESULTS:** Blood flow in the posterior tibial artery was measured bilaterally on 25 asymptomatic collegiate track athletes (15 males, 10 females, age= 20.0±1.2 years, from pre- (118.26±46.52) to post-season (102.99±30.76) (t19= 2.089, P<0.05) with decreased vascular perfusion and injury. Such findings have been validated in the lower legs of runners over the course of a competitive season. Such increase in BP can be attributed to increased total peripheral resistance may advance clinicians’ abilities to predict and prevent running related injuries.

**RESULTS:** Forceful and repetitive motions in sport lead to adaptations in various tissues. Hypertrophy and inflexibility of muscle tissue are common adaptations associated with decreased vascular perfusion and injury. Such findings have been validated in the upper limbs of throwers over the course of competitive seasons. To date, no studies have examined the influence of a competitive season of running on blood flow in the lower legs of runners. A more comprehensive understanding of blood flow adaptations may advance clinicians’ abilities to predict and prevent running related injuries.

**METHODS:** Forceful and repetitive motions in sport lead to adaptations in various tissues. Hypertrophy and inflexibility of muscle tissue are common adaptations associated with decreased vascular perfusion and injury. Such findings have been validated in the upper limbs of throwers over the course of competitive seasons. To date, no studies have examined the influence of a competitive season of running on blood flow in the lower legs of runners. A more comprehensive understanding of blood flow adaptations may advance clinicians’ abilities to predict and prevent running related injuries.

**RESULTS:** Forceful and repetitive motions in sport lead to adaptations in various tissues. Hypertrophy and inflexibility of muscle tissue are common adaptations associated with decreased vascular perfusion and injury. Such findings have been validated in the upper limbs of throwers over the course of competitive seasons. To date, no studies have examined the influence of a competitive season of running on blood flow in the lower legs of runners. A more comprehensive understanding of blood flow adaptations may advance clinicians’ abilities to predict and prevent running related injuries.

**CONCLUSIONS:** Blood flow in the posterior tibial artery was measured bilaterally on 25 asymptomatic collegiate track athletes (15 males, 10 females, age= 20.0±1.2 years, height= 171.5 ± 10.2 cm, mass= 66.7 ± 13.7 kg). Measurements were performed in one session at pre-season and immediately following the season. An independent t-test was used to compare blood flow in dominant versus non-dominant limbs at the start of season. Paired measures t-tests were used to compare changes in blood flow from pre- to post-season in the dominant and non-dominant limbs.

**RESULTS:** At pre-season, blood flow in the dominant (123.34±43.73) and non-dominant (112.64± 40.31) posterior tibial arteries was not significantly different (t19= 0.373). Blood flow in the dominant legs, however, significantly decreased from pre-season (118.26±46.52) to post-season (102.55±33.21) (t19= 2.089, P<0.05). Significant difference was seen in blood flow in the non-dominant leg between pre-season (109.53±42.03) and post-season (102.55±33.21) (t19= -1.107, P= 0.322).

**Conclusion:** This study reveals blood flow significantly decreased in the dominant posterior tibial arteries among runners over the course of a competitive season. Further research should examine mechanisms underlying changes in blood flow and its influence on injury incidence among runners.
Infrared thermography (IR-T) is a non-invasive and mobile tool to measure and portray changes of the body surface radiation (T_s) or the surface radiation pattern (T_I) in real-time. PURPOSE: The comparison and examination of the T_s of the back of the legs during an exercise test, between endurance athletes and patients with cystic fibrosis (CF). METHODS: 7 CF patients (G1) and 14 male endurance athletes (G2) performed a step-wise incremental exercise test on a treadmill. T_s was measured via IR with a high-resolution detector. T_s was calculated as the difference in temperature (°C) between the 10% of the darkest and 10% of the lightest pixels in the region of interest. T_s data were analyzed at “resting condition” (rest), “individual anaerobic threshold” (IAT) and “maximum load” (max), by repeated measures ANOVA. RESULTS: By looking at the complete optical information of temperature patterns over time in high-resolution, we were able to recognize the anatomy of subcutaneous arteries and their sensitive adjustments due to exercise over time. For G1 global testing for T_s was significant across all measuring points (rest: 2.1°C, IAT: 2.7°C; max: 3.0°C SD: 0.2°C; p<0.05), with a significant group difference between rest and max, only (p=0.022). For G2 global testing was highly significant (rest: 2.3°C; IAT: 3.4°C; max: 3.8°C SD: 0.1°C; p<0.01), and all between-group comparisons were highly significant (p<0.01) The course of the T_s during the load does not differ significantly between G1 and G2 (p=0.124). CONCLUSION: The T_s increases across groups during an exercise test. The T_s can be distinguished between rest, IAT and max for endurance athletes. In short critically ill patients, the increase in the difference of T_s appeared to be less pronounced, which could be due to the limited capacity of the patients. The adjustment of arteries during exercise was therefore dependent on the intensity of exercise and on individual prerequisites. High-resolution IR-T measurement has the potential to become a performance diagnostic tool, to generate sensitive insights into individual exercise physiology. Technological innovations like improved algorithms, automated data processing as well as deep learning should be applied in further research studies to improve IR-T diagnostics and the detection of the T_srp.

CONCLUSION: Based on our results, accepted risk factors for CVD, including blood pressure, plasma lipoproteins, and body composition, are not related to indices of vascular health as assessed with PWV and FMD.

Blood pressure, body composition and plasma lipoprotein concentrations are important markers for cardiovascular disease (CVD) risk. PURPOSE: To examine potential relationships between blood pressure, body composition, plasma lipoprotein concentrations and indices of vascular health as assessed with carotid-femoral pulse wave velocity (PWV) and flow mediated dilation (FMD). METHODS: Fourteen male subjects (age 32 ± 13 yrs, height 177.6 ± 6.6 cm, weight 83.3 ± 9.0 kg, lean mass 61.7 ± 6.3 kg, fat mass 18.4 ± 6.8 kg) volunteered for lab testing as part of a health assessment program, which included resting blood pressure, dual energy x-ray absorptiometry (DXA), FMD, PWV, and blood analysis. All testing was completed on the same day after an overnight fast. The vascular measures were taken via ultrasound, in a temperature controlled room with dim lighting. Each subject would lay supine for 10 minutes prior to the vascular measures. FMD was assessed in the brachial artery in response to a 5-minute distal occlusion. FMD results are given as a percent change from baseline. The PWV measure was assessed on the carotid and femoral arteries using 80% of the total distance between measure sites. PWV results are given in meter per second. All PWV and FMD measurements were completed according to previously published procedures (Bortel, 2011; Corretti, 2002.). Body composition was assessed via DXA. Relationships among the data were analyzed with Pearson’s r (a = 0.05).

RESULTS: No significant relationships were found with PWV or FMD and any of the CVD risk factors measured. The strongest correlations for PWV and FMD are listed in Table 1.

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CONCLUSION: Greater forearm blood flow is associated with better walking economy and gait speed in older adults. Kevin N. Hamidi1, Devon A. Dobrosielski1, Jennifer A. Schrack2, Nicolas D. Knuth1, Towson University, Towson, MD. Johns Hopkins Bloomberg School of Public Health, Baltimore, MD. Email: khamidi1@students.towson.edu

CONCLUSION: Based on our results, accepted risk factors for CVD, including blood pressure, plasma lipoproteins, and body composition, are not related to indices of vascular health as assessed with PWV and FMD.

Gait speed decline is a well-established predictor of disability and mortality in older adults. Compromised energetic efficiency (i.e. walking economy) is a strong contributor to gait speed decline, but the underlying mechanisms influencing walking economy are undefined. Impaired vascular function is common with aging and thus may be an important contributor to the development of compromised walking economy and slow gait speed, yet the relationships among blood flow within skeletal muscle, walking economy, and gait speed in older adults are unknown. PURPOSE: To examine the relationship between measured forearm blood flow and (i) walking economy and (ii) gait speed in older men and women. METHODS: Resting arterial inflow and reactive hyperemic blood flow (RHHF) of the left forearm was measured in 55 participants of the Longitudinal Aging Study at Towson (LAST; 53% male, mean age 70, range 51-91 years) using venous occlusion plethysmography. Walking economy was measured as the average rate of oxygen consumption during the final 2 minutes of a 5 minute standardized treadmill-based walking test at 1.5 mile per hour. Gait speed was assessed during 2.5 minutes of normal-paced walking over a 20-meter course. The association between RHHF and walking economy and RHHF and gait speed was modeled using linear regression, adjusting for age, height, and fat-free mass. Sobel tests were used to assess potential mediating effects. RESULTS: In fully adjusted models, RHHF (mean RHHF: 18.0 ± 5.9 mL/100mL tissue “rest” mean) was negatively associated with oxygen consumption (β = –7.5, p < 0.01), indicating that walking economy was 7.5 mL/min lower for each one-unit increase in blood flow. Gait speed (mean 1.3 ± 0.2 m/s) was positively associated with blood flow (β = 0.01, p = 0.05), indicating that gait speed was 0.01 m/s faster for each one-unit increase in blood flow. Mediation analyses further suggested that blood flow may mediate the association between walking economy and gait speed (p=0.06). CONCLUSION: RHHF is
a significant predictor of both walking economy and gait speed in older adults, suggesting that better overall vascular health is related to enhanced walking economy and gait speed. Therefore, interventions aimed at improving vascular health in the aging population may be beneficial in maintaining gait speed and mobility with age.

**1863 Board #19** May 30 2:00 PM - 3:30 PM Visceral Adiposity is Associated with Lower Cerebral Blood Velocity in Older Adults
Natalia S. Lima1, Alexander J. Rosenberg2, Georgios Grigoriadis3, Elizabeth C. Schroeder1, Wesley K. Lefferts1, Tracy Baynard, FACSM. 1University of Illinois at Chicago, Chicago, IL. 2University of North Texas Health Science Center, Fort Worth, TX. (Sponsor: Tracy Baynard, FACSM) Email: nlma3@uic.edu

(No relevant relationships reported)

**PURPOSE:** Recently, it has been shown that young African American males display lower hyperemic responses, but preserved shear-induced dilation, in response to dynamic handgrip exercise when compared to Caucasian American counterparts; however, it is unknown whether this blunted exercise hyperemia is also present in the lower limbs.

**METHODS:** Young African American (AA) (n = 4) and Caucasian American (CA) (n = 3) males performed two separate incremental exercise bouts of rhythmic handgrip and plantar flexion exercise while blood flow and diameter were evaluated in the brachial and superficial femoral arteries, respectively. Mean arterial pressure (MAP) and blood flow/vascular function variables (blood flow, shear rate, flow-mediated dilation) were measured in the last minute of each 3-minute workload.

**RESULTS:** The data revealed no significant group differences during handgrip exercise when examining blood flow (e.g. 24 kg: AA: 666 ± 52; CA: 711 ± 60 mL/min; *p = 0.3), or vascular conductance (e.g. 24 kg: AA: 6.2 ± 0.7; CA: 7.4 ± 0.8 mL/min/mmHg; *p = 0.3) across all workloads. During plantar flexion exercise, no group differences were reported when evaluating blood flow (e.g. 32 kg: AA: 993 ± 83; CA: 713 ± 97 mL/min; *p = 0.2), MAP (e.g. 32 kg: AA: 104 ± 4.9; CA: 106 ± 4.8 mmHg; *p = 0.3), or vascular conductance (e.g. 32 kg: AA: 9.6 ± 0.8; CA: 7.1 ± 0.8 mL/min/mmHg; *p = 0.6) across all workloads. Slopes derived from the relationship between shear rate and arterial dilation across all exercise workloads were not different between groups when examined in the brachial (AA: 0.0013 ± 0.00034; CA: 0.0004 ± 0.00003; *p = 0.7) or superficial femoral artery (AA: 0.0013 ± 0.0003; CA: 0.0002 ± 0.0007; *p = 0.6).

**CONCLUSIONS:** Preliminary data revealed no differences in exercise-induced blood flow or vascular responses in the upper or lower limbs when comparing young African American and Caucasian American males.

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**1864 Board #20** May 30 2:00 PM - 3:30 PM An Exaggerated Muscle Metaboreflex In Diabetic Rats Is Mediated By Potentiated Skeletal Muscle Afferent Responsiveness
Rie Ishizawa1, Han Kyul Kim1, Norio Hotta1, Gary A. Iwamoto1, Wampen Yongpanatasin1, Jere H. Mitchell, FACSM1, Scott A. Smith1, Masaki Mizuno2, Gary A. Iwamoto1, Wesley K. Lefferts1, Tracy Baynard, FACSM1. 1University of Illinois at Chicago, Chicago, IL. 2Chubu University, Kasugai, Japan. (Sponsor: Tracy Baynard, FACSM)

(No relevant relationships reported)

Patients with type 2 diabetes (T2D) exhibit an excessive increase in blood pressure during exercise. Evidence suggests that the skeletal muscle metaboreflex is exaggerated in T2D. However, the underlying mechanisms remain poorly understood. Metaboreflex sensory signals from exercising muscle are generated by activation of chemically-sensitive group IV afferent neurons. It is logical to suggest that, since other components of body composition (total body fat, lean mass) on cerebral blood flow in older adults has yet to be elucidated. **PURPOSE:** To evaluate the effects of lean mass (LM), fat mass (FM), and visceral fat (VF), on middle cerebral artery (MCA) mean velocity and conductance in older adults. **Methods:** Twenty-five older adults (60 ± 6 years; 30 ± 5 kg/m2) completed body composition assessments via dual x-ray absorptiometry (Lunar iDXA, GE, Waukesha, WI). Absolute LM, FM, and VF values were obtained and also made relative to total body weight, i.e. LM (kg/total body weight (kg)). Mean MCA velocity (MCAv) was assessed using a 2-MHz transcranial Doppler ultrasound probe on the right temporal window. Mean MCA conductance (MCAc) was calculated as MCAv/mean arterial pressure (MAP), with MAP obtained from finger photoplethysmography. **Results:** The range of values for this sample were: MCAv (30 - 105 cm/s), MCAc (0.30 - 1.05 cm/s/mmHg), MAP (79 - 116 mmHg), LM (30.73 - 68.80 kg), FM (15.55 - 63.25 kg), VF (020 - 3. kg), and body weight (51 - 123 kg). Absolute LM and VF were negatively associated with MCAv and MCAc; however, only VF remained after controlling for body weight (*p < 0.05; Table). No relationship was observed for relative LM or VF (either absolute or relative). **Conclusion:** These results indicate that increased visceral adiposity is negatively related to cerebral blood flow in older adults, whereas whole body fat mass was not as sensitive. This suggests the importance of visceral adipose interacting with cerebrovascular physiology in contrast to whole body fat mass among older adults.
1) examine whether the heightened cardiovascular response to exercise in T2D results from muscle metaboreflex overactivity in vivo, and 2) investigate the impact of T2D on neuronal responses to chemical stimulation in skeletal muscle afferents in vitro. METHODS: For 14-16 weeks, rats were given either a normal diet (control group) or a high fat diet in combination with a low dose (35 mg/kg) of streptozotocin (T2D group). In vivo, we measured changes in renal sympathetic nerve activity (RSNA) and mean arterial pressure (MAP) in response to capsaicin administration (0.3 and 1.0 μg/g) in the hindlimb arterial supply. In vitro, the function of chemically (1 μM capsaicin) activated group IV neurons were assessed by obtaining single-fiber recordings using a muscle-nerve preparation. RESULTS: T2D rats exhibited hyperglycemia after overnight fasting (104±5 vs. 161±10 mg/dL, P<0.05). Compared to control, capsaicin administration evoked significantly greater increases in RSNA (0.3 μg: 366±25 vs. 92±17 %; 1.0 μg: 55±26 vs. 246±72 %, P<0.05) and MAP (0.3 μg: 151±8 vs. 45±9 mmHg; 1.0 μg: 231±38 vs. 70±5 mmHg, P<0.01) in T2D rats. The discharge of group IV muscle afferents to 1 μM capsaicin exposure was likewise significantly greater in T2D rats compared to control (0.8±0.3 vs. 2.9±0.7 Hz, P<0.05). CONCLUSIONS: These findings suggest that the heightened cardiovascular response to exercise in T2D may be caused by an exaggerated muscle metaboreflex made overactive via a potentiation in muscle afferent responsiveness to chemical stimulation. Supported by Lawson & Rogers Lacy Research Fund in Cardiometabolic Disease and the Southwestern School of Health Professions Interdisciplinary Research Grant Program.

1865 Board #21 May 30 2:00 PM - 3:30 PM
Change In Cardiorespiratory Fitness And Prevalence Of Metabolic Syndrome After An Exercise Program
Matthew Riccardi. Ball State University, Muncie, IN.
Email: mprriccardi@bsu.edu
(No relevant relationships reported)

Metabolic syndrome (MetSyn) is defined as the clustering of multiple risk factors associated with an increased risk for cardiovascular disease (CVD) and type II diabetes. We, and others, have shown that cardiorespiratory fitness (CRF) is associated with the prevalence of MetSyn, however, it is unknown if a change in CRF with exercise training is related to reduced prevalence of MetSyn. PURPOSE: To examine the relationship between the change in CRF and the change in number of MetSyn risk factors following a self-referral exercise program. METHODS: Maximal cardiopulmonary exercise (CPX) tests and MetSyn risk factors were analyzed prospectively from 364 adults aged 46.1 years (45% women). MetSyn was defined according to the National Cholesterol Education Program. Adult Treatment Panel III criteria as updated by the American Heart Association/National Heart, Lung, and Blood Institute. Correlations and logistic ordinal regression were used to assess the relationship between the change in CRF and the change in number of MetSyn risk factors following a self-referral exercise program. RESULTS: Overall prevalence of MetSyn decreased from 25% to 15%, while CRF improved 15% (30.9 ±8.1 vs. 35.5 ±8.9 mL/kg/min, P<0.001) following the exercise program. Measured change in CRF had a significant, inverse relationship with the change in number of MetSyn risk factors following ~6 months of participation in a self-referred, community-based exercise program. Measured change in CRF had a significant, inverse relationship with the change in number of MetSyn risk factors (r = -0.21; P<0.001). Subjects who improved CRF had a 52% reduction in likelihood of gaining MetSyn risk factors compared to subjects who did not improve CRF (Odds ratio=0.474; P=0.030). CONCLUSION: This prospective analysis indicates that there is an inverse relationship between the change in CRF and the change in MetSyn risk factors in a self-referral cohort participating in an exercise program for approximately 6 months. Participating in a community-based, self-referral exercise program yields significant improvements on CRF, the MetSyn risk factors, and the overall prevalence of the MetSyn and therefore should be emphasized as a primary prevention strategy for MetSyn.

1866 Board #22 May 30 2:00 PM - 3:30 PM
Effects Of High Intensity Resistance Training on Cardiac Autonomic Modulation in Hypertensive Women
Arthur V. Vale1, Juliana C. Alves1, Paulo César V. Jardim, Thiago V. Jardim2, James Steele2, James P. Fisher3, Paulo V. Gentili3. 1Federal University of Goias, Goiania, Brazil. 2Southampton Solent University, Southampton, United Kingdom. 3Ukactive Research Institute, London, United Kingdom.
Email: arthur_vale27@hotmail.com
(No relevant relationships reported)

Individuals with arterial hypertension often have an autonomic nervous system (ANS) imbalance with predominance of sympathetic ANS. This predominance can lead to injury of several organs affecting its functioning. There is evidence that performing high intensity resistance training (RT) with heavier loads and a lower number of repetitions results in lower cardiovascular stress when compared with lighter loads and a higher number of repetitions. However, the effects of different protocols of RT in autonomic modulation are not known specially using nonlinear analyses methods.

PURPOSE: Analyze and compare the effects of different protocols of high intensity effort RT on autonomic cardiac modulation of hypertensive women using nonlinear methods. METHODS: A randomized crossover design clinical trial was conducted with 15 postmenopausal hypertensive women who underwent a control session and two high intensity RT protocols involving 6 and 15 repetition maximum (RM). The nonlinear variables that compose Heart Rate Variability (HRV) were collected pre, immediately post, 1 h post, and 24 h post each protocol. Repeated-measures ANOVA were used. RESULTS: The SD1 indices that represent parasympathetic activity in the system were lower in 15RM protocol immediately after the exercise (9.32±11.40) when compared with 6RM (16.38±13.15) and control (19.39±13.40) (p<0.05). The SD2 indices that represent a global variability in the system also were lower in 15RM protocol especially immediately after (13.84±9.57) the exercise when compared with 6RM (24.19±17.23) and control (22.62±17.41) (p<0.05). For the 6RM protocol no relevant clinical changes were observed. CONCLUSIONS: Performing high intensity RT with lower loads and a higher number of repetitions decreases parasympathetic ANS activity, which may be related to an increased cardiovascular stress. On the other hand, heavier load and lower repetition RT did not have a significant impact upon autonomic modulation when compared to a control session.

1867 Board #23 May 30 2:00 PM - 3:30 PM
Effects Of Sleep-inducing Mixed Juice On Sleep Quality And Cardiac Vagal Regulation In Adults With Disturbed Sleep
Hye-Young JUNG, Maengkyu KIM, Choun-Sub KIM, Min-Ghyu SUN, Yong-Woo KIM. Kyungpook National University, Daegu, Korea, Republic of.
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(No relevant relationships reported)

PURPOSE: To investigate whether the consumption of sleep-inducing juice would effect on sleep quality and cardiac vagal regulation in adults with sleep disorders. METHODS: This randomized and cross-over design study was conducted on twenty-three adults (24.2±1.39 yrs; 15 females, 8 males) who complained with difficulty in initiating and/or maintaining sleep (PSQI ≥ cutoff score of 5). On feeding session (FS), subjects had received sleep-inducing juice (250mls) twice a day for 8 wks while non-feeding session (N-FS) maintained usual daily life without juice intake. 2 wks washout was given between two sessions. Anthropometrics and hemodynamic index were taken before and after FS and N-FS. Sleep parameters (e.g. sleep latency) and amount of physical activity had recorded through Actigraph GTX3+ while Pittsburgh sleep diary has completed for consecutive 7 days. For evaluation of cardiac autonomic regulation, heart rate variability (HRV) at resting and during sleep had recorded through Polar RS800CX. In addition, self-reported Pittsburgh sleep quality index (PSQI) and fatigue severity scale (FSS) had completed before and after FS and N-FS. RESULTS: Anthropometrics, hemodynamic index, and amount of physical activity had no significant differences between sessions including baseline. Sleep latency, total counts/night, and sleep fragmental index had significant decreases after FS whilst total sleep time and sleep efficiency had significant increase (p<0.01, respectively) compared to post N-FS. Moreover, PSQI had significantly decreased after FS (p<0.01) coincided with significant decline of FSS (p<0.01). Furthermore, vagal activity index (e.g. HF, rMSSD, and SD1) had significant improvement followed by FS (p<0.05, respectively) yet there were no significant differences in N-FS. On the contrary, sympathetic nerve activity index (LF/HF ratio) had significant decrease after FS while there was no significant difference after N-FS. CONCLUSIONS: Major findings has suggested that consumption of sleep-inducing juice is effective to improve sleep quality accompanied with enhancement of cardiac vagal tone at resting and during sleep. Thus, sleep-inducing juice might be of benefit for managing sleep in adults with disturbed sleep.
Autophagy is an evolutionary conserved cellular degradation system implicated in maintaining health and promoting longevity. Few human data exist investigating the autophagic response to exercise; however, acute moderate-intensity, continuous exercise (MCT) has been shown to stimulate autophagy in skeletal muscle. Presently, it is unknown whether high-intensity interval training (HIIT) exercise induces autophagy. PURPOSE: The purpose of this study was to compare the autophagy response of an acute bout of HIIT exercise (treadmill running) to MCT exercise in human skeletal muscle. METHODS: Using a crossover design, ten recreationally-active males (n=5) and females (n=5) performed a bout of MCT (60 minutes at 95% of max velocity $[V_{\text{max}}]$) and HIIT (6 bouts of 1 minute at 100% $V_{\text{max}}$ and 1 minute at 3 MPH, followed by 5 minutes at 3 MPH, followed by 6 bouts of 1 minute and 100% $V_{\text{max}}$ and 1 minute at 3 MPH). Muscle biopsies from the vastus lateralis were taken pre- and 3 hours post-exercise. Exercise bouts were separated by ≥72 hours and performed after abstaining from alcohol for ≥24 hours and food and caffeine for ≥8 hours. Subjects also refrained from food, energy-containing beverages, and caffeine during the 3-hour post-exercise period prior to the muscle biopsy. Muscle tissue was analyzed for protein expression of markers of autophagy (LC3I, LC3II) and autophagy signaling (p38MAPK) via western blot analysis. RESULTS: No differences were detected for LC3I, LC3II, or p38MAPK protein content measured 3 hours post-exercise compared to pre-exercise in both HIIT and MICT groups (p>0.05). LC3II:LC3I ratio increased 3 hours post-exercise in HIIT (162.4 ± 45.9%), which was significantly higher than MICT at 3 hours post-exercise which decreased from pre-exercise (48.8 ± 9.4%; p<0.05). CONCLUSION: Our findings show that despite disparate durations and intensities, HIIT stimulates autophagy in human skeletal muscle, however, in a distinct fashion compared to MICT. Our data also add to the current literature demonstrating that autophagy is activated by continuous (≥ 60 minutes), moderate-intensity (55 – 70% $V_{\text{max}}$) exercise.

Introduction: Cellular senescence is a state of irreversible cell cycle arrest associated with aging that occurs in many cell types including endothelial cells (EC) and skeletal muscle satellite cells (SC). Senescent cells exhibit an increase in secretion of cytokines and chemokines, often referred to as the senescence associated secretory phenotype (SASP). SCs and ECs co-exist in the muscle niche and cross-talk occurs between the two cell types. Small extracellular vesicles (exosomes) have been implicated as important contributors to the SASP. PURPOSE: Determine if exosomes from human, primary, senescent muscle satellite cells impact human endothelial cell growth, angiogenesis, and senescence. METHODS: Senescence in primary human skeletal muscle satellite cells (n=6) was induced via incubation with 200μm hydrogen peroxide (H$_2$O$_2$). Exosomes were collected from normal and H$_2$O$_2$-treated satellite cells (NML-EXO and SEN-EXO, respectively). Human umbilical vein endothelial cells (HUVECs) were treated with 50 μg/ml of NML-EXOs or SEN-EXOs. HUVEC growth and senescence was evaluated using EdU and β-galactosidase staining. HUVEC angiogenesis was measured via matrigel tube formation, wound healing and transwell migration assays. RESULTS: After 48-hours, there was a decrease in proliferation (NML-EXOS: 22% vs SEN-EXOS: 18% EdU$^+$ cells) and an increase in senescence (NML-EXOS: 40% vs SEN-EXOS: 53 % β-gal$^+$ cells) in the SEN-EXO treated HUVECs. SEN-EXOs also impaired HUVEC wound healing following a scratch assay by 32.4%. There were no differences in HUVEC tube formation between the two groups. CONCLUSION: Exosomes harvested from senescent muscle satellite cells appear to transfer a senescent phenotype to HUVECs, resulting in impaired growth and angiogenesis.

**Autophagy Is Induced Following Short-term Concurrent Exercise Training in Human Skeletal Muscle**

**Board #26**

May 30 2:00 PM - 3:30 PM

**Effect of Short-Term Concurrent Exercise Training on Skeletal Muscle Exosomal Contents**

Brian P. Sullivan, Yaohui Nie, Sheelagh Evans, Chris K. Kargl, Zach R. Hettinger, Monica J. Hubal, Shihuang Kuang, Julianne Stout, Timothy P. Gavin, FACSM, Purdue University, West Lafayette, IN. Indiana University-Purdue University Indianapolis, Indianapolis, IN. Indiana University School of Medicine - West Lafayette, West Lafayette, IN.

(NO relevant relationships reported)

(conclusion)

(conclusion)

(No relevant relationships reported)
THURSDAY, MAY 30, 2019

**Effects Of Different Doses Of D-galactose On Skeletal Muscle In C57BL/6j Mouse**

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(No relevant relationships reported)

**PURPOSE:** Pharmacologically inducible models of aging could help to understand the pathogenesis of sarcopenia and to establish better exercise prescriptions for the elderly. Administration of D-galactose (50-150 mg/kg) has been used to induce aging phenotype including accumulation of oxidative stress, muscle atrophy, and cognitive impairment. A recent paper has shown that a higher dose of D-galactose (500 mg/kg-day) accumulated greater oxidative stress, compared with the commonly used dose (100 mg/kg-day). These observations suggest that there might be room to reconsider the optimal dose of D-galactose. We hence examined whether higher dose of D-galactose (above 100 mg/kg/day) exacerbate skeletal muscle atrophy.

METHODS: Male C57BL/6j mice (8 weeks old) were divided into 4 groups as follow: 1) Control (0 mg/kg/day, n=10), 2) D-Galactose (150 mg/kg/day, n=10), 3) D-Galactose (1000 mg/kg/day, n=10), and 4) D-Galactose (2000 mg/kg/day, n=10). We intraperitoneally injected D-galactose solution at indicated dose every day for 8 weeks. On the day before tissue collection, we performed grip strength measurement. Twenty-four hours after the final injection, we collected and weighed gastrocnemius muscle, and then conducted histochimical analysis to measure cross-sectional area.

RESULTS: We first confirmed that body weight and food intake during the intervention were not different among any doses of D-galactose. There were no detectable changes in muscle mass and grip strength among groups. We found that D-galactose injection decreased muscle fiber cross-sectional area at 150 mg/kg/day (-13.7%, P=0.03), but not at 1000 mg/kg/day (-11.5%, P=0.10) and 2000 mg/kg-day (-9.8%, P=0.19).

CONCLUSIONS: Daily injection of D-galactose at 150 mg/kg/day sufficiently induces muscle fiber atrophy. Even if the dose was increased up to 1000 or 2000 mg/kg/day, the muscle fiber atrophy was not aggravated but rather alleviated.

**Board #28 May 30 2:00 PM - 3:30 PM**

**Exercise Activate Tendon Cells through HGFA**

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(No relevant relationships reported)

Regular exercise enhances the musculoskeletal systems including tendon strengthening. Tendon cells, consisting of tendon stem/progenitor cells (TSCs) and tenocytes, are essential for the maintenance and repair of tendinous tissues when injured. Previously, we showed that TSCs increase in their number and quality after mice underwent moderate treadmill running. However, the molecular mechanisms underlying the activation of tendon cells by exercise are unknown. Hepatocyte growth factor activator (HGFA) is known to be a systemic factor that can activate skeletal muscle stem cells. **PURPOSE:** To test the hypothesis that HGFA is elevated and activates tendon cells in response to exercise. **METHODS:** Total 18 mice were equally divided into cage control and exercise groups. Exercise was mimicked by one-time treadmill running (OTR), with which mice ran at 13 meter/min for 6 hrs. Twelve hours before OTR, both groups of mice were injected with 1 mg of bromodeoxyuridine (BrdU) per mouse to determine cell proliferation. One day after OTR, all mice were sacrificed and Achilleas and patellar tendons were harvested. The HGFA levels in both tendons and serum were measured using ELISA, and BrdU incorporation was assayed by immunofluorescence staining. Student t-test was performed to assess statistical significance. **RESULTS:** OTR increased HGFA levels in both Achilleas and patellar tendons of OTR mice compared to cage control mice (Fig. 1A). HGFA levels in serum were also significantly increased after OTR (data not shown). Moreover, more BrdU-positive cells were present in patellar tendons in OTR group than control group (Fig. 1B), indicating that quiescent tendon cells were activated from G0 to G1 by exercise, possibly through HGFA. **CONCLUSION:** Exercise-elevated HGFA possibly may be responsible for the activation of tendon cells. This new molecular mechanism may explain the beneficial effects of exercise on tendon strengthening by stimulating synthesis.

**Board #30 May 30 2:00 PM - 3:30 PM**

**Ischemia-reperfusion Injury Remodels Skeletal Muscle Motor Unit, Myonuclear- And Mitochondrial-domains**

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Peripheral artery disease (PAD) is a significant medical condition caused by blockages in the arteries of the legs. Some PAD cases progress to critical limb ischemia (CLI) and major amputation. While recent regenerative medicine approaches on collateral vessel formation have made some progress, the myopathy and dysregulation of the skeletal muscle in CLI have not been thoroughly investigated. **PURPOSE:** To determine the regenerative mechanism of the muscle stem cell (MuSC) and its niche components in response to ischemic insults, we assessed interactions between MuSC, vascular- and neural-network, and myofibers at different times points. **METHODS:** The femoral artery ligation mouse model of PAD on different reporter mice were used in the study. Immunofluorescence, single fiber staining, and biochemistry blotting from harvested hindlimb muscles were used for data analysis. One-way ANOVA with Tukey’s post hoc test and a paired two-tailed t-test were performed to determine differences following CLI injury. **RESULTS:** Skeletal muscle regeneration persisted up to 56 days while the number of eMHC fibers (p<0.01) was highest 14 days following CLI surgery compared to the contralateral sham control. In addition, muscle regeneration was accompanied by significant alterations in the motor unit, as demarcated by the presence of denervated synapses, regeneration of the neuromuscular junction (NMJ), and increased number of subsynaptic nuclei (p<0.05). Furthermore, the size of the myonuclear domain was decreased at 7 and 14 days (p<0.01), corresponding to greater RNA content (p<0.001) and MuSC frequency (p<0.05) while the mitochondrial domain was increased 28 days (p<0.01) following CLI injury. **CONCLUSION:** Overall, these data indicate that as a regenerative response to critical limb ischemia, the neurovascular network of myofibers are remodeled and newly regenerated myofibers exhibit MuSC-derived myoneural expansion to allow enhanced transcriptional support and an increase in mitochondrial content for a bioenergetic need of the energy-demanding tissue regeneration. Supported by NIH R21AR072287 (YCJ) and Regenerative Engineering and Medicine research grant.

**Board #31 May 30 2:00 PM - 3:30 PM**

**Increased Muscle Salpha-dihydrotestosterone By Acute Resistance Exercise Contributes To Muscle GLUT4 Signaling in Diabetic Rats**

Naoki Horii, Natsuki Hasegawa, Masataka Uchida, Motoyuki Iemitsu. Ritsumeikan University, Kusatsu, Japan. (Sponsor: Izumi Tabata, FACSM)

(No relevant relationships reported)

Our previous study showed that 5α-dihydrotestosterone (DHT), an active androgen, can be synthesized in skeletal muscle by 5α-reductase. Recently, we revealed that the increase in muscle DHT level by resistance training was associated with improvement of glycemic control in type 2 diabetic rats. Acute resistance exercise activates signaling pathway such as AMPK/TBC1D1 and Akt/AS160 in skeletal muscle, resulting in enhancement of GLUT4 translocation. However, it is still unclear whether an increase in muscle DHT secretion by acute resistance exercise contributes to up-regulation of...
these signaling pathways in type 2 diabetes. PURPOSE: This study aimed to clarify whether acute resistance exercise-induced increase in muscle DHT level contributes to muscle glucose metabolism-related signaling pathway in type 2 diabetic rats. METHODS: Male 20-week-old type 2 diabetic (OLETF) rats were randomly divided into 8 groups: resting control and immediately, an hour and three hours after acute exercise (climbing ladder) with and without treatment of 5α-reductase inhibitor (N=6 each group).

RESULTS: Muscle 5α-reductase protein expression and DHT level were significantly increased immediately and an hour after acute exercise (p<0.05) whereas these exercise responses were significantly suppressed by the treatment of 5α-reductase inhibitor (p<0.05). Muscle AMPKα1/2, TBC1D1 and AktSer473 phosphorylation were significantly increased immediately and an hour after acute exercise response (p<0.05). In addition, muscle AS160Thr450 phosphorylation and GLUT4 translocation were significantly increased immediately and three hours after exercise response (p<0.05). However, the treatment of 5α-reductase inhibitor was significantly suppressed the up-regulations of GLUT4 translocation and Akt/AS160 phosphorylation (p<0.05), but did not alter the AMPK/TBC1D1 phosphorylation.

CONCLUSIONS: These results suggest that the increase in DHT secretion by acute exercise may partially contribute to enhancement of muscle GLUT4 translocation via activation of Akt/AS160 phosphorylation in type 2 diabetic rats.

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1877 Board #33 May 30 2:00 PM - 3:30 PM

Skeletal Muscle Kir6.2 Protein Expression Correlates To Ion Transport Capacity And Exercise Performance In Athletes

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No relevant relationships reported

Skeletal muscle ion regulation may affect exercise tolerance during intense muscle work. However, the inter-play between different sarcelemmal ion transport proteins is not well described in trained skeletal muscle.

Purpose: To examine associations between protein expression of Kir6.2, a key subunit of the ATP-sensitive K+ channel (K+ATP), and exercise performance, as well as different ion regulators and fiber type profile in trained skeletal muscle.

Methods: Seventeen competitive women soccer players (age: 23.4±3.4 yr, height: 166.5±3.5 cm, weight: 60.2±7.5 kg, VO2max: 50.5±1.5 ml·min⁻¹·kg⁻¹), participated. Participants have a muscle biopsy obtained from m. vastus lateralis. The Western Blot technique was applied to determine muscle protein expression of Kir6.2, different ion transporters involved in Na+, K+, H+, and Ca2+ sarcolemmal transport, a myriad of metabolic enzymes and muscle fiber type character. Finally, exercise performance capacity was assessed with a VO2max test, a repeated sprint test (RST), as well as the Yo-Yo Intermittent Endurance, level 1 (YYIE1). Inter-individual relationships between selected variables were evaluated by Pearson’s product-moment correlation coefficients.

Results: Muscle Kir6.2 and monocarboxylate transporter 4 (MCT4) correlated (r=0.59; P<0.05) with MCT4 explaining 35% of the variance in Kir6.2 protein. Moreover, the ratio of MCT4:Kir6.2 muscle protein expression correlated (r=0.50; P<0.05) to YYIE1 performance. Kir6.2 protein expression also correlated (P<0.05) with muscle Na+-K+ATPase α1 and the FXYD1 subunits (r=0.42 and 0.50, respectively). Kir6.2 correlated to the expression of Myosin Heavy Chain 1 (MHC1; r=0.51) and Phosphofructokinase (PFK) protein (r=0.45). In contrast, no relationship was observed between Kir6.2 and oxidative enzymes. Xna-K+ATPase subunits correlated (r=0.46; P<0.05) to Kir6.2 protein expression. The sum of all ion transporters correlated to VO2max (r=0.58), RST (r=0.45) and YYIE1 performance (r=0.42).

Conclusions: Skeletal muscle KATP channel abundance appears to associate with the capacity to regulate ions such as H+ and K+. Moreover, the capacity to regulate homeostasis is associated with exercise tolerance in trained human skeletal muscle.

1878 Board #34 May 30 2:00 PM - 3:30 PM

LINE-1 Retrotransposition Increases With Age in Rodent Skeletal Muscle

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No relevant relationships reported

Long interspersed nuclear element-I (LINE-1 or L1) is termed a genomic parasite due to its ability to randomly copy and paste itself back into the genome. Studies have shown that L1 accounts for roughly 17-18% of the total human genome. However, due to various mutations in most of the L1 elements, only approximately 100 copies are functionally active. L1 has been shown to increase with age in mice skeletal muscle tissue. However, there is no data regarding the effects of aging on L1 activity in rat skeletal muscle tissue. PURPOSE: To identify the effects of aging on L1 expression in rat skeletal muscle tissue. METHODS: Sedentary male Fischer 344 rats were fed ad libitum and were aged to 3, 12, and 24 months (mo) (n=9 per age group) and then sacrificed. Primer sets for qPCR were designed for the youngest most active form of L1 (L1.13), and older L1 elements (L1.Tot). Gastrocnemius skeletal muscle was harvested and then processed for RNA and DNA isolation. Thereafter, the following analysis ensued: L1 mRNA expression, L1 DNA copy number, L1 promoter methylation and ORF1 protein. Additionally, a subset of the tissues from 3 mo (n=5) and 24 mo (n=6) were shipped to LC Sciences for RNA sequencing to analyze L1 related genes. RESULTS: Primer sets designed for both L1.13 and L1.Tot significantly increased with age (L1.13, p<0.003; L1.Tot, p<0.003), and was higher at 24 mo compared to 3 mo (p=0.01). L1.13 integration into the genome was significantly higher at 24 mo compared to 3 mo (p=0.021). ORF1 protein expression significantly increased with age (p<0.001), and was higher in both the 12 and 24 mo compared to 3 mo (p<0.05). There was no statistical difference for L1 promoter methylation. From RNA sequencing CTCF was significantly higher in 24 mo compared to 3 mo (p=0.011).

Conclusion: L1 gene expression appears to increase with age, which leads to more random insertions back into the genome. This may be a result of an increase in...
Follistatin inhibits the actions of the TGFβ family to oppose inhibition of skeletal muscle growth, whereas growth and differentiation factor (GDF) 15 may inhibit muscle growth. The PURPOSE of this project was to determine if predominately aerobic exercise can induce changes in concentrations of circulating follistatin and GDF-15, and if these changes are dependent on exercise intensity and/or duration.

METHODS: Fifteen recreationally trained young (28.3±2.0 years) males (n=8) and females (n=7) participated in two bouts of treadmill running: a vigorous intensity/short duration (ViSd) bout at +15% ventilatory threshold for 30 minutes and a moderate intensity/long duration (MiLd) bout at -5% ventilatory threshold for 12 hours. Blood was collected pre-exercise, 15 minutes from the start of exercise, mid-exercise, and immediately, 1 hr-, 2 hr-, and 3 hr-post exercise. Serum was analyzed with commercially available ELISA kits for follistatin and GDF-15.

RESULTS: At 15 minutes into the exercise bout follistatin was higher (p<0.0001) in MiLd (8.1±2.7 ng/mL) than ViSd (5.28±4.3 ng/mL), and GDF-15 was higher (p=0.0002) in MiLd (209.3±40.8 ng/mL) than ViSd (183.7±31.2 ng/mL). Follistatin was higher in ViSd 1 hr-post exercise (MiLd 9.7±3.1 ng/mL vs. ViSd 12.1±7.3 ng/mL; p<0.0001), and higher in MiLd 2 hr-post exercise (MiLd 11.2±3.4 ng/mL vs. ViSd 7.6±4.2 ng/mL; p=0.0008) and 3 hr-post exercise (MiLd 10.1±3.3 ng/mL vs. ViSd 8.8±4.9 ng/mL; p<0.0001). GDF-15 was higher in MiLd immediately post-exercise (MiLd 335.0±75.9 units vs. ViSd 193.5±53.4 units; p=0.0065), 1 hr-post exercise (MiLd 461.0±84.7 ng/mL vs. ViSd 225.2±45.7 ng/mL; p<0.0001), and 3 hr-post exercise (MiLd 338.7±70.2 ng/mL vs. ViSd 224.3±44.8 ng/mL; p<0.0001).

CONCLUSIONS: The differences at the 15 minutes into exercise time point suggest that the exercise-induced follistatin and GDF-15 response is intensity-dependent. The differences post-exercise imply that there may also be a duration effect. Intensity and duration need to be considered to increase follistatin in response to running.

PAPER: The process of myogenesis is gradually declined and cells apoptosis increases with aging. However, mechanical loading of aged skeletal muscle can ameliorate its impaired myogenic and survival potential. Yet, the molecular responses of aged muscle cells to mechanical loading are still elusive. This study examined the effects of mechanical loading of aged differentiated myoblasts (myotubes) on the signaling and gene expression responses associated with the progression of their myogenic lineage and survival.

METHODS: C2C12 myoblasts were cultured for 50 consecutive days (68 cell cycles) in order to acquire aging properties, while normal myoblasts were used as a control condition. Subsequently, control and aged C2C12 cells were cultured in myogenic plastic membranes until their 9th day of differentiation (myotubes) and then underwent a passive, cyclic stretching (2.2% elongation, at a frequency of 0.25Hz, for 12h). Phosphorylation of signaling proteins ERK1/2 and Akt and increase in MyoD protein levels (p<0.05). mRNA expression levels of Atrogin, Myostatin) in response to mechanical loading of the differentiated C2C12 myotubes resulted in significant activation of Akt and increase in MyoD protein levels (p<0.05). miRNA expression of IGF-1 isoforms (IGF-1Ea: 2.1-fold, IGF-1Eb: 1.2-fold) and MRFs (Myogenin: 11-fold, MRF4 1.2-fold) were increased significantly (p<0.05), while Myod (0.8-fold), apoptotic factors FOXO: 0.7-fold, FUCA: 0.3-fold, p53: 0.6-fold and atrophy factors (Atroglin: 0.09-fold, Myostatin: 0.7-fold, Murlf: 0.09-fold decreased) (p<0.05).

CONCLUSIONS: Uregulation of myogenic and anabolic factors, along with the downregulation of apoptotic and atrophy factors by mechanical loading suggests an amelioration of myogenic and survival ability of the aged myotubes.
DOxorubicin (DOX) is a chemotherapy drug used to effectively treat a variety of cancers. Its clinical use, however, is limited by its toxicities commonly attributed to increased oxidative stress in cardiac and skeletal muscle. The DOX-induced rise in oxidative stress can overwhelm endogenous antioxidants yet exercise (both endurance and resistance) has shown promise in attenuating this decline. Little information, however, is available on how DOX and resistance exercise affect antioxidant enzymes in type II skeletal muscle.

**PURPOSE:** To determine the effects of resistance training before and during DOX treatment on superoxide dismutase (SOD1) and SOD2 expression in the primary type II extensor digitorum longus (EDL) muscle.

**METHODS:** Thirty-six male Sprague-Dawley rats were randomly assigned to one of four groups: sedentary+saline (SSS), sedentary+DOX (SSD), resistance training+saline (RRS), or resistance training+DOX (RRD). The resistance training protocol incorporated a raised cage model where food and water were elevated progressively which provided hind limb loading 10 weeks prior to DOX injection and 4 weeks during DOX treatment. Groups treated with DOX received 3 mg/kg DOX weekly for 4 weeks (12 mg/kg cumulative), and saline-treated groups received 0.9% NaCl as a placebo. Five days following the final DOX or saline injection, EDL muscles were excised, and Western blotting was performed to quantify SOD1 and SOD2 expression.

**RESULTS:** Although no significant drug effects, activity effects, or drug x activity interactions were observed with SOD1 and SOD2 expression (P > 0.05), a trend toward SSD expressing less SOD1 and SOD2 than SSS was observed (-25% and -3%, respectively vs SSS). This same trend in SOD1 and SOD2 expression, however, was not observed in RRD (+3% and -3%, respectively vs SSS). CONCLUSIONS: The DOX dosing regimen used in the current study had no effect on SOD1 and SOD2 expression in the EDL muscle, and the resistance training protocol also did not affect SOD1 and SOD2 expression. These results suggest that resistance exercise may play a limited role in modulating oxidative stress of DOX in type II skeletal muscle.

**THURSDAY, MAY 30, 2019**

**PAPER 1885**

**Board #41**

May 30 2:00 PM - 3:30 PM

**Molecular Implications of Active and Passive Recovery Following High Volume Resistance Training**

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**No relevant relationships reported**

**PURPOSE:** Deloading is widely practiced in the strength and conditioning community as a method to augment recovery; however, there is little molecular signaling data to fully explain the details of why this practice is beneficial.

**METHODS:** Recreationally-trained, college-aged males (n = 30) underwent 6 weeks of volume based training, after which the participants were split into active recovery (AR) and passive recovery (PR) groups with deload lasting 7 days. Participants donated a muscle biopsy from the vastus lateralis prior to week 1 (PRE), post training (POST), and post deload (DL). Protein expression for mTOR, AMPK, 4EBP1, and p70S6K was evaluated via western blotting. Additionally, blood was obtained via venipuncture, and serum levels of creatine kinase (CK), testosterone (TEST), and cortisol (CORT) were evaluated using commercially available assay kits.

**RESULTS:** There was an effect of time for phosphorylated (p) 4EBP1 (p = 0.014) where PRE (p = 0.003) and POSTDL (p = 0.004) expression of p-4EBP1 were significantly higher than POST. CK activity also had an effect of time (p = 0.016) where CK at POST was significantly higher than at DL (p = 0.007). There was a significant group*time interaction of proteasome activity (p = 0.040) where post-hoc analysis revealed the AR group exhibited higher proteasome activity DL than the PR group (p = 0.051). Differences in protein expression for pan and phosphorylated mTOR, AMPK, 4EBP1 and p70S6K and were not significant (p > 0.05). Additionally, there were no significant differences in serum testosterone and cortisol levels (p > 0.05).

**CONCLUSION:** AR may stimulate the PI3K/Akt pathway resulting in the phosphorylation of 4EBP1 potentially allowing hypertrophic adaptation to occur. Additionally, proteasome activity being upregulated with AR POSTDL may be beneficial in clearing damaged protein structures. More research is needed to further investigate molecular signaling after deloading paradigms.

**THURSDAY, MAY 30, 2019**

**PAPER 1886**

**Board #42**

May 30 2:00 PM - 3:30 PM

**PGC-1/ERR-Induced Regulator in Muscle (PERM1) Increases Mitochondrial Respiratory Capacity in Culture Muscle Cells**

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**No relevant relationships reported**

Peripheral arterial disease is the third leading cause of death of atherosclerotic cardiovascular mortality in the United States and the incidence of PAD increases age. Previous studies have shown that PAD displays impaired mitochondrial respiration, decreased expression of mitochondrial enzymes, increased oxidative stress, and mitochondrial DNA mutations within their ischemic limb muscles. We identified a potential transcriptional regulator of mitochondrial gene expression, PGC-1/ERR-induced regulator in muscle (PERM1) which is defined in patients with severe PAD. Interestingly, PERM1 regulates the expression of only a subset of genes induced by PGC-1a or ERRs expression in C2C12 myotubes, suggesting that PERM1 selectively functions in specific PGC-1/ERR-driven pathways.

**Purpose:** The purpose of this study is to determine whether PERM1 is a potential gene target to aid in tissue recovery and regeneration from hypoxia in C2C12 myotubes. **Methods:** We generated AAVs to overexpress the PERM1 gene or a green fluorescent protein (ZsGreen1). Following AAV infection, C2C12 myoblasts were differentiated into mature myotubes for assessments of mitochondrial biogenesis, mitochondrial respiration, and myogenesis were performed. To determine if PERM1 plays a role in recovering myob last proliferation and myotube formation from hypoxic insult. Results: AAV-PERM1 resulted in a ~16-fold increase in mRNA expression which drove ~20% increase in complex I-supported respiration compared to the control cells (P = 0.05). Additionally, expression of PERM1 did not change the myoblast fuse index (an index of myogenesis) (P = 0.32, n = 4).

**Conclusion:** Our results indicate that PERM1 is a strong regulator of mitochondrial biogenesis in skeletal muscle cells, capable of increase both mitochondrial content and respiratory function. Based on these observations, future studies should be aimed at understanding the therapeutic potential of PERM1 for improving muscle energetics in conditions with impaired muscle metabolism, including peripheral arterial disease. Partially supported by AHA Grant 18CD3A411004 to TER.
Purpose: Skeletal muscle exhibits a remarkable capacity for regeneration following injury. However, the molecular mechanisms governing skeletal muscle regeneration remain poorly understood. X-box binding protein (XBP1) is a downstream target of the endoplasmic reticulum (ER) stress inducer inositol-requiring enzyme 1 (IRE1). The purpose of this study was to determine the role of XBP1 in regulation of skeletal muscle regeneration and growth.

Methods: To investigate the role of XBP1 in the regulation of skeletal muscle regeneration and growth, we generated muscle-specific knockout (KO) mice of XBP1. Control and KO mice were then subjected to a functional overload in adult mice (226.3 ± 30.0 LNS/179.5 ± 15.0 mm², p < 0.05). Interestingly, XBP1 does not affect the rate of protein synthesis during muscle growth. Rather, deletion of XBP1 prevents skeletal muscle hypertrophy through reducing the total number of satellite cells per 100 myofibers (9.5 ± 1.1 vs. 5.8 ± 0.8, p < 0.05).

Conclusions: The results of the present study suggest that XBP1 is necessary for skeletal muscle regeneration and adult skeletal muscle hypertrophy. Furthermore, XBP1-mediated signaling in myofibers promotes satellite cell proliferation and fusion in a non-cell autonomous manner. More investigations are needed to further understand the mechanisms, especially gene network that XBP1 regulates during skeletal muscle formation and growth.

Cancer cachexia is a devastating syndrome that affects around 50-80% of cancer patients and is characterized by a rapid, drastic fat and muscle mass loss. The APCmin mouse strain is a well-studied model of human colorectal cancer and cancer cachexia. The branched-chain amino acid leucine is known to stimulate muscle growth/maintenance through activation of mTOR and protein synthesis.

Purpose: To examine the effects of chronic leucine supplementation on cancer cachexia development in APCmin mice. METHODS: 7 APCmin mice (APC) and 11 wild-type (WT) were used for this study. The animals were assigned to the following groups: WT no leucine (WTNL, n=5), WT leucine (WTL, n=5), APCmin no leucine (APCNNL, n=5) and APCmin leucine (APCNL, n=2). Mice were given ad libitum access to food and water. Mice in the leucine groups received 1.5% leucine-rich water.

Plantsarissus muscles and tendons were excised at 20 weeks of age. Tissue was immediately frozen for morphology and gene expression analysis using RT-qPCR. RESULTS: The number of polyps increased in APCNL compared to WT (46.57 ± 2.44 vs. 0.00 ± 0.00). The number of polyps < 1 mm was increased (14.33 ± 1.45 vs. 7.75 ± 2.05) in APCNL compared to APCLNL (p<.05). There was a main effect for APCNL to have lower body mass than WT (p<.0001). There was a main effect of genotype to decrease plantaris weight/tibia length in APCNL mouse vs. WT mouse (p<.0001) and a main effect of leucine to decrease plantaris weight/tibia length in APCNL mouse (p<.05), which appeared to be driven by the APCL (interaction p=0.0841). There was an ~3-fold increase in atrogin-1 gene expression in APCNL compared to WTNL (p<.05). Atrogin-1 gene expression was ~7-fold lower in APCNL compared to APCLNL (p<.05). There was a main effect of genotype to increase MuRF1 expression in APCNL mice compared to WT (p<.05) and a main effect of leucine to decrease MuRF1 expression (p<.05) which appeared to be driven by the APC genotype (interaction p=0.0560). No difference was found in MyoD or Myogenin gene expression. CONCLUSION: The preliminary data suggest deleterious effects of leucine in cancer cachexia, which need to be affirmed by further studies. Based on gene expression of the E3 ubiquitin ligases, this loss in muscle mass may be independent of protein degradation. Supported by the Arkansas Biosciences Institute.

Obesity (OB) disrupts cellular communication consistent with lower skeletal muscle capillarization. Exosomes, small membrane vesicles, transport and deliver mRNA, miRNA, and proteins in an endocrine manner and are released by muscle during aerobic exercise. The effects of resistance exercise (REx) on exosome biogenesis is unknown.

Purpose: Investigate if resistance exercise increases skeletal muscle exosome biogenesis pathways and if this response is impaired in obesity.

Methods: Lean (LN) and obese (OB) (n=9/group) sedentary men and women performed 3 sets of 8-12 repetitions/set of acute, single leg knee extension resistance exercise at 80% of 1-RM. Vastus lateralis biopsies were obtained at rest and at 15 min, and 3 hr post-exercise. Muscle mRNA, protein expression, fiber typing, and capillary staining were measured.

Results: The gene expression of the exosome biogenesis components hepatocyte growth factor-regulated tyrosine kinase (HGS) and vascular protein sorting mutant (VPS4a) were lower in OB than LN at rest (~25%) and 15 min post-exercise (~20%), but not 3 hr post-exercise. Expression of exosome surface markers apoptotic linked gene-2 interacting protein X (Alix) was lower (OB ~35% and LN ~20% 15min post-exercise) and tumor susceptibility gene-101 (TSG-101) was higher (OB ~50% and LN ~40% 3hr post-exercise) in response to REx in both groups. Acute resistance exercise increased vascular endothelial growth factor (VEGF) mRNA similarly in LN and OB. Interestingly, anti-angiogenic thrombospondin-1 (TSP-1) mRNA was increased by acute RE only in OB (~230% 3hr post-exercise), miR-130a (angiogenesis), miR-206 (myoblast to myotube differentiation) and miR-503 (repressor of cell proliferation) were increased in OB at rest and following exercise. Type II fiber size was greater and capillary density was lower in OB. Conclusion: Obesity alters skeletal muscle exosome biogenesis, angiogenic, and muscle differentiation pathways possibly contributing to greater muscle fiber size and lower muscle capillarization. Resistance exercise alters skeletal muscle exosome marker expression similarly in both lean and obese.

Muscle antioxidant enzymes may be upregulated in parallel with increased exercise training status and capacity for reactive oxygen species (ROS) formation. Purpose: To examine associations between antioxidant protein expression and different physiological markers of endurance exercise in trained women athletes.

Methods: Seventeen competitive women soccer players (age; 23±4 yrs; height; 166±5 cm, body weight; 60±7.5 kg; VO2max: 50±1.5 ml·min⁻¹·kg⁻¹) participated. Participants had a muscle biopsy taken from m. vastus lateralis, which was analyzed for protein expression of superoxide dismutase 1 and 2 (SOD1 and 2), several metabolic enzymes and muscle fiber type profile. Participants also performed a VO2 max test, a repeated sprint test (RST), as well as the Yo-Yo Intermittent Endurance test, level 1 (YIE1) and Recovery test, level 1 (YYR1). Int-individual relationships between selected variables were analysed using Pearson’s product–moment correlation coefficients.

Results: VO2max and SOD2 correlated (P<0.05) with VO2 max explaining 24% of the variance in SOD2 protein expression. Myosin Heavy Chain 1 (MHC1) and Ila (MHC1a) explained 26 and 25%, respectively, of the variance in SOD2 protein. Oxidative enzymes such as citrate synthase, isocitrate dehydrogenase and cytochrome
c oxidase correlated (P<0.05) with SOD2 explaining 24, 31 and 17% of the variance, respectively. Finally, SOD2 protein expression correlated (P<0.05) to monocarboxylate transporter 4 (MCT4; r=0.71), and phosphofructokinase (PK; r=0.62). No statistical relationship was observed between SOD2 protein and neither Na+-K+ATPase subunits, Na+/H+ exchanger, Acetyl-CoA carboxylase, PECAM-1, nor YY1E1, YY1R1 and RST performance. SOD1 protein expression displayed an inverse correlation with MHCIIa (r=0.61; P<0.05), but did not correlate with any other variable assessed in muscle or physical capacity. CONCLUSIONS: Skeletal muscle antioxidant capacity associates with markers of endurance exercise such as maximal aerobic power, type I and IIa muscle fibers, and mitochondrial function. However, strong relationships were additionally observed between antioxidant profile and lactate production as well as transport capacity, supporting a link between lactate and ROS generation.

Satellite cells drive skeletal muscle regeneration in response to injury, a process regulated by factors released into the local muscle environment. However, the cellular sources of this trophic support are poorly defined. In this regard, recent work on skin and bone repair has revealed a surprising supportive role for cells termed “senescent cells” which are commonly associated with aging and pathology. However, the role of senescence in skeletal muscle repair is currently unknown. The PURPOSE of this study is to determine the presence and contribution of senescent cells in skeletal muscle repair following acute injury. METHODS: The tibialis anterior (TA) of C57BL6 mice was injured with cardiotoxin (CTX) and collected 5, 7, 10, 14, and 21 post-injury for histological/ immunohistochemical (IHC) and gene expression analysis. To examine the function of senescent cells during muscle repair, mice were treated with a senolytic compound (ABT-263) following injury to selectively ablate senescent cells. RESULTS: Senescent cell number (as revealed using the senescence-associated beta-galactosidase (SA-β-gal) assay) increased significantly following injury (p <0.05) and returned to baseline by day 21 post-injury, a time-course that is coincident with the repair process. In agreement with this, qPCR analysis of putative senescence pathways including p16 and p21 and p53 as well as secreted factors commonly secreted by senescent cells such as IL1 and MMP13 were significantly upregulated in injured compared to control tissue (p <0.05). Preliminary IHC analysis demonstrated that at 5 days post-injury, 58% of senescent cells were positive for macrophage marker F4/80, while at 10 days post-injury, 43% of senescent cells were F4/80 positive and 9% were CD31 positive; an endothelial cell marker. Identification of other cell types is under investigation. Senolytic treatment was effective at removing senescent cells as a significant 44% reduction in the number of SA-β-gal+ cells was observed, the consequences of which on muscle repair are currently under analysis. CONCLUSION: Senescent cells are a newly identified component of the muscle repair environment which may influence skeletal muscle repair and satellite cell function. Supported by NSERC discovery grant and The Canadian Foundation for Innovation and ACVA.
BIS device as well as DXA before and after six weeks of progressive resistance training. METHODS: Twenty-three resistance-trained males (mean ± SD: age, 21.6 ± 2.1 years; height, 178.4 ± 7.8 cm; weight, 80.9 ± 10.5 kg) underwent six weeks of resistance training. DXA (Lunar Prodigy IDA, GE) and BIS (SOZO, ImpediMed Inc.) were administered pre and post-intervention with participants in a fasted and normally-hydrated state wearing a t-shirt and athletic shorts for determination of whole body fat mass. Agreement between methods for determination of whole body FFTM at each time point and across time were determined by Bland and Altman plot analysis (mean difference and 95% limits of Agreement), bivariate linear regression analysis and dependent samples t-tests with statistical significance set at p<0.05. RESULTS: Bland and Altman plot analysis revealed good agreement between methods producing a mean difference and 95% LoA of 1.9 ± 2.3 kg, respectively. Regression analysis revealed a strong and significant relationship (r=0.96, r²=0.92, SEE=2.2 kg, p<0.001) between DXA and BIS-derived FFTM. Both DXA and BIS-derived FFTM significantly (p<0.001) increased post-training (pre vs post, 63.2±7.9 vs 65.8±7.4 and 65.2±8.3 vs 67.6±7.2 kg, respectively). Importantly, mean FFTM delta scores were not statistically different between DXA and BIS (2.6±1.4 vs 2.4±1.6 kg, p=0.57). Furthermore, regression analysis revealed a significant relationship between DXA and BIS-derived FFTM delta scores (r=0.72, r²=0.50, SEE=1.01 kg, p<0.001). CONCLUSIONS: BIS-derived FFTM agrees well with DXA-derived FFTM for single measurements as well as following resistance training-induced skeletal muscle hypertrophy and is an accurate and acceptable alternative to DXA.

Funding provided by ImpediMed Inc

Jordan R. Moon is an employee of ImpediMed Inc

Body composition has several implications for the overall health and performance of athletes. Changes in body composition can serve as indication of the physical demands of a competitive season as well as provide valuable feedback of the training adaptations from different training regimens. PURPOSE: To evaluate the pre- to post-season changes in body composition and maximal aerobic capacity in male (MXC) and female (WXC) Division 1 cross-country athletes. METHODS: Eleven MXC (age: 18±1.1 yrs; body fat: 9.8±4%; and 13 WXC (age: 18±1.1 yrs; body fat:19.8±4%) participated. Body composition (lean mass, LM; leg lean mass (LLM); fat mass, FM; body fat% and bone mineral density, BMD) were measured pre- and post-season. Regional BMD of the total body, lumbar spine (L1-L4), hip (femur), LM and FM were obtained for analysis. The appendicular skeletal muscle adjusted by factorial analysis (ASMI) and LLM were used for analysis with significance accepted at p<0.05. The ASMI and LLM increased significantly in both MXC and WXC from pre- to post-season (p<0.05), increased significantly in both MXC and WXC from pre- to post-season (p<0.05), with no differences between genders. Further, the LLM did not differ between groups (p=0.15, r²=0.31, 1.3±3.7 kg). There were no gender by time and time effects for FM, body fat% and regional BMD. There were no pre- to post-season changes in VO2max for both MXC (70.3±4.3 to 69.5±3.9 ml/kg/min) and WXC (56.6±3.9 to 58.3±4.3 ml/kg/min). CONCLUSIONS: Results suggest highly trained cross-country athletes maintain positive changes in total and regional LM with no changes in FM, body fat% and BMD. Aerobic capacity was maintained across the season despite increases in LM. Results highlight the seasonal changes in body composition in collegiate distance runners that maintain stamina and conditioning coaches and athletic trainers.

Dual energy X-Ray absorptiometry (DXA) determined lean tissue mass has long been regarded as a criterion method for independent of mitochondrial mass. Uncp2 expression was not different between groups (p=0.05), suggesting the impairment of respiratory function to be independent of mitochondrial mass. CONCLUSIONS: We highlight an under-recognized role of liver mitochondria in cancer cachexia, and suggest hepatic mitochondrial function to be a therapeutic target.

**METHODS:** Male Brazilian Army cadets (n=163; 21±0.4 years) were genotyped for the LEP rs6570241 and -2548G>A (rs7799039) and LEP rs668A>G (rs1137101) polymorphisms. Anthropometric, hormonal and aerobic capacity parameters were measured 48 h after intense military exercise.

**RESULTS:** Sixty-seven percent of participants were classified as having superior aerobic conditioning (VO2max ≥55.2±10.2 ml·kg⁻¹·min⁻¹) and had lower plasma leptin levels (36%, P<0.008) than subjects classified as having excellent aerobic conditioning. Considering all subjects VO2max correlated negatively with fat mass (r=-0.21, P<0.007), whereas plasma leptin level correlated positively with body fat (r=0.642, P<0.005) and fat mass (r=0.723, P<0.001), and negatively with VO2max (r=-0.223, P<0.005). Only individuals homozygous for the wild-type homozygote for LEP -2548G>A SNP had higher plasma leptin values (59%), body fat (85%), and fat mass (82%) (P=0.05) compared to those with a GA genotype. LEP -2548G>A SNP was a positive predictor for plasma leptin levels (B=0.217, P=0.02), adjusting for fat mass, and therefore, genotype effects may affect leptin levels.

**CONCLUSIONS:** Polymorphism in the leptin promoter gene may influence plasma leptin levels, but not aerobic capacity, in response to intense physical exercise. Additional studies are needed to show the precise contribution of the SNPs on aerobic capacity. Financial support FAPERJ.

**PURPOSE:** The aim of the present study was to determine the association between single nucleotide polymorphisms (SNPs) in the leptin (LEP) and leptin receptor (LEPR) genes, and body composition, plasma leptin levels, and aerobic capacity in response to 48 h of intense exercise.

**METHODS:** A study with the following design was conducted: pre- and post-training, with a control group of 11 healthy individuals who did not exercise. The results were analyzed using statistical tests with significance accepted at p<0.05.

**RESULTS:** The VO2max increased significantly in both MXC and WXC from pre- to post-season (p<0.05), without differences between genders. Further, the LLM did not differ between groups (p=0.15, r²=0.31, 1.3±3.7 kg). There were no gender by time and time effects for FM, body fat% and regional BMD. There were no pre- to post-season changes in VO2max for both MXC (70.3±4.3 to 69.5±3.9 ml/kg/min) and WXC (56.6±3.9 to 58.3±4.3 ml/kg/min). CONCLUSIONS: Results suggest highly trained cross-country athletes maintain positive changes in total and regional LM with no changes in FM, body fat% and BMD. Aerobic capacity was maintained across the season despite increases in LM. Results highlight the seasonal changes in body composition in collegiate distance runners that maintain stamina and conditioning coaches and athletic trainers.

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Purpose: To evaluate the influence of low carb diet on body composition of trained individuals. Methods: Twenty eight CrossFit practitioners (M:13, W:15, age range: 19-59 years) for at least 6 months followed a personalized diet plan for 2 months. The diet had 27% of energy from carbohydrate, 50% of energy from fat and 23% of energy from protein, and consisted of 5 meals per day, comprising mainly of fruits and vegetables, complex carbohydrates (cereals and tubers) and animal proteins (red meat limited to 3 times/week). The body weight was measured to the nearest 0.01 kg using electronic scales and body composition (including percent body fat, muscle, and fat mass) was evaluated by portable ultrasound during the days 1, 30 and 60 of the dieting program. The collected measures were chest, triceps, subscapular, medial axillary, suprailiac, abdomen and medial thigh. The equations developed by Jackson and Pollock were used for the calculation of body density. Waist and hip circumference were also measured. Samples were tested for normal distribution and groups were compared by either paired Student’s t-test or Mann-Whitney test. The type I error was set at p<0.05. Results: There was a significant reduction in body weight and hip circumference after 30 days (weight: 79.1±15.4 vs 77.5±14.4, p<0.001; hip circumference: 107.6±6.9 vs 104.9±7.3, p=0.007) and 60 days (weight: 79.1±15.4 vs 77.0±14.6, p<0.001; hip circumference: 107.6±6.9 vs 105.5±8.3, p=0.007) of dietary intervention. Additionally, there was a significant reduction of total fat and %body fat after 30 (total fat: 23.8±16.1 vs 20.4±15.6, p=0.004; %body fat: 25.1±6.5 vs 21.5±5.3, p<0.001) and after 60 days (total fat: 23.8±16.1 vs 19.9±15.3, p<0.001; %body fat: 25.1±6.5 vs 20.0±5.5, p<0.001) and a significant gain of body fat-free mass after 60 days (59.1±12 vs 60.9±13, p=0.01). When subgroup analyses were performed by sex, it was found that the relative loss of body fat was similar. Thus, there was no difference between lean mass gain between men and women. Conclusion: The low carbohydrate diet promoted body weight, total fat and %body fat reduction and fat-free mass gain, independently of sex, after 30 and 60 days, in trained Crossfit individuals.

Board #55 May 30 2:00 PM - 3:30 PM

Body Composition and Muscle Contractile Properties in Male Professional Soccer Players
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(No relevant relationships reported)

Purpose: Lower limb muscle injury accounts for >50% of all injuries in professional soccer. Despite this, there is an absence of body composition and muscle function reference ranges in professional players. The purpose of this study was to generate lower limb reference ranges for lean tissue mass (LTM) and muscle contractile function regardless of leg (dominant vs. non-dominant) studied. Differences between dominant and non-dominant limbs (P<0.05). Increasing lower limb LTM was associated with a reduction in Dm (right = 0.375, left = 0.394, P<0.05). Lower limb muscle contractile properties normalised to lower limb LTM were higher in forwards compared to other outfield playing positions (P<0.05). Conclusions: Our findings suggest players are homogenous in terms of the total amount of LTM and contractile function regardless of leg (dominant vs. non-dominant) studied. Differences in muscle contractile properties between playing positions may represent differences in positional demands. Increasing LTM might have been expected to produce increasing Dm; however, an increase in LTM is associated with an increase in non-contractile tissue that may lead to an overall reduction in contractile mass.

1900 Board #56 May 30 2:00 PM - 3:30 PM

Electromyographic Evidence of Excessive Achilles Tendon Elongation During Isometric Contractions After Achilles Tendon Repair

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(No relevant relationships reported)

Purpose: Increased tendon elongation after Achilles repair is thought to contribute to selective weakness in end-range plantarflexion (PF). Excessive tendon elongation during maximum voluntary contraction (MVC) means greater muscle fiber shortening. Since mean frequency (MF) of the electromyogram (EMG) increases with decreasing fiber length, it was hypothesized that MF would be higher on the involved (Inv) versus non-involved (Non) side during isometric PF MVCs. The purpose of this study was to examine MF during isometric MVCs in patients with Achilles tendon repairs.

Methods: Isometric PF MVC was measured at 20°, 10°, 0° dorsiflexion (DF), and 10°, 20° PF in 17 patients (age, 39±9 years; 15 men, 2 women) 43±24 months after surgery. Surface EMG signals were recorded during MVCs. MF was calculated from Fast Fourier Transforms of medial gastroc (MG) lateral gastroc (LG) and soleus (S) EMG signals. Effect of weakness on MF was assessed using analysis of variance.

Results: Patients had weakness in 20° PF (deficit 28.18±1.11, P<0.01; 14 of 17 deficit >20%) but no weakness in 20° DF (deficit 8.15±1.11, P=0.20; 4 of 17 deficit >20%). MF increased moving from DF to PF (P<0.001) but was not different between Inv and Non (P=0.22). At 10° PF 8 of 17 patients had weakness (>20% deficit). MF was significantly higher on Inv versus Non, across all angles, in patients with weakness versus no weakness at 10° PF (side by group P=0.014; Table 1). MF was 13% higher on Inv versus Non in patients with weakness (P=0.012) versus 3% lower in patients with no weakness (P=0.47).

Conclusions: Higher MF for Inv versus Non in patients with PF weakness is consistent with greater muscle fiber shortening. This indicates that weakness was primarily due to excessive lengthening of the repaired Achilles tendon. If weakness were simply due to atrophy, a lower MF would have been expected.

1901 Board #57 May 30 2:00 PM - 3:30 PM

Spatial Resolution Of The Medial Gastrocnemius Mechanomyograph Resolved By Time-Frequency And Principle Pattern Analysis
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(No relevant relationships reported)

Purpose: The purpose of the present study was to examine the mechanomyograph of the medial gastrocnemius spatially using a grid of nine accelerometers during electrically-contracted invocations.

Methods: 16 (8M, 8F) moderately-active volunteers (mean age = 21 ± 3 y) with measurable H-reflexes participated. The tibial nerve was stimulated in 20° increments with 10-second rest intervals, and data where the peak-to-peak M-wave amplitude exceeded the H-reflex were analyzed. Peak-to-peak MMG (MMGmax) data were subjected to the intensity analysis, and total intensity, the peak total intensities (Max), and time to Max (TTMax) were determined. Maps of the dependent variables were plotted across a 9-accelerometer grid for each stimulus for each participant to be analyzed. The MMG intensity maps were subjected to a principle pattern analysis (p-space) and p-values (N = 5) were compared across-subs. Pearson’s r among the dependent variables and repeated measures ANOVA were calculated for P, MMGmax, Max, and TTMax, by stimulus (Stim) and accelerometer (ACC) using R open source software (www.r-project.org). Statistical significance was set at α = 0.05.

Results: A significant correlation existed only for MMGmax and Max (r = 0.9434, p<0.0001). RM-ANOVA demonstrated significant effects of Stim for MMGmax and Max; ACC for MMGmax, Max, and TTMax; and Stim by ACC for TTMax (p<0.001). Progression of the MMG acceleration maps varied among the dependent variables and repeated measures r values. The MMG acceleration maps varied among the dependent variables and repeated measures r values.
eight participants, and Stim (p < 0.05) in five participants. In addition, there were significant interactions for Stim by P (p < 0.01) and ACC by P (p < 0.01). CONCLUSION: We found no significant spatiality for CAI associated sensorimotor impairments. This lower planter stiffness may influence ankle joint stiffness during activities, which may be a risk factor for recurrent ankle sprain.

1904 Board #60  May 30 2:00 PM - 3:30 PM
Influence Of Plyometric Training On Tendinous Tissue Elongation During Initial Phase Of Explosive Power Exertion
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(No relevant relationships reported)

PURPOSE: The sharp rise of the ground reaction force due to high pre-activation of muscles upon drop jump (DJ) contributes to increases in the reactive strength index (RSI). In our previous studies, in a comparison between athletic long jumpers and general men, the long jumper showed a significant increase in Achilles tendon tissue elongation immediately after DJ contact due to high pre-activation of the gastrocnemius muscle. In this study, we aimed to clarify the influence of plyometric training on Achilles tendon tissue elongation dynamics immediately after DJ contact.

METHODS: Five men (age, 21.0 ± 0.7 y; height, 172.2 ± 4.6 cm; weight, 67.6 ± 3.8 kg) volunteered to participate in this study. The subjects were asked to undergo plyometric training (maximum hopping 10 reps × 3 sets, 3 times a week, 12 weeks). Experiments were conducted before and after training and after 12 weeks of detraining. Changes in the Achilles tendon tissue length of the mediolateral medials (the distance from the muscle tendon junction to the calcaneus along the line of action of the tendon) during DJs from a height of 0.3 m were measured using a high-speed camera and ultrasonography equipment. Electromyographic parameters and ground reaction force were measured in synchrony with the camera and ultrasonography equipment.

RESULTS: The RSI increased significantly after training (1.89 ± 0.35) and after detraining (1.78 ± 0.46) compared to that before training (1.49 ± 0.43). The elongation of Achilles tendon tissue immediately after the grounding of DJ was significantly increased by training (+ 2.99 ± 2.36 mm), and the training effect disappeared after detraining (- 0.23 ± 2.50 mm). On the other hand, there was no significant effect on the maximum elongation of tendon tissue in the push-off phase. In other words, the elongation of tendon tissue during the initial phase of explosive power exertion is more important than the maximum elongation of the tendon tissue.

CONCLUSIONS: Plyometric training increases tendon tissue elongation immediately after the DJ grounding and increases the RSI. These results suggest that the increase in tendon tissue elongation during the initial phase is one of the factors to increase explosive power exertion.
PURPOSE: Strengthening of the rotator cuff and periscapular muscles is crucial for appropriate neuromuscular control of the mobile glenohumeral and scapulothoracic joints. The aim of the current study was to quantify and compare the regional activation of supraspinatus (SUP), infraspinatus (INF) and some periscapular muscles during shoulder strengthening exercises with elastic bands.

METHODS: 27 right handed healthy volunteers (22.5 ± 2.7 years old) were recruited. Four fine wire electrodes were inserted into the anterior and posterior regions of SUP and the superior and middle regions of INF under ultrasound guidance. Four paired surface electrodes collected data from the upper, middle and lower trapezius and serratus anterior (UT, MT, LL, SERR respectively). Participants performed four resistance exercises (in Y, T, W and L postures) with elastic bands while maintaining good form and cadence. Kinematics were recorded synchronously by Vicon motion tracking system. Electromyography values were presented as % of maximal voluntary isometric contraction (MVIC) and compared across exercises using ANOVA.

RESULTS: Rotator cuff and periscapular muscles showed similar activation profiles throughout the Y, T and W exercises. The peak activation of SUP anterior occurred in 20% of L exercise cycle while for other regions it occurred in 40-60% of time cycle. Mean activations of all rotator cuff partitions were over 40% of MVIC during four exercises, except middle INF during T exercise (29.3% MVIC). UT was activated >80% MVIC during all four exercises, with no significant differences across exercises while MT was significantly more active in T exercise. The activations of SERR and UT were significantly higher during Y exercise. CONCLUSIONS: YT WL exercises induced moderate to high activation in supraspinatus and infraspinatus partitions, and very high activation in lower trapezius. These exercise are appropriate for strengthening of some rotator cuff and periscapular muscles and can potentially be useful for rehabilitation of scapular dyskinesia and shoulder impingement. However, caution should be taken while prescribing Y exercise for these pathologic conditions as this exercise may induce high activation in UT. Providing additional strengthening exercises for SERR to this exercise package is recommended.

INTRODUCTION

Shoulder pain is a common orthopedic ailment, with multiple potential sources of pain and dysfunction. A combination of treatments may be used. While treatment has generally shown to be effective, it does not resolve the syndrome for all patients. PURPOSE: To determine the effect of a standardized treatment protocol on the neuromechanics of the shoulder. It is hypothesized that rotator cuff activation will increase with both pain relief and physical therapy.

METHODS

Seven subjects, who were diagnosed with subacromial impingement, and seven healthy controls were recruited. At the first testing session, the subject was instrumented with six surface electromyography sensors and two fine-wire sensors. Subjects elevated their arm in the scapular plane, while kinematics and EMG were recorded. At baseline, it appears that muscle activation in the patients is decreased compared to healthy controls. To determine the effect of a standardized treatment protocol on the neuromechanics of the shoulder, subjects returned for additional testing following the same protocol. For patients, the three testing periods were designated T1 (before injection), T2 (after injection), and T3 (after physical therapy). For healthy controls, only the original time point was analyzed.

RESULTS

Figure 1 shows the supraspinatus activity of seven patients during humeral elevation in the scapular plane. At baseline, it appears that muscle activation in the patients is lower than controls, but in most cases, increases over time. There also are potential differences in activity between patients and control subjects at the three time points, as well as changes associated with the subacromial injection or with physical therapy.

CONCLUSIONS

Immediately following the subacromial injection, activation levels appear to have remained relatively constant. However, after physical therapy, activation levels show a pattern of increase. Data collection and analysis are continuing.
Exercise adherence and physical activity can be difficult to measure. Current methods often rely upon self-report surveys which are susceptible to error. Machine learning methods can be applied to biomechanical data to classify and identify activity. Each exercise has a unique “fingerprint” of biomechanical data in that there is a unique combination of motion in each joint. Inertial measurement units (IMU) can move biomechanical analysis from the lab to real world environments allowing for more ecologically valid measurements. PURPOSE: The purpose of this study is to develop a machine learning algorithm for classifying nine different upper extremity exercises, based upon biomechanics captured from an IMU-based device. METHODS: 50 participants (mean age = 21.9 years) were recruited. Participants performed one compound and eight isolation exercises with their right arm while wearing the device. Each exercise was performed ten times for a total of 4500 trials. The device consists of a small, self-contained computer and four 3-axis IMUs. IMUs were placed on the hand, forearm, upper arm, and torso. Joint angles were calculated using relative rotations between pairs of IMUs. A modified Hampel filter and Savitzky-Golay filter were applied to remove outliers and noise. Random Forests were trained on 50% of the data and tested on the remaining 50%. RESULTS: The model performed well with an overall classification accuracy of 92.4%. Figure 1 shows the class confusion matrix where the numbers represent the proportion of true cases that were predicted. CONCLUSION: The results suggest upper extremity exercises can be classified using biomechanics data captured with a novel IMU-based device. These findings set the basis for more objective activity logs which can be used for measuring exercise adherence, physical therapy, and physical activity levels. Ultimately, the device may be used to create activity profiles for health screening and health status.

D-59 Free Communication/Poster - Upper Limb
Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1911 Board #67 May 30 2:00 PM - 3:30 PM
Classifying Upper Extremity Exercises Using Biomechanics Captured with an Inertial Measurement Unit-based Device
Andrew Hua, Pratik Chaudhari, Nicole Johnson, Joshua Quinton, Bruce Schatz, David Buchner, FACSM. University of Illinois at Urbana-Champaign, Champaign, IL.
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(No relevant relationships reported)

Exercise adherence and physical activity can be difficult to measure. Current methods often rely upon self-report surveys which are susceptible to error. Machine learning methods can be applied to biomechanical data to classify and identify activity. Each
Improper posture including forward head, rounded shoulder and scapular dyskinesis have been linked to neck and shoulder pain. Treatment for forward head posture (FHP), rounded shoulder posture (RSP), and scapular dyskinesis has consisted of an exercise protocol. Kinesiote (KT) has recently emerged as a treatment method but there is a lack of research on the effectiveness, or whether exercise or KT is better than the other. PURPOSE: To compare a KT intervention to a strengthening and stretching program for correction of FHP, RSP, and scapular dyskinesis in a healthy, non-athletic, college age population. METHODS: Twenty healthy college-aged subjects with forward head, rounded shoulder posture and scapular dyskinesis completed the study. There were 10 subjects (7 females, 3 males, 20.30±1.52 yr, ht=171.67±11.82 cm, wt=69.40±14.11 kg) in the KT group and 10 subjects (7 females, 3 males, 20.40±1.43 yr, ht=166.61±11.99 cm, wt=69.40±11.48 kg) in the EG group. Subjects were randomized into two intervention groups undergoing a four-week program. One group participated in a strengthening and stretching exercise protocol (EG) based on the current literature, while the other group had KT applied to the upper back and shoulders for a duration of five days with two days of no tape in a seven-day period. Pre-and post-test measurements included the craniovertebral angle (CVA) in degrees, forward shoulder angle (FSA) in degrees, and scapular dyskinesis as assessed using scapular dyskinesis scoring (0-3, maximum combined score = 6) for each scapula. RESULTS: There was a significant time main effect for the scapular dyskinesis score (SDS) as both groups improved pre-to-post intervention (F=12.5, P<0.01; EG=4.8±1.14 vs. 5.3±1.94, KT=4.0±1.59 vs. 4.9±1.01). Time effect sizes were small to moderate for CVA (KT=-13 to EG=-53), RSA (EG=15 to KT=-46) and SDS (EG=-44 to KT=-30) in both groups. Group effect sizes were small for CVA (0.24), RSA (0.25) and SDS (0.36). Minimal-detectable-change-scores were achieved for the CVA (EG=3.90, KT=80) and SDS (EG=50, KT=80) for both groups, indicating clinical improvement. No other results were significant. CONCLUSIONS: Both groups improved pre-to-post intervention for the three measurements, even though only SDS was significant. Thus, either treatment could be used.

Physical activity (PA) positively influences health parameters such as cardiorespiratory fitness (CFR) and body composition in children and adolescents. However, evidence of these associations, including sedentary time (ST), among Hispanic children is insufficient. PURPOSE: To determine associations between PA, ST, body composition, and CFR in 4th-grade Hispanic children. METHODS: A group of 70 boys (n=33) and girls (n=37), 9.4±0.5 years of age completed a CFR test (PACEY) and body composition evaluation (height, weight, calf and triceps skinfolds) using the FITNESSGRAM® protocol, and wore an accelerometer for 7-consecutive days. T-tests and Wilcoxon rank-sum tests were conducted to test for sex differences when appropriate, and correlation analyses by sex to test for associations between variables. RESULTS: Compared with boys, girls were less active (238.7±48.1 vs. 199.4±72.4 min/day of moderate to vigorous PA, P<0.01, 158.25±4539 vs. 1500±5883 steps/day, P=0.01) and more sedentary (6.61±2.7 vs. 7.8±1.8 hrs/day, P<0.01). Boys and girls were not different in their mean BMI (18.0±5.0 vs. 18.5±3.6 kg/m², P=0.63), %fat (22.6±11.0 vs. 25.2±8.1 %, P=0.26), max steps/min (133±14.4 vs. 131±18 steps, P=0.05), and CFR test (34.2±21.2 vs. 26.3±17.1 lps, P=0.11). CFR in boys was inversely correlated with BMI and %fat (r=-0.39 (P=0.04), -0.42 (P=0.02), respectively), and directly correlated with vigorous PA (r=0.40, P=0.03); while in girls, CFR was directly correlated with maximal steps/min (r=0.34, P=0.04). CONCLUSION: Although boys and girls appear sufficiently active, lower PA and higher ST among girls should be addressed to promote healthier lifestyles. Also, the
influence of PA intensity and body composition on CRF appear to differ by sex, a consideration for future PA interventions in this population. Supported in part by FIPP DEG/UPRPRP.

1917 Board #73 May 30 3:30 PM - 5:00 PM Effects of Exergaming on Motor Skill Competence, Perceived Competence, and Physical Activity in Preschool Children

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(No relevant relationships reported)

PURPOSE: Few school settings offer structured physical activity (PA) opportunities for preschool children, with little study conducted examining exergaming’s effectiveness on health outcomes in this age group. This study’s purpose, therefore, was to examine a school-based exergaming intervention’s effect on preschool children’s perceived competence, motor skill competence and PA versus usual care (recess), as well as examine gender differences for these outcomes.

METHODS: Sixty-five preschoolers (33 girls; M_age = 4.45 ± 0.46; M_height = 95.05 ± 32.04) from 2 underserved urban elementary schools in a Midwestern U.S. state were enrolled and then assigned to 1 of 2 conditions, with school as experimental unit: (1) usual care recess group (8 weeks of 100 minutes [5 days x 20 minutes] recess/week); and (2) exergaming intervention group (8 weeks of 100 minutes [5 days x 20 minutes] school-based exergaming/week). All children underwent identical perceived competence, motor skill competence and moderate-to-vigorous PA (MVPA) assessments at baseline and at the end of the 8th week. A multivariate analysis of variance with repeated measures was employed to examine preschool children’s changes in perceived competence, motor skill competence and MVPA over time.

RESULTS: A significant Group by Time effect was observed for MVPA (F(1, 52) = 4.37, p = 0.04, n² = 0.04), but not perceived competence (F(1, 52) = 0.83, p = 0.37, n² = 0.02) or motor skill competence (F(1, 52) = 0.02, p = 0.88, n² = 0.00). Specifically, intervention children displayed significantly greater increased MVPA at 8 weeks than the comparison children (4.05 vs. -1.99 minute). Additionally, there was a significant Time effect for motor skill competence (F(1, 52) = 15.61, p < 0.01, n² = 0.23) and Gender effect for MVPA (F(1, 52) = 5.06, p = 0.03, n² = 0.09). In detail, while all preschoolers’ motor skill competence improved over time, boys demonstrated higher MVPA than girls at both time points.

DISCUSSION: Exergaming showed a positive effect in promoting preschool children’s MVPA at school and has the potential to enhance perceived competence and motor skill competence. More research with larger sample sizes and longer study durations is warranted.

1918 Board #74 May 30 3:30 PM - 5:00 PM The Effect of Extracurricular Coordinated Physical Education on the Development of Basic Motor Skills of Children aged 7-9 Years Old

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to analyze the effect of the extracurricular physical education program through a 12-week-coordination on the development of basic motor movements for children of 7-9 years.

METHODS: A sample of 120 children of the elementary school period, 58 of whom were in the experimental group and 62 of whom were in the control group, were incorporated into the study in line with their own consent after their guardian had also informed. The program lasted for 12 weeks in the form of 2 days and 2 hours a day. The control group was not involved in any extracurricular physical education program. The predictors identified support theories associated with the importance of readiness for change (SSB consumption, willingness to meet with a dietician and suggest that engaging families when children are young may improve retention rates for clinic-based interventions targeting healthy weight or energy-balance behaviors.

RESULTS: Significant variables in univariate analyses included BMI50, sex, age, baseline cholesterol, sugar sweetened beverage (SSB) consumption, willingness to meet with a dietician, and the mother gaining more than 35 pounds during pregnancy. In logistic regression, children who consumed SSB once per week were more likely to return for a second clinic visit than those consuming SSB every day (OR 4.5 (95% CI: 1.9 - 10.5)) and older children were less likely to return than younger children (OR 0.9 (95% CI: 0.8 - 0.99)).

CONCLUSIONS: The predictors identified support theories associated with the importance of readiness for change (SSB consumption, willingness to meet with a dietician and suggest that engaging families when children are young may improve retention rates for clinic-based interventions targeting healthy weight or energy-balance behaviors.
INTRODUCTION: Evidence for physical activity (PA) compensation (e.g., high PA leads to low PA in another part of the day) and synergy (e.g., building on times of high PA with additional high PA) in school-aged youth has been reported, but has not been studied in preschoolers. PURPOSE: To determine if preschoolers exhibit evidence of compensation or synergy in indoor and outdoor PA during child care.

METHODS: Children (N=44; 3-4 y) in three preschools were observed for 160 sessions weekly for 6 wk. PA intensity was measured using accelerometers on their right hip for two school days. PA intensity was determined using Pate cut-points (counts/15sec). A proximity tagging beacon was placed in each classroom, and children’s accelerometers acted as receivers. Lack of communication between beacons and receivers indicated that children were outdoors. Indoor and outdoor time (min/hr) in light, moderate, vigorous, or total PA was determined. Paired t-tests were used to identify if time in each intensity (for indoor/outdoor time) significantly differed between days (p=0.05). Difference in time in each intensity between days was calculated and Pearson correlations were performed to compare between-day changes in indoor and outdoor light, moderate, vigorous, and total PA (e.g., correlation between change in outdoor total PA vs. change in indoor total PA). Positive associations support synergy, while inverse associations support compensation. RESULTS: No differences in time in each intensity between days were found. Change in outdoor light (r=0.02, p=0.883), moderate (r=0.17, p=0.279), and total (r=-0.14, p=0.369) PA were not significantly related to change in indoor light, moderate, and total PA, respectively. Change in outdoor vigorous PA was positively related to change in indoor vigorous PA (r=-0.4, p=0.007). For total PA, 59% of children exhibited evidence of compensation and 41% exhibited evidence of synergy. For vigorous PA, 45% of children exhibited evidence of compensation, and 55% exhibited evidence of synergy. CONCLUSION: Results suggest that vigorous intensity exercise may be more synergistic in nature. The weak-to-moderate, negative correlations among light, moderate and total PA warrant evidence for PA compensation at these intensities; however, results should be further examined in future studies using a larger sample size. 

Funding: ACSM Foundation, MWACSM, NASPSEM, SHAPE.
The Effects of Playground Zoning on Physical Activity During Recess in Elementary-Aged Children.

Jillian Barnas, MS, Stephen Ball, PhD. University of Missouri, Columbia, MO. (Sponsor: Jill Kanaley, PhD, FACSM)

No relevant relationships reported

While many factors contribute to the development of obesity, a sedentary lifestyle plays a significant role in this epidemic. Epidemiological data indicates that 50% of children aged 6-11 years old and approximately 92% of adolescents aged 12-18 years old are not meeting the recommended health guideline of 60 minutes of moderate-to-vigorous physical activity (MVPA) per day. Therefore, the most effective interventions for combating inactivity and childhood obesity should target children before inactivity develops in their adolescent years. Due to the increasing youth obesity rates, schools have been identified as ideal environments to promote physical activity (PA).

PURPOSE: The purpose of this study was to compare changes in physical activity in youth, measured by accelerometry, during recess with a playground zoning intervention.

METHODS: The sample included 433 third-, fourth-, and fifth-grade boys and girls from two elementary institutions. PA was observed during recess using systematic observation of play and leisure activity in youth (SOPPLAY) and measured using Actigraph GT3X accelerometers on a subset of students (n=78). Baseline data were collected for one week prior to playground zoning. Afterwards, the playgrounds were zoned into six various activities for two weeks and PA data was observed and measured.

RESULTS: A repeated measures ANOVA detected a significant main effect of the zoning with the decreased time spent in sedentary activity (p<.013) and moderate activity (p=.027). A significant cross-over interaction was detected with zoning and an increase in time spent in vigorous activity (p=.017) and MVPA (p=.006) for third graders, whereas fifth graders significantly decreased the time spent in MVPA (p<.001). Furthermore, third grade boys accumulated 204 more steps on the zoned playground compared to baseline measurements (p=.001). A McNemar test revealed a 5% increase in observational PA on zoned playgrounds (p<.001).

CONCLUSION: Zoned playgrounds are an applicable, manageable, and effective program that can help improve PA during recess for young children. However, a different intervention may be needed to improve PA in older children.
PURPOSE: Children with asthma often experience physical activity (PA)-induced symptoms 5-10 minutes following the start of exercise, with symptoms peaking 5-10 minutes post-activity. Classroom PA breaks provide shorter bouts of PA (4 minutes), and may represent a novel strategy to promote PA participation in this clinical population. Using a classroom-based PA intervention, we tested the feasibility of 5-4 minute PA breaks to promote PA participation in children with asthma. METHODS: Nine, 3rd grade classrooms at an elementary school in Detroit, MI (79% Hispanic; 80% on free/reduced lunch; 31% prevalence of asthma and asthma-like symptoms) participated in the 20-week intervention. Asthma status was self-reported via the International Study of Asthma and Allergies in Childhood (ISACA) questionnaire in conjunction with nurse documentation. PA participation, exercise intensity (sedentary (SED), low-intensity physical activity (LPA), moderate-to-vigorous intensity physical activity (MVPA)), and asthmatic symptom occurrence were assessed via direct observation. RESULTS: All students accumulated approximately 19 total minutes (4.5±0.8 PA breaks x 2468±8.0 seconds) of activity per day during PA breaks. Throughout the intervention, a greater percentage of children with asthma participated in MVPA during the PA breaks compared to children without asthma (asthma: 52.9±1.5% vs. non-asthma: 46.1±1.3%; p=0.001). In contrast, a greater percentage of students without asthma participated in LPA during PA breaks (non-asthma: 30.2±1.1% vs. asthma: 25.8±1.2%; p=0.006). There were no differences in the percentage of students who were SED during PA breaks (asthma: 21.3±1.7% vs. non-asthma: 23.7±1.1%; p=0.155). Out of 294 observations, six instances of asthmatic symptoms (coughing) were observed post PA break. CONCLUSIONS: Classroom-based interventions that incorporate short bouts of PA, represent safe exercises for children with asthma. Given the higher participation in MVPA among children with asthma, classroom interventions may be effective in reducing PA disparities in school settings.

PURPOSE: It is well known that childhood obesity has become a common issue in the United States (1), and that obesity contributes to a multitude of chronic diseases and negative health conditions (2). One of the biggest challenges in the treatment and prevention of childhood obesity is that the goal of these programs is primarily to modify behaviors that occur outside of the program space. The purpose of this study was to summarize the findings from a 6-month program that used wearable activity monitors (WAM) as part of a clinical obesity treatment program for fifteen children in Arizona (USA) between December 2015 to November 2017. METHODS: Obese children were referred to participate in this program by their pediatrician. Participants were provided a WAM that was used to monitor their physical activity (PA) levels, heart rate, and sleep habits. For the first week, participants were instructed not to change their behaviors so that baseline PA data could be collected. Subsequently, appropriate step and heart rate zone goals were set and progressively increased each week that a participant met their previous goal. RESULTS: Adherence to wearing the WAM was high, with only about 1.3% of activity data and 3% of sleep data missing throughout the entire program. Three children dropped out of the study before the program was completed. For the children who completed the program, the children who met improvements were noted for step count, and healthy sleep habits were found to be positively correlated with PA. In baseline data collection, the children walked on average 8,900 steps per day. In the final week, the children recorded 9,784 daily steps on average, representing approximately a 10% increase in the average number of steps taken. CONCLUSIONS: Overall, childhood obesity treatment programs focus heavily on modifying behaviors that occur outside of the clinic setting. A WAM appears to be a feasible approach to continuously monitor and increase the PA of obese children. Including WAM and progressive goal setting in a clinical obesity treatment program for children may be an effective method to increase PA levels outside of the clinical setting. Further exploration of the link between healthy sleep habits and PA could yield additional findings useful to childhood obesity treatment and prevention.
Previous research shows a decline in activity intensity during outdoor free play in young children, with the pattern of decline varying between boys and girls. However, this area has not been studied in other outdoor locations (i.e., garden) or during semi-structured play. PURPOSE: To determine if a time course change in intensity level,

CONCLUSIONS: Boys’ MET, level was consistent across time in both locations. Girls’ MET, level declined in the playground but increased in the garden. For girls, semi-structured activity in a garden may result in sustained higher MET activity during play.

Prior research demonstrates that elevated acute (1-week) relative to chronic (3-4 weeks) training load (TL) ratios are associated with increased injury risk. However, there is no existing research examining this relationship in youth female soccer athletes, who are at high risk for certain injuries during sport, such as anterior cruciate ligament injury. PURPOSE: To investigate the association between acute-to-chronic TL (A:C) ratio measures with time-loss injury in elite-youth female soccer athletes. METHODS: Forty-three elite-youth female soccer athletes participated in the study. Daily measures of training load, measured by self-reported (0-10 scale) rating of perceived exertion (RPE) multiplied by training duration (minutes), were recorded within 30-minutes of practices and games from pre-season (August 2017) until the end of the fall competitive season (December 2017) using a customized phone app. Following completion of the competitive season, the athletes completed a survey to determine their history of experiencing a time-loss injury during the season. A:C ratios were calculated at week-9 relative to weeks 5 through 8, as this was the most intensive TL period of the season. Binary logistic regression examined the association between A:C ratio and time-loss injury status. Receiver operator curve (ROC) analyses was performed to select a A:C TL cutpoint, followed by computation of sensitivity, specificity and area under the curve (AUC). Odds ratios (OR) were calculated and compared between those with and without time-loss injury. RESULTS: Nineteen athletes reported to miss ≥1 day of practice or game due to injury. Logistic regression demonstrated greater A:C ratio was associated with increased risk of time-loss injury (OR = 12.65 [95% CI=1.51, 105.27], Wald=5.49, P=0.019). ROC curve analysis identified an A:C ratio cutpoint of 1.62 to have optimal screening properties: sensitivity=73.3%, specificity=87.5%, AUC=0.76. The OR for an A:C ratio of 1.62 or higher compared to less than 1.62 was 19.25 (95% CI=3.64, 101.77).

CONCLUSIONS: Elevated A:C ratios (≥1.62) are associated with increased risk of suffering time-loss injury in elite-adolescent female soccer athletes. Monitoring and managing A:C TL may be an important injury prevention strategy in this population.
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**Board #93**

**May 30 3:30 PM - 5:00 PM**

**Physical Education Enrollment Trends of Youth with Obesity in a Large Midwestern Metropolitan Area**

Amanda Gier, Philip Khoury, Shelley Kirk, Christopher Kist, Robert Siegel. Cincinnati Children’s, Cincinnati, OH.

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(No relevant relationships reported)

**PURPOSE:** To determine physical education (PE) enrollment trends of youth with obesity in primary and secondary schools in a large Midwestern metropolitan area.

**METHODS:** Data from 71 months of clinical visits to a pediatric weight management program were extracted from electronic medical records. Entries were refined to include only school-aged children, ages 6-18 years old. Multiple encounters per subject were included if the encounters occurred during separate school years. Information regarding frequency (days per week) and duration (length of school year) of PE class was used to determine what percent of total school days a subject was enrolled in PE. Data were analyzed to determine trends in PE enrollment by age, gender, race, ethnicity and socioeconomic status.

**RESULTS:** Data were obtained for 6221 patient encounters (3514 females, 2706 males). Of these, 31.4% of patients were not enrolled in PE during the school year of the encounter. The most common frequencies of PE enrollment overall were 20% (29.4%) and 40% (16.3%) of total school days. There was no significant difference in PE enrollment between the age groups of 6-11 years and 12-13 years (22.6% vs. 26.5%). Students ages 14-18 years old were enrolled in PE a lower percentage of school days (18.5%, p<0.0001). Of students ages 14-18 years, males were enrolled in PE significantly more than females (21.2% vs. 16.7%, p=0.002). Subjects with government-funded health insurance were enrolled in PE more than students with private health insurance (25.2% vs. 22.0%, p=0.0001). Differences between race and ethnicity were not significant. **CONCLUSION:** PE enrollment in this population falls below previously reported national averages for elementary and middle school students and slightly above average for high school students. The majority of school-aged youth with obesity in this metropolitan area do not acquire enough physical activity through PE to meet recommended daily physical activity guidelines.

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**Board #94**

**May 30 3:30 PM - 5:00 PM**

**BMI, Body Composition and Race are Associated with Decreased Bicycling Ability in Youth with Obesity.**

Christopher Kist, Amanda Gier, Phil Khoury, Shelley Kirk, Robert Siegel. Cincinnati Children’s Hospital, Cincinnati, OH.

(No relevant relationships reported)

**PURPOSE:** To evaluate which factors may decrease the ability to ride a bike in youth with obesity.

**METHODS:** Data from 71 months of clinical visits to a pediatric weight management program were extracted from electronic medical records. Demographics and anthropometric measures, along with patient response to the question, “Are you able to ride a bike?” were analyzed to determine which factors limit a patient’s ability to ride a bike. Levels of continuous variables for riders vs non-riders were compared using Wilcoxon rank sums tests. Fisher’s Exact tests were used to compare proportions.

Stepwise logistic regression was used to determine independent predictors of ability to ride.

**RESULTS:** Data were obtained from 4276 patients (2409 females, 1876 males).

Mean age was 12.2 ± 3.2 years. Mean BMI was 33.5 ± 9 kg/m². Overall, 78.9% of the subjects were able to ride a bike. Males were more able to ride than females (79.4% vs. 78.6%, p=0.54). Caucasians were more able to ride than African Americans (80.0% vs. 76.9%, p=0.0491). Older aged subjects were more able to ride than younger aged subjects (12.6 ± 3 vs. 11.9 ± 3.8 years, p=0.0001). Subjects with a higher BMI were less able to ride (34.8 ± 9.3 vs. 33 ± 8.8 kg/m², p<0.0001). Subjects with a higher percent body fat (BF%) were also less able to ride (46.4 ± 6.1% vs. 43.4 ± 6.7%, p=0.0001). Body fat mass was also significantly higher in the group that was unable to ride (41.1 ± 25.5 kg vs. 37.3 ± 15.1 kg, p=0.0001).

**CONCLUSIONS:** Many different factors contribute to the ability to ride a bike in youth with obesity. Gender, race, age, BMI and body composition were all associated with the ability to ride a bike. Youth with greater amounts of obesity and body fat may struggle more to ride a bike. Being unable to ride a bike limits options for active transportation and moderate-to-vigorous play in youth with obesity.

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**Board #95**

**May 30 3:30 PM - 5:00 PM**

**Game-Play Characteristics by Field Size in Girls’ Youth Lacrosse.**

Patricia M. Kelshaw1, Matthew Johnson2, Lisa H. Hepburn1, Andrew E. Lincoln1, Reginald E. Dunn2, Shane V. Caswell2. *George Mason University, Manassas, VA, 1Colby College, Waterville, ME, 2MedStar Sports Medicine, Baltimore, MD.

(No relevant relationships reported)

To facilitate player development, the Lacrosse Athlete Development Model (LADM) recommends the use of small-sided games (SG) and fewer players on the field. Yet, no studies have evaluated if SG change game-play in girls’ youth lacrosse (GYL).

**PURPOSE:** To describe game-play characteristics during SG and full-field games (FG).

**METHODS:** Sexual and racial (N=28, 8.5±0.5 years, 132; 143.3±3.8 kg, 31.4±1.7 kg) participated on either a small-sided (SG, n=13) or a full-field (FG, n=15) 10U level team within a single GYL league in Virginia. Both SG and FG teams participated in 6 games during the season. All games were filmed using a digital camera affixed to a camera lift system. Game-play characteristics were measured by reviewing game video and coding the frequency of observed activities (e.g. successful passes, changes of possession, intercepted passes, shots on goal, and loose balls). Descriptive statistics (Frequency, Mean) for game-play characteristics were calculated.

**RESULTS:** A total of 137 athlete-exposures (AE) occurred across 12 games (SG=59AE, FG=78AE). Total characteristics for the season were: unsuccessful passes (SG=476, FG=378), successful passes (SG=59, FG=110), shots on goal (SG=183, FG=189), goalie saves (SG=58, FG=79), changes of possession (SG=333, FG=281), loose balls (SG=625, FG=575), and intercepted passes (SG=17, FG=10). Average characteristics per game were: unsuccessful passes (SG=79.3, FG=63.0), successful passes (SG=9.93, FG=18.3), shots on goal (SG=30.5, FG=31.5), goalie saves (SG=9.7, FG=5.2), changes of possession (SG=5.5, FG=6.8), loose balls (SG=104.2, FG=95.8), and intercepted passes (SG=2.8, FG=1.7). Further, the FG team had a larger proportion of successful passes (23%) than the SG team (11%). However, the SG team had a larger proportion of successful shots on goal (63%) than the FG team (54%).

**CONCLUSION:** A greater proportion of successful passes were observed in FG than SG with comparable attempts and slightly fewer intercepted passes per game. Further, SG was observed to have a greater proportion of successful shots on goal despite FG having slightly more attempted shots on goal and more goalie saves. Additional research is needed to better understand how all aspects of LADM guidelines affect player development and skill acquisition in GYL.

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**Board #96**

**May 30 3:30 PM - 5:00 PM**

**Physical Activity Among Youth Lacrosse Players: Full vs. Modified Field Play.**

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(No relevant relationships reported)

**PURPOSE:** US Lacrosse developed the Lacrosse Athlete Development Model (LADM) to provide every athlete the opportunity to enter, enjoy and excel by learning and playing lacrosse in a way that’s best for each stage of growth and development. Evaluation is essential to determine whether the LADM achieves the stated goals. The study aim was to assess whether players’ physical activity (PA) was greater during games played on modified (Mod) fields than fully-sized (Full) fields.

**METHODS:** This prospective cohort study involved two boys’ and two girls’ youth lacrosse teams who participated in six full or modified games. 61 youth players between the ages of 8-10 (U10) were selected via a convenience non-probability sample. Full field games were played on 60x110 yard fields; modified field games were played on 35x60 yard fields; games were 50-54 minutes long. Players wore the Actigraph WGT3X-BT, a triaxial accelerometer that recorded PA over time in units of Metabolic Equivalents (1 MET = 3.5 ml O₂·kg⁻¹·min⁻¹). Data were categorized by PA level and analyzed using Chi-square tests to assess differences in PA by play (Full vs. Mod).

**RESULTS:** Boys’ median PA was 3.0 METs (Full) and 2.8 METs (Mod). Girls’ median PA was 2.9 METs (Full) and 3.2 METs (Mod). Among boys, vigorous physical activity was higher in full field games (13.9%) compared to modified field games (9.4%). (p=0.001) Among girls, moderate physical activity was higher in full field games (12.6%) compared to modified field games (10.3%) (p=0.001).

**CONCLUSIONS:** There were modest differences in activity level by game type among youth (U10) boys and girls lacrosse players when playing on the modified (smaller) field compared to the full field games. Although statistically significant, differences may be attributable to the following factors: • Higher player-field density on the modified fields (i.e., less open space on the modified fields); • More experienced and talented players participating in full field play; • Relatively more players on the
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Serum Vitamin D, and Metabolic Risks In Obese Youth Involved In a Physical Activity Program
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Purpose: To investigate whether a physical activity (PA) promotion program in overweight/obese (OW/OB) youth is favorable to changes in PA levels, vitamin D (VIT-D) and metabolic profile and the correlations between those changes.

Methods: This was an intervention study performed twice a week, over a period of six months with 57 OW/OB youngsters (31 girls). PA promotion program aimed to increase children and adolescent’s moderate-vigorous PA levels. It was performed evaluation of body composition, physical activity, maturational stage and biochemical variables (HDL, LDL and VLDL cholesterol, glucose, insulin and VIT-D). For statistical analysis, Paired sample t-tests and partial correlations were used. Results: Significant differences between baseline and post intervention were observed for body composition, lipid profile and PA levels. Furthermore, ΔVIT-D was positively correlated with the ΔHDL (r=0.30), while negative correlations were found with body composition, lipid profile and PA levels. Additionally, ΔVIT-D was positively correlated with the ΔHDL (r=0.30), while negative correlations were found with metabolic risk factors. ΔVPA showed significant correlations with ΔVIT-D (r=0.37) and ΔHDL (r=0.34). Conclusions: After a PA program, OW/OB youth presented positive changes in body composition, vitamin D, metabolic profile and PA levels, indicating that interventions involving physical exercise should be promoted as an important component of a healthy lifestyle.

Board #98 May 30 3:30 PM - 5:00 PM
Investigating the Impact of Daily Physical Education on Fitness Levels of Underserved Minority Youth
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Purpose: To investigate the impact of a 45-minute daily physical education intervention on overall fitness among underserved, minority elementary school youth.

Methods: An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on the Progressive Aerobic Cardiovascular Endurance Run (PACER), push-ups, and curl-ups among elementary school youth attending Legacy Early College, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2018 - original pre-test assessment in September 2017) were calculated and analyzed for significance. The interaction between school and time was estimated for each outcome. Each analysis was stratified by gender and adjusted by age to control for baseline differences by school. A Title I control school that provided physical education only one day per week was used as a comparison.

Summary of RESULTS: Legacy students had significantly greater increases in curl-ups (Gain Score=12.23, F=31.323, p=0.000) and PACER laps (Gain Score=6.18, F=9.502, p=0.002). Legacy males and females observed greater increases in their fitness levels than controls. Legacy male and female students performed significantly better than controls in curl-ups, push-ups and PACER laps (Gain Scores=11.46, 3.14, 5.22, F=71.695, 51.126, 9.51, p=0.000, 0.000, 0.002 respectively).

Conclusion: Implementing 45 minutes of daily physical education in underserved elementary schools could improve children’s overall fitness levels. Supported by Campbell Young Leaders.

Board #99 May 30 3:30 PM - 5:00 PM
Using Dance to Promote Physical Activity and Fitness Among Adolescent Girls with Intellectual Disabilities
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(no relevant relationships reported)

Purpose: To evaluate the feasibility and preliminary efficacy of a 12-week dance intervention to promote engagement in moderate to vigorous PA (MVPA) and increase cardiorespiratory (CR) fitness among girls with ID ages 16-21.

Methods: The intervention was implemented in 3 urban communities and included two 75-minute weekly dance sessions. Dance styles included hip hop, jazz, and modern; the choreography and session structure were designed to promote MVPA. Continuous heart rate (HR) monitoring (Polar® E600) was used for motivation and to record time spent below/in/above each girl’s target HR (THR) zone (60-80% HRmax). Pre- and post-test CR fitness was measured by the 6-minute walk test (6MWT). Survey items assessed enjoyment and satisfaction. Results: 18 adolescent girls (17.3 ± 2.7 y) with ID completed the intervention. Attendance was high; girls attended an average of 87% of dance sessions (range 67% - 100%). Overall, girls spent 52% ± 23% of each session engaged in MVPA; defined as in or above their individual THR zone. Engagement level was quite variable; one girl averaged 4% of the dance session in her THR zone and another averaged 94%. When queried weekly about their PA intensity during the sessions, 11 of 18 girls reported that they worked “really hard” at every session. We observed a mean increase of 74.6 feet in distance walked on the 6MWT baseline to post-test (t=14); however, this difference was not significant (p=0.17). Post-intervention surveys indicated that girls “liked” the dance program (14 of 17), perceived improved fitness (15 of 17), and wished to continue dancing (15 of 17). Most girls reported a preference for a girls-only dance program and a program exclusively for those with ID. Conclusion: Participants were engaged in dance at an MVPA intensity level for over half of the 75-minute sessions, supporting that dance is viable for promoting PA for girls with ID. Girls expressed their enjoyment of the program and wanted to continue beyond the 12-week program. More frequent training is likely needed to increase CR fitness.

Background: There is increasing evidence of positive associations between physical activity (PA), cardiorespiratory fitness (CRF) and academic achievement. Some studies have found an inverse association between sedentary time and academic achievement, however, the findings are mixed and the literature is inconclusive. Purpose: To examine the associations between objectively assessed PA, sedentary time, CRF and academic achievement in a sample of Norwegian adolescents. Methods: This cross-sectional study included 1518 adolescents aged 13.9 years (53.8% girls) from 29 schools in Norway. We assessed PA and sedentary time by accelerometry (Actigraph GT3X+). Intensity thresholds for sedentary time and MVPA were <100 counts per minute (CPM) and >2000 CPM, respectively. CRF was measured with an intermittent shuttle run test. Academic achievement in reading and numeracy were assessed using standardized national academic tests. We used a multiple linear mixed model analysis including school as random effect to account for clustering, adjusted for covariates (age, sex, socio economic status (SES) and accelerometer wear time). Additionally, the analyses modelling sedentary time and MVPA as exposure variables were mutually adjusted.

Results: Mean achievement in reading and numeracy was 55.9 (Standard deviation (SD) 10.0) and 55.8 (SD 9.7) points, respectively. Achievement in reading was positively associated with sedentary time (B=0.044, 95% CI: 0.027; 0.062), time spent in MVPA (B=0.050, 95% CI: 0.018; 0.083) and CRF (B=0.014, 95% CI: 0.009; 0.019). Achievement in numeracy was positively associated with sedentary time (B=0.033, 95% CI: 0.016; 0.050), time spent in MVPA (B=0.033, 95% CI: 0.014; 0.065) and CRF (B=0.013, 95% CI: 0.009; 0.018). Conclusion: Achievement in reading and numeracy are positively and independently associated with sedentary time, time spent in
MVPA and CRF. The results suggest that accumulating 10 minutes more in MVPA or sedentary per day, is associated with improved achievement in reading and numeracy by approximately 0.5 and 0.3 points, respectively. However, due to the cross-sectional design and the small magnitude of the associations, the practical implications of these results should be interpreted with caution.

Both the decline in moderate to vigorous physical activity intensities (MVPA) and the increase in sedentary behavior (SB) have different deleterious effects on the health of adolescents. PURPOSE: Verify a 10-week intervention using exergames with adolescents was able to promote levels of physical activity from moderate to vigorous intensities (MVPA) and compare the time in MVPA between the group with more or less participation in sessions. METHODS: Twenty adolescents (11 boys and nine girls) with an average age of 11.7 ± 0.9 years participated in an intervention with 10 sessions of exergames on the school, twice a week for about 40 to 60 minutes. XBOX 360 equipment was used with Kinect and the pair of adolescents practiced the games using an ActiGraph accelerometer. The analyzes included the total time and time of involvement in MVPA at each session. Descriptive statistics analyzes and the independent student T test were used. The level of significance was 5%. RESULTS: Of the 20 adolescents, three participated in all the sessions (10), six participated in nine sessions and seven participated in eight sessions, representing 80% of effective participation in the intervention. Only 20% of the students participated in only four to six sessions per week. Approximately half the time of each session was spent with MVPA (20.7min vs. 24.4min), in favor of the group with the largest participation in sessions with active video games. This same group presented up to the ninth session participation in the intervention. Only 20% of the students participated in only four sessions with adolescents was able to promote levels of physical activity of moderate to vigorous intensities (MVPA), mainly in the group that have more participation in sessions.

The evidence-based 24-h Movement Guidelines (MG) for children and youth was launched in 2016, shifting the thinking from one single movement behavior to an integration of three behaviors under the 24-h circle: physical activity (PA), screen time (ST), and sleep. A low compliance rate of meeting these combined recommendations has been reported for children. However, few studies have focused on adolescents, and its association with health outcomes such as body weight status is largely unknown. PURPOSE: To examine compliance with the 24-h MG among Hong Kong adolescents and their associations with body mass index (BMI). METHODS: 1,039 adolescents (11-18 years) wore the wearable activiPAL™ for 24-h over 7 consecutive days to assess PA and sleep duration. ST was measured using items from the validated Chinese version of the Children’s Leisure Activities Study Survey. Participants were classified into 8 categories depending on the adherence to the 3 recommendations: none, single recommendation (PA, ST or sleep), two recommendations (PA & ST, PA & sleep, or ST & sleep) and all three recommendations. BMI was calculated as weight (kg) / height (m)^2. Linear mixed models were used to examine the associations of BMI with the 8 categories and the number of guidelines met (0–3), adjusted for age, sex and school clustering effects. RESULTS: The analytic sample consisted of 656 adolescents (48% of girls) who provided valid activiPAL™ data for at least 4 days and completed questionnaire. Only 1.1% of the adolescents met the overall 24-h MG, while 38.7% met none of them. The proportion of meeting one single recommendation of PA, ST and sleep was 9.9%, 30.3% and 39.2%, respectively. Adolescents who did not meet the PA recommendation (HR 1.34; 95% CI, 1.02 to 1.76, p = 0.032) had higher BMI than those who met the respective recommendations. No significant association was found between number of recommendations met and BMI. CONCLUSIONS: Compliance with the 24-h MG was alarmingly low among Hong Kong adolescents. Meeting PA recommendation and the combination of PA and sleep recommendations were more likely to have a healthier body weight. Supported by the General Research Fund of the Research Grants Council, Hong Kong, China (#14501415).

**Abstracts were prepared by the authors and printed as submitted.**
LIT, and the training time is at least four weeks; The final results of the study should include weight (body weight), BMI, body fat ratio (% body fat), and body fat (fat weight). The risk assessment was assessed using the Jadad scale (total score of 7).

**RESULTS:** Compared with LIT, HIIT can significantly reduce % body fat (-1.27(95% CI: -1.87, -0.67), Z = -4.14, p < 0.001), BMI (-0.42(95% CI: -0.83, -0.01), Z = -2.00, p = 0.05) and body weight (-0.40(95% CI: -0.73, -0.06), Z = -2.33, p = 0.02). Comparing the EG and the CG of HIIT and LIT respectively which is found that for the body weight index, the combined statistical effect size was 0.45(95% CI: -0.70, -0.21).

**CONCLUSIONS:** HIIT is more effective for obese children/adolescents than LIT. HIIT is better for whole body weight loss, but HIIT is better for body fat reduction. For aerobic training, the training period and the number of times are not proportional to the weight loss effect.
viewed (p=0.012) or computer used (p=0.010). However, Heavy TV viewers had a higher risk of being overweight/obese regardless of PA level. The associations of TV viewing and computer use were similar with BMI categories and WHtR tertiles. CONCLUSIONS: Heavy TV viewing and computer use are associated with higher BMI and central adiposity in preadolescents. Heavy TV viewing seems to increase the risk for overweightness and central adiposity, regardless of PA level. Strategies to reduce high sedentary screen times could potentially help in preventing overweightness and adiposity among children and adolescents.

Children and adolescents in the U.S. fail to meet physical activity guidelines and health consequences associated with inactivity, such as high body fat composition, continue to impact children. Targeting children for physical activity and fitness interventions have the potential to improve body composition; however, little is known on body composition changes during a fitness-based intervention. PURPOSE: To determine changes in body composition for children participating in a fitness-based intervention. METHODS: 21 children (age = 9.38 ± 3.82, BMI = 21.0, body fat percentage = 30.90) participated in an 8-week, structured fitness intervention consisting of 1-hour weekly sessions. Weekly sessions provided fitness opportunities in a fun, non-competitive environment with the purpose to elicit moderate-to-vigorous physical activity. Pre- and Post-testing using the iDXA was conducted to detail changes in body composition. RESULTS: Results from a paired samples t-test showed significant increases in the following body composition measures: Left Leg Lean Mass (t = -2.366, p = 0.028), Right Leg Lean Mass (t = -3.914, p = 0.001), Lean Mass Truck (t = -2.766, p = 0.012), Lean Mass Total (t = -4.575, p = 0.001), Right Leg Bone Mass (t = -2.500, p = 0.021) and Bone Mass Total (t = -0.836, p = 0.004). CONCLUSIONS: Participation in an 8-week fitness intervention showed positive body composition changes for children. These changes occurred with minimal intervention (1 hour per week). Future studies should determine the duration of the effect.

The prevalence of childhood obesity has increased markedly in both eastern and western countries. Development of obesity in early life could lead to serious health problems including a premature cardiovascular disease. Therefore, a primary prevention such as an effective weight management program would be needed in order to minimize the adverse effects of childhood obesity. PURPOSE: This study aimed to determine the effects of multi-component school-based weight-management program on body composition, physical fitness and vascular function and structure in obese adolescents. METHODS: Twenty-eight obese adolescents (21 males, 75%) between the ages of 13 and 15 (14.1±0.8) at an above the sex-specific 90th percentile on BMI-for-age growth charts were recruited. Participants were randomly assigned into control (CON, n=12) and intervention (INT, n=16) groups. The INT group participated in a multi-component school-based intervention for 10 weeks which included supervised after-school physical activities, dietary and daily physical activities related advice. Moreover, school-health promotion environment and health education lectures for school staffs, students and parents were included in the program. Non-curricular physical activities (i.e., running, playing games and resistance training) were performed moderate to vigorous aerobic activities for 50 minutes/day, three days a week on alternate days. Body composition, physical fitness, vascular function (brachial-FMD) and structure (IMT and baPWV) were measured before and after intervention. RESULTS: After 10-week of multi-component school-based weight-management program, body mass (89.7±6.8 vs. 88.0±10.5, p<0.05) and body fat percentage (44.13±5.27 vs. 41.22±6.74, p<0.05) significantly decreased only in an INT group. Peak oxygen consumption (29.25±12.41 vs. 31.56±3.05, p<0.05) and health related physical fitness increased only in an INT group (p<0.05). Moreover, vascular reactivity of an INT group was improved after 10-week program compared with a CON group (6.81±2.25 vs. 3.62±1.48, p<0.05). There was no change in artery wall thickness and stiffness in any group. CONCLUSIONS: Multi-component school-based weight-management program may be an effective primary prevention for reducing cardiovascular disease risk factors.

The current physical activity (PA) guidelines for children and adolescents recommend accumulating 60 minutes of moderate-to-vigorous intensity physical activity (MVPA), 7 days per week. Although the time and intensity components of the PA guidelines have been rigorously studied, the days per week (frequency) component is less researched. PURPOSE: To examine the influence of frequency of meeting the MVPA guidelines on cardiometabolic risk in children and adolescents. METHODS: Accelerometer data from children and adolescents (age 6-18 years; n=673) with at least 4 valid days, 10 hours of wear time, and an average of ≥60 minutes per day of MVPA participating in the National Health and Nutrition Examination Survey 2003-2006 were used. The Evenson cut points for MVPA were applied. The proportion of valid days meeting the ≥60 minutes of MVPA guidelines (DMG) were calculated and used to assign subjects to quartiles. General linear modeling was used to compare associations of quartiles to individual cardiometabolic risk factors. Covariates included age, sedentary time, MVPA, sex, race/ethnicity, asthma, physical disability, adolescent period, quartiles of the Healthy Eating Index, and poverty-income ratio. RESULTS: DMG by quartile are as follows: Quartile 1 (n=158; DMG=43.6%; 95% CI 41.8-45.5); Quartile 2 (n=171; DMG 62.3%; 95% CI 61.4-63.2); Quartile 3 (n=154; DMG=75.3%; 95% CI 74.6-76.0); Quartile 4 (n=194; DMG=91.6%; 95% CI 90.2-92.4). Diastolic blood pressure was higher in Quartile 1 and Quartile 2 compared to Quartile 3 (p=0.001; 51.5±3.6mmHg vs. 52.6±3.8mmHg, Q1-Q2; p=0.001; 52.6±3.8mmHg vs. 54.4±3.9mmHg, Q3-Q4). CONCLUSIONS: This cross-sectional analysis found no association between proportion of DMG and cardiometabolic risk factors in children and adolescents. Achieving an overall average weekly average of 60 minutes per day of MVPA appears to be sufficient for cardiometabolic health regardless of meeting the frequency component of the PA guidelines. Future studies are needed to understand optimal weekly patterns and volume of PA as well as their associations with health outcomes in youth.
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**Board #111 May 30 3:30 PM - 5:00 PM**

**Contribution Of In-school And Out-of-school Physical Activity Towards Meeting The Daily Recommendations.**

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(No relevant relationships reported)

**PURPOSE:** The purpose of the study was to examine in-school and out-of-school activity in children as related to achieving daily activity recommendations for moderate-to-vigorous physical activity (MVPA) and steps. **METHODS:** Activity patterns of 346, 10-12 year old fifth-grade students in three Midwestern elementary schools were assessed during a two week period, one week during school hours only and the other week for continuous 24 hour periods. Data were collected using wrist worn activity trackers (Polar Active). Teachers distributed the devices at the start of each school day and collected at the end of each school day for the first week and provided to the students for the next week for continuous monitoring. Monitors measured MVPA, steps, and calories expended per day. Demographic and anthropometric data were also recorded (age, height, weight). All data were uploaded to the monitor’s manufacturer website and then collected by the researchers. A prior study was used to determine that four days of monitoring could accurately estimate physical activity. A final sample of 186 (N=186) students who attained a 500 step minimum for the same four consecutive school days between both weeks (M-R or T-F), were identified. These data were used to determine averages for steps, minutes of daily activity, and calories expended. **RESULTS:** Results indicate students attained an average of 15319.38 steps/day. In-school activity and out-of-school activity accounted for an average of 6362.79 steps/day (41.53% of total), 8956.59 (58.47% of total) respectively. Activity minutes averaged 77.43 minutes/day. In-school and out-of-school activity accounted for an average of 33.58 minutes (43.37% of total), and 43.85 minutes (56.63% of total) respectively. Calories expended averaged 2044.66 Kcal/day. In-school and out-of-school activity accounted for an average of 1560.56 Kcal (76.32% of total), and 484.10 Kcal (23.68% of total) respectively. **CONCLUSIONS:** These results indicate that out of school activities account for most of daily steps taken and activity minutes in the fifth grades students studied during an average school day. A similar distribution of caloric expenditure was not observed between in school and out of school monitoring.

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**Board #112 May 30 3:30 PM - 5:00 PM**

**The Effect Of Increased Extracurricular Physical Activity On The Mathematics Achievements Of Children aged 7-9 Years Old**

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(No relevant relationships reported)

**PURPOSE:** The purpose of this study was to assess the impact of an increased extracurricular physical activity on mathematics academic performance for children aged 7-9 years. **METHODS:** A sample of 120 children aged 7-9 participated in the MQ101 Program. The experimental samples were randomly divided into the experimental group (58 children) and the control group (62 children). The experimental group involved in the extracurricular exercise with games as the main activity content, intervention. The activity lasted for 12 weeks, twice a week for 60 minutes each time, exercise intensity: MVPA = (220-age) x (60-69%); the control group did not participate in any intervention project. The body shape, physical fitness, and mathematics testing scores of the subjects were tested before and after the experiment. The main finding is the change in numerical scores, measured by a standardized mathematical test of 10 minutes. The secondary outcome is a change in body perception and physical fitness. **RESULTS:** The results showed that the experimental group was better than the control group in the problem solving (t=2.37, p<0.01), calculation speed (t=3.39, p<0.01) and accuracy rate (t=2.21, p<0.05). The math scores of the experimental group were significantly higher than the control group (t=4.14, p<0.01). In addition, the changes in physical fitness of the experimental group were significantly better than the control group (t=2.34, p<0.01), however, the difference in body shape index was not statistically significant (t=1.91, p>0.05).
race, gender, and major were collected. Participants then answered 89 questions and completed MetS knowledge questionnaire (Yahia et al., 2014; Becker et al., 2008). The questionnaire was designed to assess MetS knowledge among Hispanic students and has seven categories: diabetes, adiposity, hypertension, high serum cholesterol, arteriosclerosis, stroke, and myocardial infarction. Students’ responses were scored and interpreted as poor knowledge (≤50% correct), fair knowledge (51-80% correct), and good knowledge (81-100%).

RESULTS: The results showed that majority of the students had fair level of knowledge (71.80% correct) related to MetS conditions. The participants were more knowledgeable on stroke and adiposity, and least knowledgeable on cholesterol, myocardial infarction, and diabetes components. There was no significant difference between genders for the level of knowledge for adiposity, cholesterol, myocardial infarction, and diabetes component of the questionnaire. However, there was a significant difference in knowledge level for stroke component between genders (p<0.01). Males had more knowledge on stroke component than females.

CONCLUSIONS: Majority of Hispanic college students have fair level of knowledge about MetS and MetS related conditions. Findings suggest that students MetS related knowledge and awareness can be improved. MetS is highly prevalent among Hispanic population. Therefore, increasing Hispanic students’ awareness and knowledge related to MetS is essential to improve students’ overall health. Previous studies identified colleges and universities as potential settings for health prevention and early intervention. Future studies should investigate the effects of various intervention methods on Hispanic students’ MetS related knowledge and long-term health conditions.

HBCU Examine How PA, Depression, Body Mass Index, Fruit, and Vegetable Consumption Among College Students

Abstracts were prepared by the authors and printed as submitted.

Lack of sleep among college students is currently a massive epidemic affecting millions. Sleep duration and quality is an important determinant of overall health, and is related to health behaviors (physical activity (PA) & diet) and outcomes (mental health). But little is known about these relationships among college students.

Purpose: Examine how PA, depression, body mass index (BMI), fruit and vegetable consumption (FVC), and academic performance differed based on sleep quality and duration. Methods: Students completed an online survey, self-reporting their sex, height, weight, grade-point average (GPA), levels, and academic performance. Results: Participants were grouped into those who reported sleep better than the average for both sexes and those who reported worse sleep. The results showed that participants who reported better sleep also reported significantly better sleep. Though, a positive relationship between sleep and better sleep was marginally significant trends towards improvement in measures of perceived stress and depression (p = 0.055), and self-reported better sleep. Conclusion: A positive relationship between adequate sleep and better sleep was marginally significant. Further research is required to examine the relationship, in particular directionality, between the amount PA and the duration of sleep in college students.
with a subset of 10 (6 female, age 18-21years, 70% Caucasian) students who were enrolled in a larger study (n=135) investigating learning and behavioral outcomes from participation in a health and fitness course. Interviews were audio-recorded and transcribed verbatim. Thematic analysis was used to identify predominant themes. RESULTS: Interviewees described their experiences and learning outcomes from the course. In regards to PA attitudes and practices, three themes emerged: (1) Self-Consciousness. Participants reported feeling embarrassed and awkward in the fitness class environment and were uncomfortable joining in with the rest of the students. (2) Friends and Family Influences. The majority of interviewees reported exercising with friends as a strategy to improve motivation. Additionally, many identified family members as either having a positive or negative influence on PA behaviors. (3) Motivational Factors. The primary factors participants cited as influencing PA motivation were health, and maintenance of body weight. CONCLUSIONS: Results show that several factors influence college students’ PA motivations, attitudes, and adherence to PA participation. It is recommended that health educators consider implementing practices to ensure that physical activity courses meet the specific needs of college students. This study was funded by a Fitchburg State University Special Projects Grant.

1964 Board #120 May 30 3:30 PM - 5:00 PM Effects Of A 13-week Yoga Class On College Aged Student’s Flexibility, Body Image, And Mood Suet Hon. The Chinese University of Hong Kong, Hong Kong. Hong Kong. Sponsor: Professor Stanley Hui S.C., FACS(M). Email: hon1102suet@gmail.com (No relevant relationships reported)

PURPOSE: Yoga has been practiced as a low to moderate intensity physical activity in recent years and evidence suggests that yoga practices can bring beneficial effects on physical and mental health. The present study examined whether a 13-week yoga practice of postures, breathing, and relaxation techniques can improve the flexibility, body image and mood of college aged students. METHODS: A sample of 60 students was recruited from university to participate in a 13-week yoga class. A pre-post test design was used for this study. Measurement on the physical aspects included the flexibility test and whereas the mental aspects included body image questionnaire (Body Appreciation Scale-2) and mood questionnaire (The Positive and Negative Affect Scale). Data were analyzed at the significance level of p<0.05 for one group pre- and post-test of two data sets. RESULTS: The Mann-Whitney showed significance at the p<0.01 for the sit and reach flexibility test and significance at the p<0.05 for the body image and mood questionnaire. Sixty students (19 ± 2.1 years; 1.60 ± 0.15 m; 52 ± 8.4 kg) reported improved flexibility (ranged from 3% to 9%), increased body appreciation (mean value from 3.8 to 4.2) and positive mood (mean value from 3.9 to 4.3) after the 13-weeks class. The majority students desired to participate in more yoga classes in the future. CONCLUSIONS: This study suggests that a 13-week yoga class showed improvements of flexibility, increasing positive body image and enhancing mood who are novice yoga practitioners. Since the participants in this study were all girls and future study can examine the gender difference on the topic.

1965 Board #121 May 30 3:30 PM - 5:00 PM Associations between Parents’ Physical Activity and Young Children’s Health Outcomes Nan Zeng1, Susan L. Johnson2, Richard E. Boles2, Laura Bellows1. Colorado State University, Fort Collins, CO. 1University of Colorado Anschutz Medical Campus, Aurora, CO. (No relevant relationships reported)

PURPOSE: While parents play an important role in child development, little is known about the influence of parents’ physical activity (PA) on young children. This study examined the associations between parents’ PA and their preschoolers’ body mass index (BMI), PA, and fundamental movement skills (FMS). METHODS: Of 257 parent-child dyads recruited across 3 cohorts from 4 Colorado Head Start/pre-school centers from 2010-2012, 109 children (57 girls, 36 Hispanic, X̅ age = 4.90±3.49, X̅ BMI = 0.49±1.14) and complete data were included in this study. Parents’ and children’s PA on 4 weekdays and 2 weekends were assessed by pedometers and calculated as steps per hour. Children’s BMI and sex- and age-adjusted BMIz scores were calculated using 2000 CDC Growth Charts for the United States. Children’s FMS was assessed via the Bruininks-Oseretsky Test of Motor Proficiency—Second Edition (BOT-2), including 1 Balance, 2 Running Speed and Agility (locomotor skills), 3 Upper-Limb Coordination (object control skills), and 4 Strength. Bivariate correlation and linear regression were used to examine the associations between parents’ PA and children’s BMI, PA, and FMS. RESULTS: Bivariate correlation indicated that parents’ PA was positively associated with children’s locomotor skills (r = 0.19, P = 0.05), strength (r = 0.21, P = 0.03), PA (r = 0.22, P = 0.03), and FMS (r = 0.23, P = 0.05). Linear regression further suggested that parents’ PA was a significant predictor of children’s locomotor skills [F (5, 108) = 2.45, β = 0.13, P = 0.05, R² = 0.11], PA [F (5, 108) = 2.95, β = 0.32, P = 0.05, R² = 0.13], and FMS [F (5, 108) = 2.97, β = 0.16, P = 0.05, R² = 0.13], but not a significant predictor of strength [F (5, 108) = 1.35, β = 0.18, P

Sleep plays a critical role in the growth of youth. However, increasing studies suggest that the sleep quality (SQ) in Chinese youth is in a worrying situation. Meanwhile, SQ is associated with lifestyle factors, such as physical activity (PA). Therefore, this study will particularly focus on the association between PA level and SQ in Chinese college students, a special youth group who are under academic pressure.

PURPOSE: The present study is aimed to determine the correlation between SQ and PA level in Chinese college students.

METHODS: In 2017, the 4330 college students (male: 60.1%; female:39.9%) aged 17-24 years were randomly sampled from Shanghai Jiao Tong University, China. SQ, PA level, academic pressure and lifestyles of students were collected via a questionnaire. SQ and PA level were evaluated by Pittsburgh Sleep Quality Index (PSQI) and International Physical Activity Questionnaire, respectively. SQ dichotomizes two levels: good SQ (PSQI score ≤5) and poor SQ (PSQI score >5). PA was also divided into two levels: sufficient PA and insufficient PA according to World Health Organization moderate-to-vigorous physical activity (MVPA) recommendations.

RESULTS: Average MVPA time was 43.5±3.7 min/day (males: 47.0±3.96 min/day; females: 38.1±3.32 min/day). About 25.5% of participants met MVPA recommendations (males: 29.0%, females: 20.1%). Average SQ score was 7.81±1.89 (males: 7.67±1.86; females: 8.06±1.91). About 89.5% of participants had poor SQ (males: 87.9%; females: 91.8%). Males with sufficient PA had better SQ (7.42±1.87) than those with insufficient PA (7.74±1.85, P<0.05). But no significant correlation was found in females. The linear regression results showed that insufficient PA was
Physical inactivity, poor diet, and alcohol/substance abuse are common health behaviors among college students. However, little is known about the relationship between these health behaviors and academic performance. Purpose: To examine differences in grade point average (GPA) based on physical activity (PA) levels, fruit and vegetable consumption (FVC), and use of alcohol and substances. Methods: Students completed an online survey self-reporting demographics (age, sex, race/ ethnicity), PA (min/week of moderate and vigorous PA), FVC (servings/day), use of alcohol and substances (yes/no), as well as GPA. Independent samples t-tests were used to examine differences in GPA between those who did not meet PA and FVC recommendations, and those who did not use alcohol and substances. Results: Data was collected from 5738 participants (women, 57.8%, non-Hispanic white, 77.2%). For all participants, GPA differed significantly between those who did (3.40±.40) and did not (3.36±.48) accumulate 500 weekly MET-min (p=.034), and those who did (3.42±.40) and did not (3.34±.46) meet FVC recommendations (p=0.01). GPA also differed significantly between tobacco users (3.26±.41) and non-users (3.40±.42, p=.001), as well as cigarette users (3.30±.40) and non-users (3.41±.42, p=0.001), but not based on alcohol use, for all participants. Conclusion: Findings indicate that those who utilize substances, are less physically active and display unhealthy eating habits, tend to have poor academic performance. This provides insight to students and campus health professionals regarding how their health behaviors may be affecting their GPA.

Student-athletes face challenges maintaining physical activity when they transition beyond college athletics, including loss of team support, few specific goals and strong athletic identities with weaker exercise identities (Fuller, 2014; Reifsteck, Gill, & Labban, 2016). Resources that prepare final-year student-athletes for meaningful lifetime physical activity support physical and psychological wellness. Purpose: To implement the PILATES Connect program for final-year student-athletes and evaluate their experiences and program support in the transition to lifetime physical activity. Methods: Twelve final-year student-athletes participated in PILATES Connect, once each week for six weeks. The sessions included 35 minutes of Pilates training, 15 minutes of reflection and discussion, and 10 minutes of evaluation. Measures included attendance, session and program evaluations, and focus groups. Results: Final-year student-athletes strongly adhered to the program, with an overall attendance rate of 94.4%. In session evaluations (1=not at all true, 7=very true), participants agreed that they were pretty good at Pilates (M=4.8), did the activity because they wanted to (M=6.6), and felt like they could trust the other participants (M=6.4). Participants agreed that PILATES Connect supported their confidence in the transition to PA activity (M=5.5), greater control over activity choices (M=5.9), and connection to other participants (M=6). They would recommend PILATES Connect to other student-athletes (M=6.8) and consider participating in Pilates or other group exercise in the future (M=6.8). Focus group responses highlighted increased confidence through progression in a new form of activity and recognition of different options for activity after graduation. Student-athletes enjoyed discussing the transition with peers and felt less alone. They recommended more sessions and promoting the program through word of mouth and feedback from past participants. Conclusion: The six-week PILATES Connect program was feasible, as evidenced by strong adherence rates and positive feedback from participants. Final-year student-athletes agreed that the program supported their competence, autonomy, and relatedness in physical activity as they approached the transition to alumni.

Purpose: To examine the effect of 10-week flag football exercise and regular physical education class on daily physical activity (PA) levels in elementary school students. Methods: A total of 48 9-10yr students (mean age in yr: 9.73±0.55; 24 males, 24 females) was divided into either a flag football intervention group or a conventional physical education group. The intervention group received a 35-minute flag football exercise session, twice a week, for 10 weeks. The physical education group received a 35-minute/day routine session, including gymnastics and sports games. Daily PA was measured before and after 10 weeks for both groups using ActiGraph GT3X + (wore on right hip) for seven consecutive days. The cut-points established by Evenson et al. were programmed to measure PA time at any intensity (i.e. no minimum requirement for incorrect MVPA settings) and adjusted for transport time. Linear mixed effects models were used to assess relationships between TP A and MVPA, and child sex and grade level. To examine the school and teacher influence, we utilized teachers nested within schools in a random effect in the model. All analyses were run in R. Results: Analyses were done on data from 577 boys and 552 girls. There were significant sex and grade-level differences in the volume of TP A and MVPA accrued throughout the school day (p < 0.001). Boys accrued more TP A and MVPA than girls, and younger children accrued more TP A and MVPA than older children (p<0.001). There was a significant grade by sex interaction. Specifically, for both MVP A and TP A girls in 2 nd through 4 th grades accumulated fewer minutes than similarly aged boys, and this difference was attenuated as children got older. By grade 5, boys and girls were accruing similar levels of TP A and MVPA during school hours. Conclusions: Physical activity levels at school declined for all students from 1 st through 5 th grade. Girls in 2 nd and through 4 th grades exhibited lower TP A and MVP A levels than boys. Preliminary findings suggest different approaches to increase PA among elementary school girls may be warranted. More data are needed to learn where to target those approaches. Supported in part by USDA NIFA, Grant #2011-68001-30020.
The Effect Of Extracurricular Physical Activities In The Development Of Coordination Of Children Aged 7 To 9 Yearsold

Yunsai Chen1, Ming Yang1, Jinglong Chang2, 1Southwest University, Chongqing, China. 2The Branch of the Collaborative Innovation Center of Assessment toward Basic Education Quality at Southwest University, Chongqing, China. Email: yunsai@swu.edu.cn

1974 Board #130 May 30 3:30 PM - 5:00 PM Evaluation Of A Physical Activity Level And Physical Fitness In Obese Children: Health Educational Program For Children (hepchild)

Henrique L. Ribeiro, Suliane B. Bauber, Carmen S. Campbell, Universidade Católica de Brasília, Águas Claras, Brazil.

PURPOSE: This study aimed to investigate the impact of a Health Educational Program for Children (HEPchild) being 5 days of Camp and 12weeks follow-up on the physical activity level (PAL) and physical fitness (PF) in obese children.

METHODS: The HEPchild was designed for obese children and developed in two phases: The Phase 1 consisted of Pre assessments and five-day camp (CAMP); and Phase 2 corresponded to the 3 months follow-up. Twelve children attended to CAMP as well as PAL and PF tests

RESULTS: After 12 weeks, 25% of children became more active (> 1500 and <3000METs per week). In contrast the amount of sedentary children (<600METs week) decreased by 15% and the insufficiently active (> 600 and < 1500METs per week) increased by 15%. No child was classified as very active (>3000METs per week) in any time. The PAL leisure time during the week and during the weekend increased 26.06% and 14.1%, respectively, when comparing pre-CAMP to the end of 12 weeks follow-up. SB during the week and the weekend showed a significant mean reduction of 177.14 and 41.43 minutes respectively. A significant improvement was observed in the subjects’ sit and reach flexibility, upper limb strength, and lower limb strength.

CONCLUSIONS: The HEPchild contributed to increase PAL and reduction of sedentary behavior and improve physical fitness in obese children.

Assessing the feasibility, acceptability & costs of delivering a physically active lessons (PAL) training program to secondary school teachers & explore preliminary effectiveness for reducing pupils’ sedentary time. METHODS: Two mixed-sex, non fee-paying schools were randomised as intervention (n=1; received PAL training) & control (n=1; no training) schools. Training was delivered to all subject teachers in two after school sessions & focused on integrating movement into lessons. Feasibility & acceptability of PAL training were assessed with quantitative & qualitative measures. Student outcomes (including accelerometer assessed activity) were assessed at baseline & 8 weeks post training for 107 & 98, 11-14 year olds at intervention & control schools, respectively. The study received ethical approval.

RESULTS: 29 of 33 teachers attended both training sessions. Teachers’ feedback indicated low acceptability of PAL training & a need to revise certain training components, eg, outdoor PAL training & increasing the learning challenge of the PAL strategies. The assistant head teacher echoed teacher’s concerns about the training but suggested the concept was acceptable for secondary schools. At follow-up, teachers had increased PAL delivery & students received an average of 6.9 PAL minutes each time), while children in the control group (6 girls, 5 boys) followed a traditional afterschool program (eg, free play). Children’s pre- and post-intervention data were collected using the Test of Gross Motor Development - 2nd edition (TGMD-2; Ulrich et al., 2000), accelerometers (Actical), and a cognitive function questionnaire (PedoQL; Varni et al., 2011). To examine the intervention effect, a 2 × 2 repeated measures MANOVA was used, with group as the between-subjects variable and time as the within-subjects variable.

RESULTS: The MANOVA showed significant differences between the intervention and the control group over time, F(4,26) = 16.83, p < .001, partial η² = .72. Follow-up univariate tests for the group × time effect indicated significant differences (p < .05) in locomotor skills (intervention: M1 = 25.4 vs. M2 = 37.98, d = .83; control: M1 = 29.73 vs. M2 = 30.32, d = .25), object-control skills (intervention: M1 = 24.68 vs. M2 = 39.78, d = 7.07; control: M1 = 27.05 vs. M2 = 27.59, d = .19), and MVPA (intervention: M1 = 143.62 vs. M2 = 170.06, d = 2.54; control: M1 = 166.24 vs. M2 = 155.17, d = .79), but not in cognitive function (p > .05). Conclusion: The FMS intervention showed significant improvements in FMS and MVPA, compared to a traditional afterschool program. Findings highlight the importance of FMS for motor skill competence and MVPA promotion among school-aged children.

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week. Of the pupils who recalled being in a PAL (58%), >90% wanted teachers to continue teaching PAL. Delivering the training cost £901 (£451 staff time, £450 laboratory equipment). Change in students’ self-reported (24 males and 35 females, age: 18-65 yrs., BMI: 19.45 kg/m², including exercisers and non-exercisers, were recruited for this two-day study. On Day 1 participants completed 30 minutes of EX on a treadmill at 64.74% of their age-predicted HRmax wearing a pedometer and wristband PA monitor. Pedometer and wristband PA monitor steps were recorded after EX and pedometer steps were subtracted from 10,000 to determine the remainder of steps participants needed to accumulate 10,000 steps through ADL on Day 2 (ADL pedometer steps = 10,000 steps – exercise pedometer steps). Next, participants were sent home with a pedometer and wristband PA monitor. On Day 2, participants were instructed to accumulate the remainder of steps needed to reach 10,000 steps through ADL. Once participants accumulated their ADL pedometer steps, step counts on both devices (i.e., wristband PA monitor and pedometer) were recorded. Total step counts were calculated as: EX steps on Day 1 plus ADL steps on Day 2 for devices. RESULTS: Significantly fewer wristband PA monitor steps were accumulated than pedometer steps during treadmill EX (3864±68 vs. 3573±81 steps; P<0.01) on Day 1 by 7.5%. Conversely, on Day 2, accumulated wristband PA monitor steps were significantly greater than pedometer steps during ADL (7973±275 vs. 6255±72 steps; P<0.01) by 27.5%. Consequently, total steps were significantly higher for wristband PA monitor steps than pedometer steps (11546±281 vs. 10119±57 steps; P<0.01). CONCLUSION: In order to achieve to the equivalent of 10,000 pedometer steps per day, a wristband activity monitor user should strive for closer to –11,500 “steps” per day.

**Board #130 May 30 3:30 PM - 5:00 PM Physical Activity Level And Prescription Pattern Of Physical Activity Among Physicians In Santiago De Chile.**

Alejandro Quijada. Universidad Mayor, Santiago, Chile. Email: doctoriquijada@gmail.com

(Please note: No relevant relationships reported)

PURPOSE: The aim of this research was to determine the level of physical activity (PA) and prescription pattern (PP) of physical activity among physicians in their private practices. METHODS: An analytical cross-sectional study analyzed 341 physicians (182 males, 159 females; mean age 39.7 years) of 13 different private health care centers in Santiago de Chile, South America. Data of PA was collected using the short form of the International Physical Activity Questionnaire (IPAQ-SV) and the data of the PP was collected using the Exercise Is Medicine (EIM) questionnaire distributed in Latin America. RESULTS: 30% of the participants reported low level of physical activity (≤600 MET min/week). Higher physical activity levels were found among male physicians compared to female physicians (9% versus 6%). 80% of the physicians reported prescribing PA to their patients (always 37%; almost always

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**Board #132 May 30 3:30 PM - 5:00 PM SOFIT Studies of Physical Education in U. S. and International Schools**

Nicole J. Smith¹, Thomas L. McKenzie, FACSM¹, ‘CSU Fresno, Fresno, CA; ‘San Diego State University, San Diego, CA.

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(No relevant relationships reported)

There is growing interest in assessing physical education programs worldwide in order to improve program quality. To this end, SOFIT (System for Observing Fitness Instructional Time) is a valid and reliable tool for assessing physical education, and it has been used to evaluate physical education programs worldwide since 1991. PURPOSE: To compare and contrast the characteristics of SOFIT studies of PE conducted in U.S. schools and in other countries. METHODS: Following guidelines outlined by PRISMA, we searched 10 library databases for SOFIT studies conducted worldwide. We retrieved a total of 800 distinct records (233 U.S. and 567 non-U.S.) for eligibility. Studies were selected if they (a) were published in English in peer review journals; (b) used the standard total of 305 full-texts (137 U.S. and 168 non-U.S.) for eligibility. Studies were selected as: EX steps on Day 1 plus ADL steps on Day 2 for devices. RESULTS: Significantly fewer wristband PA monitor steps were accumulated than pedometer steps during treadmill EX (3864±68 vs. 3573±81 steps; P<0.01) on Day 1 by 7.5%. Conversely, on Day 2, accumulated wristband PA monitor steps were significantly greater than pedometer steps during ADL (7973±275 vs. 6255±72 steps; P<0.01) by 27.5%. Consequently, total steps were significantly higher for wristband PA monitor steps than pedometer steps (11546±281 vs. 10119±57 steps; P<0.01). CONCLUSION: In order to achieve to the equivalent of 10,000 pedometer steps per day, a wristband activity monitor user should strive for closer to –11,500 “steps” per day.
43%), but only 8% fully knew the international PA recommendations for health. When asked why they do not prescribe PA, among those who do not do it regularly, the main cause was because they do not know the PA current guidelines (12%), and among those who knew the guidelines, the “lack of time within the consultation” was the most common cause (39%), followed by the doctor’s preconceived notion that “the patient will not comply with the prescription given” (19%). Although both national and international guidelines establish PA as the first line of treatment of chronic non-communicable diseases, 22% of the physicians do not follow these recommendations. Among these, 46% of them refer not to know these recommendations and something that in our opinion is even more worrisome is that 21% of the doctors surveyed, had knowledge of the guidelines, but do not apply them. CONCLUSION: data suggested a relationship between the level of knowledge of PA recommendations, the prescription pattern in clinical practice, and the practice of PA itself among doctors.

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The aim of the present study is to determine if endurance training (ET) involving a small muscle mass, e.g. single leg cycling (SLC), might elicit a greater development of higher V'O2peak and WRpeak in ET with large muscle masses, e.g. double leg cycling (DLC), in KTR and LTR.

METHODS: 9 sedentary patients were enrolled (KTR=6; LTR=3) and divided into SLC (n=5; age 50±10.3 yrs; time post transplant 11±4.8 yrs; BMI 26±2.9) and DLC (n=4; age 58.5±0.7 yrs; time post transplant 4.3±1.5 yrs; BMI 26.3±2.9) groups. Subjects completed DLC incremental test to determine V'O2peak and WRpeak on an electronically braked ergometer. Pulmonary gas exchange was measured using breath-by-breath analyses. All subjects were asked to attend 24 ET sessions: the DLC group trained both leg at the same time and the SLC group performed the first half of the session with one leg and the second half with the other leg.

RESULTS: 2 subject in the DLC group did not complete the ET regimen due to health-related issues, thus were excluded from the analysis. SLC (n=5) and DLC (n=2) groups completed 20±2.5 and 23±1.4 ET sessions, respectively. SLC and DLC groups increased significantly (p=0.025) the V'O2peak and WRpeak on an electronically braked ergometer. Results are promising, but the low sample sizes prevent us from drawing firm conclusions.

1981 Board #137 May 30 3:30 PM - 5:00 PM Recalled Age at Menarche from The Michigan State University Motor Performance Study Shannon R. Siegel, FACSM1, Karin A. Pfeiffer, FACSM2, Larissa True3, Eric M. Martin4, Christine Pacewicz2, Crystal Branta2, Rebecca Battista, FACSM1. 1University of San Francisco, San Francisco, CA. 2Michigan State University, East Lansing, MI. 3SUNY-Cortland, Cortland, NY. 4Appalachian State University, Boone, NC. Email: sziegel@ccga.edu (No relevant relationships reported)

Background: Many growth studies have assessed age at menarche to quantify physical growth, and motor performance tasks twice yearly for 32 years. One maturation marker, age at menarche, was collected for female participants and their mothers. In a follow-up study to investigate participants’ adult health outcomes, females again reported age at menarche. PURPOSE: 1-Determine whether recalled age at menarche (up to 20 years after the fact) was related to a more timely assessment of age at menarche, and 2-Determine whether daughters’ and mothers’ ages at menarche were related to each other. METHODS: During the MPS, a letter was sent to participants’ mothers asking for age at menarche for themselves (n = 118) and their daughters (n = 99). At the follow-up, 127 females provided their recalled age at menarche; 25 of these respondents were matched with their earlier recall data. Descriptive statistics and correlations were calculated. RESULTS: Age at menarche asft provided PA recommendations with these recommendations. Among these, 46% of them refer not to know these recommendations and something that in our opinion is even more worrisome is that 21% of the doctors surveyed, had knowledge of the guidelines, but do not apply them. CONCLUSION: data suggested a relationship between the level of knowledge of PA recommendations, the prescription pattern in clinical practice, and the practice of PA itself among doctors.

1982 Board #138 May 30 3:30 PM - 5:00 PM Time Spent In Moderate- To Vigorous-intensity Physical Activity Is Associated With Intramuscular Adipose Tissue Content In Young Men Madoka Ogawa1, Noriko Tanaka2, Akito Yoshiko2, Hiroshi Akima3, Jorge Ziegler4,5. 1Nagoya University, Nagoya, Japan. 2Chukyo University, Nagoya, Japan. (Sponsor: Katsumi Anaso, FACSM) Email: dv0ldem0.mad020@gmail.com (No relevant relationships reported)

Physical inactivity induces decreases of skeletal muscle mass and increases content of the adipose tissue in humans. However, it is not well known that the relationships between daily physical activity and various types of adipose tissues such as intramuscular adipose tissue (IntraMAT), intermuscular adipose tissue (InterMAT) or subcutaneous adipose tissue (SAT). PURPOSE: To investigate relationship between daily physical activity and contents of IntraMAT, InterMAT and SAT in the thigh for young men.

METHODS: Twenty healthy young men (24.5±4.8 years) participated in this study. Axial images of the mid-thigh were taken using magnetic resonance imaging. The cross-sectional area (CSA) of IntraMAT, InterMAT, SAT and skeletal muscle were measured. Daytime physical activity time was measured using an accelerometer on 14 consecutive days and summarized the activity time of two intensities; light-intensity (1< INT< 3 METS), and moderate-to-vigorous-intensity (3.0< INT< 6.0 METS). RESULTS: In the accelerometer data, time spent in light-intensity physical activity was 672.4±74.6 min/day, and time spent in moderate-to-vigorous-intensity physical activity was 96.6±30.5 min/day. Light-intensity physical activity time was not significantly correlated with contents of all adipose tissues in the thigh. The moderate- to vigorous-intensity physical activity time was correlated with IntraMAT content (r = 0.739, P < 0.01). On the other hand, moderate-to-vigorous-intensity physical activity time was not significantly correlated with contents of InterMAT and SAT. Stepwise regression analysis was performed, with IntraMAT content as a dependent variable and age, body mass index, SAT CSA/body weight, skeletal muscle CSA/body weight, light-intensity physical activity time, moderate- to vigorous-intensity physical activity time as independent variables. As a result, skeletal muscle CSA/body weight and moderate- to vigorous-intensity physical activity time were independent variables (R² = 0.655).

CONCLUSIONS: These results suggest that moderate- to vigorous-intensity physical activity time was related to IntraMAT content only, skeletal muscle size and moderate-to- vigorous-intensity physical activity time could be a major determinant of IntraMAT content in young men.

1983 Board #139 May 30 3:30 PM - 5:00 PM Association Between BMI And Health Perceptions In Preservice Teachers Lesley S. Leonard. College of Coastal Georgia, Brunswick, GA. Email: llenard@ccga.edu (No relevant relationships reported)

Schools play an important role in shaping the dietary and physical activity behaviors of children, and teachers are increasingly called to deliver health-related information in the school setting. No study has examined the association between body mass index (BMI) and health perceptions in preservice teachers in elementary education programs. PURPOSE: To determine the association between perceptions of physical activity, healthy weight, and healthy eating in a sample of preservice teachers in elementary

ACSM May 28 – June 1, 2019 Orlando, Florida
expenditure programs. METHODS: Participants included 341 preservice teachers enrolled in elementary education programs in the state of Florida. Individuals ranged in age from 18 to over 50, with 93% of the participants in the age range of 18 to 29. Females accounted for 91% of the participants. All participants provided self-report height and weight information and responded to statements regarding perceptions of physical activity, healthy weight, and healthy eating. Participants also provided the number of days per week they engaged in at least 30 minutes of moderate to vigorous physical activity. RESULTS: Bivariate correlations showed lower BMI was associated with the perceptions of a more physically active lifestyle ($r = -0.25, p < 0.01$), healthier weight ($r = -0.66, p < 0.01$), and healthier eating choices ($r = -0.26, p < 0.01$). In terms of exercise, higher BMI was associated with fewer days per week of at least 30 minutes of moderate to vigorous physical activity ($r = 0.16, p < 0.01$). CONCLUSION: The current findings indicate that BMI is associated with perceptions of health in preservice teachers in elementary education programs. Shifting their behaviors by replicating such findings encourages researchers to examine the ways in which health promotion programs should be delivered to preservice teachers to improve their health and enhance their ability to promote healthy eating and physical activity to their future students.

Rates of overweight and obesity have risen significantly since the 1980’s, while levels of physical activity have declined. Reductions in physical activity may explain much of the increased body fatness realized over the past several decades, and increases in physical activity may contribute to improved body composition and weight management.

PURPOSE: To examine the relationships among markers of energy expenditure and body composition in adults. METHODS: Participants arrived at the laboratory between 6:00 and 9:00 a.m., having fasted for at least 10 hours. Height and body mass (BM) were measured, and 4-compartment body composition (percent body fat [%BF], fat mass [FM] and fat-free mass [FFM]) was determined using data derived from bioelectrical impedance analysis and dual energy x-ray absorptiometry. Resting metabolic rate (RMR) was determined via indirect calorimetry. Participants were then provided with accelerometers to allow for measurement of various markers of physical activity (PA), including physical activity energy expenditure (PAEE), sedentary time (SEDT), time spent in moderate- to vigorous-physical activity (MVPA), and step counts (STEPS). Accelerometers were worn for 21-28 days, and associations between markers of PA and body composition were analyzed. RESULTS: Absolute expressions of PA (e.g., PAEE, STEPS) were not associated with body composition. However, expressions of PA relative to various fractions of BM were significantly correlated with %BF in both men and women. The strongest predictor of %BF was STEPS·kgFM$^{-1}$·day$^{-1}$. Power regression analysis yielded the model, 2907.1(STEPS·kgFM$^{-1}$·day$^{-1}$)$^{-0.778}$, which measures of PA relative to various fractions of BM were significantly correlated with %BF in both men (R$^2 = 0.91$), and 820.25(STEPS·kgFM$^{-1}$·day$^{-1}$)$^{-0.546}$ in women (R$^2 = 0.82$). CONCLUSIONS: Physical activity expressed per unit of FM strongly predicted %BF. These findings suggest relative expressions of PA (e.g., STEPS·kgBM$^{-1}$·day$^{-1}$ or STEPS·kgFM$^{-1}$·day$^{-1}$) may be more efficacious than absolute expressions of PA in developing PA prescriptions for weight management.

**1985 Board #141**
May 30 3:30 PM - 5:00 PM
What is the Effectiveness of HIIT Body Work on Energy Expenditure in Active Male Adults
Alexander F. Machado$^1$, Roberta L. Ríca$^1$, Fábio L. Ceschini$^1$, Victor M. Reis$^1$, Aquiles Y. Silva$^1$, Danilo S. Bocalini$^4$, Aylton F. Junior$^1$.

1University Sao Judas Tadeu, S Paulo, Brazil.
2Research Center in Sports Sciences, Vila Real, Portugal.
3University Mayor, Santiago, Chile. 4University Federal of Espirito Santo, Vitória, Brazil.

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(No relevant relationships reported)

**INTRODUCTION:** The High Intensity Interval Training (HIIT) has been identified as an important strategy in fitness by improving the cardiometabolic function in adults. However, different models of HIIT performed with body weight, known as High intensity body work (HBW) in blocks with maximum intensity, still lack information namely the energy demand imposed in training. **PURPOSE:** Assessment the energy expenditure in a single session of HBW in healthy male adults. **METHODS:** 12 male adults (33.3 ± 12 years old) performed an all-out protocol with 30 seconds effort x 30 seconds recovery, accounting 20 minutes in the total session. The session exercises were Jumping Jack (JJ), Burpee (BP), Mountain climber (MC) and Squat Jump (SJ), performing 5 sets for each set. The energy expenditure was determined by indirect calorimetry with K5, gas analyser throughout the entire session. Heart rate was also measured as well as the rating of perceived exertion (0-10 Borg scale). Repeated measures ANOVA, followed by Tukey (0.05) post hoc test, were performed to compare the differences between exercises. All analysis were performed using SPSS software.

**RESULTS:** The session mean VO$_2$ was 35.31 ± 5.21 ml.kg$^{-1}$·min$^{-1}$, total energy expenditure was 250.78±27.41 kcal; mean heart rate was 164±8 bpm and mean RPE was 8.92±2.68. The mean and standard deviation for the blocks of the different exercises are described in the table below, values followed by the same letter do not differ significantly from each other. Table – Mean VO$_2$ and energy expenditure per exercise and per minute of exercise.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>VO$_2$ (kcal)</th>
<th>Energy expenditure (kcal.min$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JJ</td>
<td>50.27±8.23</td>
<td>10.5±1.65</td>
</tr>
<tr>
<td>BP</td>
<td>73.66±8.84</td>
<td>14.73±1.77</td>
</tr>
<tr>
<td>MC</td>
<td>62.60±8.2</td>
<td>12.52±1.64</td>
</tr>
<tr>
<td>SJ</td>
<td>64.24±6.55</td>
<td>12.85±3.11</td>
</tr>
</tbody>
</table>

**CONCLUSION:** The burpee exercise is the most demanding exercise in terms of aerobic energy expenditure. Contrarily, the jumping jack exercise was the least demanding. Aerobic energy expenditure seems consistent with the use of this type of workout to promote weight loss and/or fat loss.

**1987 Board #143**
May 30 3:30 PM - 5:00 PM
Weight Loss Decreases Dyspnea on Exertion and Unpleasantness in Obese Adults
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(No relevant relationships reported)

**PURPOSE:** We have previously shown that weight loss improved dyspnea on exertion in obese, otherwise healthy, women. Dyspnea is a multidimensional symptom comprised of at least two distinct domains: sensory-perceptual (i.e., dyspnea intensity) and affective distress (i.e., unpleasantness and emotional response). Both domains may lead individuals to avoid exercise. In this retrospective study, we investigated the effects of weight loss in obese women and men on these dyspnea domains.

**METHODS:** Twenty-one participants (12 M, 9 F, 33 ± 7 years, 169 ± 12 cm, 102 ± 18 kg, 35 ± 4 kg.m$^{-1}$, 41 ± 7% body fat) underwent a 12-week weight loss program. Pre-
and post-intervention measurements included a submaximal cycling test at 60W for women and 105W for men. Participants rated their perceived breathlessness (RBP, 0-10 Borg scale) as well as unpleasantness, depression, anxiety, frustration, anger, and fear associated with their breathlessness (visual analog scales, 0-10 cm) at the end of the test. Paired t-tests were used to analyze difference between pre- and post-intervention.

**RESULTS:** Significant decreases were achieved in body weight by 9.4 ± 4 kg (9 ± 4%), BMI by 3 ± 1.6 kg/m², and body fat by 5 ± 10% (p = 0.05). RBP dropped by 1.5 ± 1.8 (p = 0.05). Significant decreases in ratings of unpleasantness (-2.3 ± 2.2), anxiety (-1.2 ± 1.8), frustration (-0.8 ± 1.9), and fear (-0.4 ± 1.0) were observed, while ratings of depression and anger were unchanged. **CONCLUSIONS:** Moderate weight loss alleviated not only dyspnea on exertion, but also the unpleasantness and negative emotional response related to the dyspnea. Supported by NIH Grant R01 HL096762 and King Charitable Foundation Trust.

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

**1988**
**Board #144 May 30 3:30 PM - 5:00 PM**

**Prior Baby Jumper Use Is Correlated With Children's Parent-Reported Physical Activity Level**

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(No relevant relationships reported)

**PURPOSE:** Baby jumpers are ubiquitous in the infant equipment selection. Anecdotally, while some parents link them to enhanced motor development, others link them with delayed walking onset. Baby jumper use involves successive vertical push-offs (rebounds) against the floor with the feet. The resulting raising and lowering of the body’s center of mass is consistent with movements that require leg stiffness regulation. Leg stiffness has been shown to be positively related to maximum sprint velocity in adults and adolescents. Yet, no studies (to our knowledge) have investigated relationships between prior baby jumper use and current locomotor and physical activity (PA) behaviors in young typically developing children. This pilot study investigated these relationships.

**METHODS:** Parents of 45 children (age: 4 ± 2.3 years; height: 97.5 ± 25.6 cm; mass: 17.2 ± 9.4 kg) completed a 24-item survey administered through Qualtrics software. Questions included prior use of a baby jumper, age at walking onset, current fundamental locomotor behavior and PA level. Questions on the degree of a behavior level were on a 5-point Likert scale. Surveys were excluded, if a parent indicated that the child was born preterm or diagnosed with an intellectual or developmental disability. Bivariate correlations were used to evaluate the directionality of relationships between previous baby jumper use and locomotor and PA behaviors. A Mann-Whitney U test was used to compare age at walking onset between children who used and did not use a baby jumper.

**RESULTS:** Of the sample, 64% previously used a baby jumper. The proportions of the sample that were underweight, healthy weight, overweight, and obese were 14%, 51%, 17%, and 17% respectively. Prior use of a baby jumper was moderately positively correlated with children’s parent-reported PA level (ρ = 0.545, p = 0.013) and running pace (compared to peers their age and sex) (ρ = 0.348, p = 0.019). There was no significant difference in age at walking onset between the groups (U = 231.0, p = 0.981).

**CONCLUSIONS:** Prior baby jumper use may be linked with running performance and PA level and may promote physical activity in young children. These relationships should be further investigated and modeled using objective measures of locomotor and PA behaviors. Prior baby jumper use did not delay walking onset in the sample.

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**1989**
**Board #145 May 30 3:30 PM - 5:00 PM**

**Overall Mortality, Survival, And Causes Of Death In Former US Olympians**

Juliana Antero1, Hirofumi Tanaka2, Quentin D. Larochelambert1, Maja Pohar-Perme3, Jean-François Toussaint1.

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(No relevant relationships reported)

United States (US) send a greatest number of athletes to Olympic Games but their longevity and specific causes of deaths have not been examined.

**PURPOSE:** To quantify US Olympic athletes’ longevity and to determine the impact of specific causes of deaths (CoD) on Olympians life duration in relation to the general population.

**METHODS:** Female (n = 2,301) and male (n = 5,823) US athletes who have participated at least once in the summer or winter Olympic Games between 1912 and 2012 were followed up to 2016. Their life status and CoD were certified by the National Death Index. The years-saved method was applied to quantify longevity gains/losses in former US Olympians in comparison to the general population.

**RESULTS:** Former US Olympians lived on average ~5 years longer (95% CI 4.3 to 6) than their referents in the general population, based on the 2,309 deaths observed out of 8,124 former athletes. The burden of each CoD was distributed according to its impact on the total number of years of life saved: cardiovascular diseases (CVD), 2.2 years (1.9 to 2.5); cancer, 1.5 years (1.3 to 1.8); respiratory diseases, 0.8 years (0.7 to 0.9); suicide and external causes, 0.5 (0.4 to 0.6). Nervous system diseases and mental disorders mortality rates were not significantly different from their peers in the general population.

**CONCLUSION:** US Olympians live ~5 years longer than their referents in the general population, advantage mainly driven by lower risks of CVD and cancer. Nervous system diseases and mental disorders do not appear to contribute to the extended longevity that Olympians display.

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**1990**
**Board #146 May 30 3:30 PM - 5:00 PM**

**Elevated Serum Uric Acid And Heart Failure In U.S. Adults: 2007-2016 NHANES**

Michelle L. Stone, Michael R. Richardson, Larry Guevara, Bethany G. Rand, James R. Churilla, FACSM. University of North Florida, Jacksonville, FL. (Sponsor: Dr. James Churilla, FACSM)

(No relevant relationships reported)

There is limited evidence examining the relationship between elevated serum uric acid (UA) concentration and heart failure (HF) in U.S. adults. **Purpose:** Examine the associations between elevated UA and HF using a nationally representative sample of U.S. adults. **Methods:** The final sample with complete data for this analysis (N=17,412) included men and women aged ≥40 years who participated in the 2007-2016 National Health and Nutrition Examination Survey. Self-reported diagnosis of HF was assessed via interview. Elevated UA was defined as values ≥6.9 mg/dL for women and ≥7.2 mg/dL for men. Multivariable gender-stratified logistic regression was utilized to examine the odds of HF. **Results:** The estimated prevalence of HF was 3.85% and 3.93% among men and women, respectively. Age adjusted analysis revealed significantly increased odds of HF in men (odds ratio [OR], 2.78; 95% confidence interval [CI] 2.09-3.71, P<0.01) and women (OR, 3.25; 95% CI 2.37-4.45, P<0.01) with elevated UA. Significance remained following adjustment for education, income, race, body mass index, alcohol consumption, hypertension, diabetes, physical activity, and creatinine in men (OR, 1.59; 95% CI 1.04-2.43 P=0.03) and women (OR, 2.03; 95% CI 1.33-3.08, P=0.01). **Conclusions:** In a representative sample of U.S. adults, having an elevated UA concentration was associated with significantly increased odds of HF when compared to adults with normal UA.

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**1991**
**Board #147 May 30 3:30 PM - 5:00 PM**

**Modernization of a Developing Country: Effect on Body Mass Index**

Cynthia Villalobos1, William E. Herrin1, J. Mark VanNess1, Norah Madaya2, Margaret E. Ciccollella1, Courtney D. Jensen1, 1University of the Pacific, Stockton, CA. 2Uganda Bureau of Statistics, Kampala, Uganda.

(No relevant relationships reported)

Modernization provides technology and resources that commonly displace physical activity (PA) from the daily routine; in time, body mass index (BMI) trends upward.
The scientific literature has shown increased data on the FitBit ambulatory self-monitoring device but little is known about its effects on sedentary adults.

**Purpose:** The purpose of this pilot study was to evaluate the impact of FitBit HR2 (G1) and FitBit HR2 with kinesiology - Dietitian counseling (G2) on the number of steps taken per day. METHODS: 12 sedentary men aged between 18-35 y/d were asked to wear a Fitbit watch for 60 days. Six men using FitBit (mean±75.3±3.2 years old, BMI 21.8±3.7 kg/m²) were compared to 6 men using FitBit while also receiving kinesiology - Dietitian counseling (mean=27.3±5.0 years old, BMI 25.2±8.3 kg/m²) for their respective ecologic environment. The participants in G2 received four 60-minute individual counseling sessions. RESULTS: Both groups appear to have significantly increased the number of steps they take per day during the study. Participants in G1 took 5838.9±1035.0 steps on average at week 1 and 9029.0 to 2524.9 steps at week 7 (Cohen’s d = 1.65; p<0.001). Participants in G2 took 3708.2±1340.2 steps on average at week 1 and 9842.9±4456.6 steps at week 7 (Cohen’s d = 1.59; p<0.01). While G2 mean steps difference (week 7-week 1) is bigger than that of G1, it is too early to suggest that counseling sessions combine with FitBit had an increased depression score. CONCLUSION: It appears that using a self-monitoring ambulatory device

**Abstracts were prepared by the authors and printed as submitted.**
by itself is likely to help sedentary men to increase the step per day number. Future research should involve more sedentary men and women of all ages to help conclude the impact of either Fitbit alone and Fitbit and counseling.

**1996 Board #152**

May 30 3:30 PM - 5:00 PM

Heart Rate Characteristics for Male Chinese College Students of Different PA-Level during 3000 Meters Running

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No relevant relationships reported

**PURPOSE:** To explore the Heart Rate load variation for male Chinese college students of different physical activity level during 3000 meters running, providing a reference for training load monitoring and security.

**METHODS:** Real-time heart rate of 475 Chinese undergraduate students in Tsinghua University were test with Team 2 Polar tester during 3000-meter-run test. The physical activity was investigated by an international questionnaire. All subjects were grouped three by PA levels. Data calculated by SPSS 20.0.

**RESULTS:** 1. There were significant difference in heart rate among students with different levels of physical activity during 3000-meter-run. The mean of maximum heart rate in group with lower PA level was the highest 202±8.9, while that of the group with good PA level was the lowest 197±6.4. 2. The heart rate has relation to the time during 3000-meter-run. The average speed of first three laps has a significant linear relationship to the average heart rate (R=0.875). The heart rate reached a plateau in the last four laps. The heart rate of all reached the maximum in the end of test. 3. The maximum heart rate of 20% individual students reached or exceeded the expected value of maximum heart rate (220-age), and continued for several minutes within a relatively dangerous range.

**CONCLUSIONS:** Mean of maximum and average heart rate of Chinese male college students with good PA level group was lower than that of poor PA level group in 3000-meter-run test. There is a high risk factor for poor PA level Chinese male students when running continuously in the maximum heart rate level. Study was supported by The Chinese General Administration of sports (2015B075).

**1997 Board #153**

May 30 3:30 PM - 5:00 PM

Monitor Type: Participant Evaluations of Two Types of Activity Tracking Devices during a Walking Intervention

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No relevant relationships reported

Commercial physical activity tracking devices have gained popularity both in the lay population and in research settings, however, research examining the effectiveness of commercial physical activity monitors has been mixed. One potential factor to the mixed results may be participants’ perceptions and preferences of the type of activity monitor. **PURPOSE:** The purpose of the study is to investigate usage and adoption issues as well as the perceived impact for two types of activity trackers.

**METHODS:** A 2-arm randomized trial was used to compare the influence of type of data engagement on activity with two types of activity monitors 1) a hip accelerometer (New Lifestyles 1000) (n = 19) requiring manual logging (MANUAL) and 2) a wrist accelerometer (Fitbit Charge 2) (n = 19) with digital logging (DIGITAL). Participants wore the activity trackers for four weeks with instructions to attempt to meet daily step goals. At the end of the study they completed an online questionnaire exploring their experiences with the activity trackers. The open-ended question responses for each participant were analyzed qualitatively by a content analysis. Meaning units (n = 166) from responses were coded and organized into categories and sub-categories. **RESULTS:** For both MANUAL and DIGITAL groups, the top identified categories regarding the perceived impact of the devices were 1) awareness of daily activity patterns (n = 28), 2) influenced motivation (n = 15), and 3) enhanced intuitive understanding of activity (n = 14). Differences between groups were found in prominent themes related to usage and adoption. The MANUAL users identified three themes equally: 1) concern about security of device while wearing (n = 8), 2) issues with ease of wearability (n = 8), and 3) positive experiences (n = 8). The DIGITAL users identified top themes: 1) no issues (n = 8) and usability problems (n = 8) equally, and 3) questioning accuracy (n = 8). **CONCLUSION:** Participants in both groups identified similar themes related to the impact of the devices indicating the both types of trackers were found to be perceived similarly impactful. Differences emerged in usage and adoption. Users of both types of trackers identified negatives and positives to tracker type indicating the importance of matching tracker type with personal preferences to maximize usage.

**1998 Board #154**

May 30 3:30 PM - 5:00 PM

The Downfall of Sitting: The Relationship Between Sedentary Time and Blood Pressure

Megan L. Conner, Grace Shin, Jamie C. Clark. University of Central Oklahoma, Edmond, OK.

No relevant relationships reported

One third of the population is affected by hypertension, and previous research has shown that sitting for extended amounts of time can be detrimental to a person’s health. **PURPOSE:** The purpose of this study was to evaluate the correlation between self-reported sitting time and blood pressure. It was hypothesized that sedentary time was significantly related to blood pressure. **METHODS:** The study included faculty or staff that were ambulatory and full-time equivalent. The participants were given a self-reported physical activity questionnaire (The International Physical Activity Questionnaire [IPAQ]) to determine sedentary time. Resting blood pressure (systolic and diastolic) was assessed using a stethoscope and sphygmomanometer, after sitting quietly in a chair for 5 minutes. Data was analyzed with a bivariate correlation test.

**RESULTS:** There was a significant, positive, moderate relationship between sedentary time and systolic blood pressure (n = 10, r = .705, p = .01) and a significant, positive, strong relationship between sedentary time and diastolic blood pressure (n = 12, r = .810, p = .001). **CONCLUSION:** Self-reported sedentary time was positively related to blood pressure. In other words, the greater the individual’s sitting time, the higher the systolic and diastolic blood pressure was found to be. Engaging in physical activity and reducing sedentary time may decrease the likelihood of developing hypertension. Future research should focus on the effects of programming to decrease sedentary time on measures of health.

**1999 Board #155**

May 30 3:30 PM - 5:00 PM

Self-Reported Sedentary Behavior Is Associated With Total, Visceral, And Segmental Body Fat In Adults

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Email: megann@uidaho.edu

**Reported Relationships:** M.C. Nelson: Industry contracted research; InBody USA.

Regional body fat deposition, particularly visceral fat, may be an important mechanistic link between sedentary behavior and cardiometabolic disease risk with advancing age. **PURPOSE:** To examine the associations of sedentary behavior and screen time with total, visceral, and segmental body fat in middle to older aged adults. **METHODS:** 47 adults (mean±SD: age 53.5±11.2 y; body fat 30.5±10.6%; men 38.3%) self-reported sedentary behavior and moderate-to-vigorous physical activity (MVPA) using the Sedentary Behavior Questionnaire and International Physical Activity Questionnaire, respectively. Leisure screen time was defined as television viewing, video games and computer games. Total, visceral, and segmental body fat were estimated with the InBody770 bioelectrical impedance analyzer. Waist circumference was measured at the top of the iliac crest. Multiple regression assessed the associations of sedentary behavior and screen time with total and regional fat distribution, controlling for age, sex and MVPA. **RESULTS:** Average sedentary time was 7.5±2.3 h d-1 with 1.3±0.9 h·d-1 reported as screen time. Sedentary time was associated with total fat mass (R2 =0.19, β=0.30, p=0.02), visceral fat (R2=0.20, β=0.31, p=0.03), trunk fat (R2=0.17, β=0.36, p=0.001), waist circumference (R2=0.23, β=0.39, p=0.001) and leg fat (R2=0.24, β=0.30, p=0.003) independent of age and sex. When MVPA was added to the model total fat mass (R2=0.20, β=0.30, p=0.04), trunk fat (R2=0.17, β=0.34, p=0.03) and waist circumference (R2=0.25, β=0.36, p=0.01) remained significant. Screen time was associated with trunk fat (R2=0.13, β=0.30, p=0.04) and waist circumference (R2=0.23, β=0.38, p<0.01) independent
Cardiovascular disease (CVD) is the leading cause of mortality and is associated with modifiable lifestyle factors, such as physical activity (PA). Research has examined CVD knowledge (CVDK) and PA level in undergraduates; however, no research has examined the relationship between CVDK and PA in this group.

PURPOSE: To examine differences in CVDK and indices of PA between sex and major (health (HB) or non-health (NHB) based) and potential associations between CVDK and PA.

METHODS: Students (N=241) completed an online survey including the 30-item Heart Disease Knowledge Questionnaire and 7-item International Physical Activity Questionnaire. Two-fifths of the sample was excluded due to previous exercise testing in their careers (n=21; 21.1±2.7 yrs; 146 females, 145 HB majors). Independent samples t-tests were conducted to test for differences in total (TK), dietary (DK), epidemiological (EK), medical (MK), risk factor (RFK), and symptom (SK) knowledge, as well as weekly frequency and duration of moderate PA (MPA), vigorous PA (VPA), and total MET-min/week of MPA and VPA between sex and major. Alpha was adjusted for multiple comparisons. Pearson’s r was used to test for linear associations between TK and PA indices.

RESULTS: Sixty-seven percent of students met recommended PA guidelines with a minimum of 500 MET-min/week of MPA. Females had greater RFK than males (4.6±1.6 vs. 4.0±1.6; p<0.001). HB majors had significantly higher TK (8.4±3.0 vs. 7.7±3.3; p<0.001), DK (4.0±1.7 vs. 3.1±1.9; p<0.001), EK (2.8±1.1 vs. 2.4±1.2; p<0.001), MK (4.4±1.5 vs. 3.3±1.4; p<0.001), and RFK (4.6±1.6 vs. 3.9±1.5; p<0.002) than NHB majors. There were no significant differences in SK between majors (p>0.05). Males reported significantly higher levels of MPA than females (230.7±237.7 vs. 144.1±134.8 MET-min/week; p<0.001). There were no associations between TK and any PA index (p>0.05).

CONCLUSION: HB majors had greater knowledge than NHB majors in all areas except SK; however, there were no differences in PA levels between majors. This suggests that CVDK may not translate to increased PA levels in undergraduates. Future research should investigate relationships between CVDK and risk reduction behaviors in this population.

Body mass index (BMI), calculated using height and weight, is used clinically to diagnose obesity. The ability of BMI to estimate adiposity is limited in the general population and unadjusted in college aged individuals. Relative fat mass (RFM) has been proposed as an alternative technique to BMI for diagnosis of obesity. RFM accounts for mass stored in the lower portion of the torso by incorporating height and waist circumference into the equation.

PURPOSE: The purpose of this study was to compare rates of obesity determined by BMI, RFM and objectively measured percent body fat (BF%) via biodependence impedance analysis (BIA) in a large cohort of college aged men and women.

METHODS: 3804 college aged men and women completed an initial fitness assessment, where they self-reported their age and sex, and height, weight, waist circumference, and BF%, were assessed. Correlation and chi-square tests for independence analyses examined the relationships and differences in rates of obesity between each method.

RESULTS: The mean age of the sample was 21.2±1.1, and the majority (n=2406, 63%) identified as male. Significant correlations were found between BMI and BF% for men (r=0.79, p<0.001) and women (r=0.84, p<0.001); BMI and RFM for men (r=0.85, p<0.001) and women (r=0.83, p<0.001); and, BF% and RFM for men (r=0.74, p<0.001) and women (r=0.76, p<0.001). Differences were found between the observed and expected classification of normal adiposity or obesity by BMI, RFM, and BF% for men and women (all p<0.001). Among men, comparing BF% vs. BMI and RFM vs. BMI, more obese men via BF% or RFM were classified as normal via BMI (54BF% χ²=576.0, p<0.001; BF% χ²=1.08, p<0.001). Comparing RFM and BF%, more men and women classified as obese by RFM were considered normal by %BF (χ²=626.0, p<0.001; χ²=246.5, p<0.001).

CONCLUSION: Strong associations are observed among BMI, RFM and objectively measured %BF in college students. Despite these strong relationships, discrepancies were observed between obesity classifications between BF%, BMI and RFM.

Of the recognized emergency medical service professionals, the least is known about EMRs and EMT students. One known study suggests that EMT-B students have some level of predisposition to conditions such as high blood pressure, low exercise tolerance, obesity, and poor health-habit decision-making with regard to tobacco and alcohol use.

PURPOSE: To determine the prevalence of health risk, physical activity and sedentary behaviors among students enrolled in an Emergency Medical Technician Certification Program.

METHODS: Sixty EMT students (mean age 24.9 ± 8.3 years, 46.7% female, 98.4% Caucasian) completed risk behavior surveys including physical activity, health status, smoking, and alcohol use modeled after the Centers for Disease Control and Prevention (CDC) Behavioral Risk Factor Surveillance System (BRFSS) and a Modified Activity Questionnaire (MAQ) to assess leisure-time physical activity and sedentary behavior.

RESULTS: The median (25th, 75th percentile) MET/min/ week of self-reported physical activity from the MAQ for all participants was 558 (228, 1074) and by gender 660 (246, 1074) males and 480 (375, 1098) females. When categorized as meeting or not meeting the current US Physical Activity Guidelines, 56.7% met or exceeded the ≥ 500 MET/min-week guideline. Median BMI for all participants was 25.6 (22.9, 30.1) kg/m² with approximately 28.3% of the population considered overweight and 25% obese. Among reported health conditions, 41.7% rated their general health as very good or excellent; 20.0% percent reported being diagnosed with asthma and 16.7% reported being diagnosed with a depressive disorder. With regard to smoking and alcohol, 11.7% reported currently smoking, 15.0% reported current use of chewing tobacco or snuff and 43.3% reported ever vaping or using an e-cigarette. Additionally, participants reported a mean (standard deviation) of 4.4 (4.6) days per month of drinking at least one drink of alcohol and drinking 2.5 (2.4) drinks when they drank. CONCLUSION: Among EMT students, over half are meeting the current US Physical Activity Guidelines. Prevalence of overweight/obesity, smokeless tobacco use, and reported depression may put this population at risk for comorbid conditions as they transition from student to professional EMT.

PURPOSE: High accumulated sedentary time with inadequate physical activity is a common behavioral profile in the United States. Examining differences in activity patterns across occupational categories can distinguish target populations for intervention.

METHODS: This cross-sectional analysis of Year 20 CARDIA data (2003-6) included participants who had valid accelerometer data (24 days with ≥10 hours), reported job and job duties, and were not currently a student (n=2,050). Uniaxial accelerometer data (Actigraph7164), including leisure and occupational time, were expressed in 60 second epochs and summarized as: average counts per minute (CPM) and time spent (hours/day) in total sedentary behavior (SED), light physical activity (LPA), and moderate-to-vigorous physical activity (MVPA) using Freedson cutpoints. Self-reported job and job duties were categorized into the 23 major groups of 2010 Standard Occupational Classification (SOC) using Occucoder v2.7 followed by adjudication by a trained researcher. Military and forestry categories were excluded because <5 participants reported jobs in those categories. Omnibus group differences were analyzed using ANCOVA adjusted for sex, race, age, education, wear time, center, and BMI.

RESULTS: Table 1 shows the least and most favorable three SOC groups in each activity category with mean (standard error) reported. P-values represent overall group comparisons.
difference across occupational categories. Building grounds maintenance had the highest CPM while office and admin support had the lowest. Architecture/engineering had the highest CPM while food preparation had the lowest. Food preparation had the most LPA and legal had the least. Food preparation had the highest CPM while office and admin support had the lowest.

**Conclusion:** Activity patterns have large variation across occupational categories, justifying occupation as an important determinant of activity and the workplace as a potential intervention setting.

Table 1 – Occupational Categories with the Least and Most Favorable CPM, SLA, LPA, and MVPA

<table>
<thead>
<tr>
<th>Least favorable categories</th>
<th>Mean (SE)</th>
<th>Most favorable categories</th>
<th>Mean (SE)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office and Administrative Support</td>
<td>322.5 (2.03)</td>
<td>Healthcare Support</td>
<td>367.5 (2.73)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Healthcare Support</td>
<td>322.5 (2.03)</td>
<td>Construction and Extraction</td>
<td>426.7 (2.39)</td>
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<tr>
<td>Architecture/Engineering</td>
<td>364.2 (2.93)</td>
<td>Construction and Extraction</td>
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<tr>
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<td>Personal Care and Service</td>
<td>7.58 (0.16)</td>
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</table>

**CPM units:** perc min-1; SEDL: sedentary light activity; LPA: light physical activity; MVPA: moderate to vigorous physical activity.

2004 Board #160 May 30 3:30 PM - 5:00 PM

**Association Between Cardiorespiratory Fitness and Cardio Metabolic Syndrome Risk Score in Korean Men**

Hyun Jeong Kim1, Min Jeong Cho1, Eun sun Yoon1, Yoon-Ho Choi2, Sae Young Jae1. 1University of Seoul, Seoul, Korea, Republic of. 2Samsung Medical Center, Seoul, Korea, Republic of. Email: hjjeong3705@naver.com

**No relevant relationships reported**

**Purpose:** We examined the hypothesis that cardiorespiratory fitness (CRF), defined as maximal oxygen uptake, predicts the risk of incident cardiometabolic syndrome (CMS) defined as having ≥3 relevant risk factors and is prospectively associated with continuous CMS risk score in healthy men. **Methods:** Participants were 2,742 Korean men who underwent general health examinations and had no evidence of CMS, cardiovascular diseases, diabetes, and hypertension at baseline. Baseline CRF was directly measured by peak oxygen uptake (VO2peak) and divided into quartiles. Incident CMS was defined as participants having ≥3 CMS components, and continuous CMS risk score was computed as the sum of z-score of five risk factors at follow-up. **Results:** During a median follow-up of 5 years, 946 (34.5%) men developed CMS. The relative risks (RR) and 95% confidence interval (CI) of incident CMS in the highest quartile (≥31.8 ml.kg.min) vs. the lowest quartiles of peak oxygen uptake (VO2peak) was 0.62 (95% CI: 0.52-0.75) after adjusting for age, body mass index, smoking and alcohol intake. Baseline peak oxygen uptake was independently associated with continuous CMS risk score at follow up after adjusting for covariates (p<0.001). **Conclusion:** The associations between CRF and incident CMS and continuous CMS risk score, suggesting that improving CRF should be considered as an additional risk factor to predict the future likelihood of CMS in Korean men.

2005 Board #161 May 30 3:30 PM - 5:00 PM

**Differential Impacts Of Excessive Eustolic Blood Pressure Response On The Risk Of Sudden Cardiac Death In Men With And Without A History Of Cardiovascular Disease**

Sae Young Jae1, Jari Laukkanen2, Barry Franklin, FACSM1, Bo Fernhall, FACSM1. 1University of Seoul, Seoul, Korea, Republic of. 2University of Eastern Finland, Kuopio, Finland. 3William Beaumont Hospital, Royal Oak, MI. 4University of Illinois at Chicago, Chicago, IL. Email: syjae@uos.ac.kr

**No relevant relationships reported**

**Purpose:** Although exercise systolic blood pressure (ESBP) response has been associated with cardiovascular disease, it remains unclear whether ESBP is associated with an increase or a decrease in the risk of sudden cardiac death (SCD) in both groups. We tested the hypothesis that ESBP would be associated with differential outcomes of SCD in men with and without a history of cardiovascular disease. **Methods:** This prospective study was based on a population sample of 2,410 men, aged 42-61 years, who were followed up in the Kuopio Ischemic Heart Disease cohort study. Excessive ESBP was defined by a maximal SBP ≥210mmHg during progressive bike exercise testing to volitional fatigue. Participants were stratified by men (n=884) and women (n=1,526) and a history of cardiovascular disease at baseline. **Results:** During a median follow-up of 25 years, 226 SCDs occurred. After adjusting for age, each 10 mmHg increase in ESBP was associated with an increased or decreased risk for SCD in men without (HR=1.14, 95% CI 1.06-1.24) and with (HR=0.94, 95% CI 0.89-0.99) a history of cardiovascular disease, respectively. After adjusting for age, BMI, resting SBP, smoking, alcohol intake, LDL-C, HDL-C, family history of heart disease, diabetes, and maximal oxygen uptake, an increased risk of SCD was observed with excessive ESBP response in men without a history of cardiovascular disease (HR 1.73, 95% CI 1.07-2.82). A tendency for a reduction in the SCD risk was observed with excessive ESBP response in men with history of cardiovascular disease (HR 0.92, 95% CI 0.60-1.41).

**Conclusion:** Our findings indicate that ESBP response was associated with the risk of SCD in both groups. However, the heightened risk of SCD associated with excessive ESBP response appeared in men without a history of cardiovascular disease, whereas excessive ESBP response may have opposite results in men with a history of cardiovascular disease.

2006 Board #162 May 30 3:30 PM - 5:00 PM

**Moderators Of The Relationship Between Worksite Walkability And Physical Activity**

Jane C. Hurley, Mike Todd, Christine B. Phillips, Hannah Hook, Steven P. Hooker, FACSM1, Panum Ohiri-Vacasapti, Marc A. Adams2, Arizona State University, Phoenix, AZ. (Sponsor: Steven Hooker, FACSM)

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**No relevant relationships reported**

**Purpose:** This study examined traditional and novel moderators (i.e., age, sex, race, income, # of children <18 yrs, ratio of cars to drivers, home walkability) of the relationship between worksite neighborhood walkability (WNW) and physical activity (PA).

**Methods:** Participants (n = 521, mean 44 yrs, 59% female, 70% White) were employed (not at home) during the baseline phase of a larger trial. Measures included self-reported PA (total min/week, min/week of transport-PA inside (TPAin) and outside (TPAout) the home neighborhood, NPAQ and Actigraph-measured PA (min/week moderate-to-vigorous PA in bouts (MVPA) and sedentary-light PA (SLPA). GIS-assessed WNW (500m network buffer of residential, intersection, and transit densities; land use mix). Negative binomial regression estimated associations of WNW with PA, each moderator, and WNW x moderator (i.e., age, sex, race, income, # of children <18, car driver ratio, home walkability) interactions. Alpha level set at 0.10 to probe conditional effects. Main effects of covariates (residence tenure, distance to work, reason moved to residence, total household members; and in accelerometer models, wear time) were included.

**Results:** Sex and # of children <18 yrs moderated relationships of WNW with MVPA and SLPA. Race moderated the relationship of WNW with TPAout. For women, the conditional effect of WNW on MVPA was positive (p <0.02, p<0.001). **Conclusion:** The independent association of WNW with TPAout was negative (p = .07), not different from zero for non-Whites. No other moderators (age, income, car driver ratio, or home walkability) interacted with WNW.

**Conclusions:** For women, adults without young children, and Whites (but not men, those with young children, and non-Whites), PA is influenced by walkability of worksite environments in mostly expected directions. An undereveloped aspect of behavioral ecological models is identifying who is sensitive to the environmental conditions that can bolster health promotion efforts.

2007 Board #163 May 30 3:30 PM - 5:00 PM

**Association of Leisure Time Physical Activity and Back Pain in Brazilian adults**

Italo R. Lemes1, Rômulo A. Fernandes1, Bruna C. Turi-Lynch2, Jamile S. Codogno1, Henrique L. Monteiro1, Rômulo A. Fernandes1, Bruna C. Turi-Lynch2, Jamile S. Codogno1, Henrique L. Monteiro1, 1São Paulo State University, São Paulo, Brazil. 2São Paulo State University, São Paulo, Brazil. Email: itolemes@hotmail.com

**No relevant relationships reported**

**Purpose:** Leisure time physical activity (PA) may reduce the risk of back pain. A recent meta-analysis found that moderate to high PA during leisure time protects against low back pain by up to 16%. However, there is no study investigating this association in a developing country like Brazil (the biggest nation in Latin America).

**Methods:** To investigate the association of leisure time PA and back pain in adults from the Brazilian National Health System (NHMS).

**Results:** Data were obtained from 557 adults (410 women) enrolled in the Brazilian NHS in 2016. Participants were 50 years or older, registered for at least
Body mass index (BMI) is a worldwide used method for obesity identification. It is an easy and low-cost method recommended for large samples assessment. Concerns about the accuracy and validity of BMI as an anthropometric scale (Welmy-RI W200). Both m-BMI and r-BMI were calculated as BMI ≥30.0 kg/m². Obesity was defined as BMI ≥30.0 kg/m². Due to lower sensitivity among women, a BMI ≥22.0 kg/m² alternative cut-off point was also tested. Agreement analyses were done considering BMI as reference, using following indices: 1) total agreement (TA) as the sum of the percentage of true positive and true negative values (TA=Tp+Tn); 2) sensitivity = [Tp / (Tp+Fp)] X 100, were FN is false negative; 3) specificity = [Tn / (Tn+Fp)] X 100. All indices were calculated as their point value and 95% interval of confidence (95%IC).

RESULTS: We observed very high agreement between r-BMI as compared to m-BMI in the total sample and showed that BL has lower scores than HU, IT and PT in EQ_index (differences ranged between -17% to -28%, p<0.05, d=0.80 to 1.30), HandT (differences ranged between -12% to -28%, p<0.05, d=0.80 to 1.30), 6MW (differences ranged between -29% to -69%, p=0.000; d=2.60 to 3.98); and 6MW (differences ranged between -73% to -72.33%, p=0.000; d=4.58 to 12.03), for both sexes. In all counties the EQ-5D-5L was lower among women, probably affected by its lower prevalence. Using the 29.0 kg/m² cut-off point was used in the r-BMI, we found a much higher sensitivity (88.2%) with specificity (84.1%) compared to insufficiently active group (OR: 0.59; 95%CI = 0.36 to 0.95).

CONCLUSION: These findings may have a public health impact given the large number of sedentary Americans with high amounts of screen time.

The age-related life quality in aged population has been widely reported in literature including muscular functioning and self-reported health state. The EQ-5D-5L questionnaire is widely used at population level and comprises five dimensions including mobility, self-care, usual activities, pain/discomfort and anxiety/ depression. Grip strength and walking ability are known to be associated with muscular functioning and activities of daily living. Little research has examined the differences throughout European countries. Purpose: this study aimed to investigate the relationship between the health state and health predictors, among elderly from 4 different European countries [Portugal (PT), Italy (IT), Bulgaria (BL) and Hungary (HU)]. Methods: 324 (81 PT, 119 IT, 76 BL and 48 HU) older adults (68,9±6,3 yrs, 73,6±12,7 Kg, 1,61±0,08 m), male (24%) and female (76%), were recruited from local population. The subjects completed the EQ-5D-5L and were assessed as handicap test (HandT), 6 minutes walking test (6MW). EQ-5D-5L index (EQ_index) was calculated to assess the quality-adjusted life years (QALYs). ANOVA was performed to detect country group differences. Pairwise comparisons was executed with Tukey post hoc test and Cohen D. Pearson coefficient of correlation was used to assess relationship between determinants. Significance level was set at p<0.05. Results: Pairwise comparisons showed that BL has lower scores than HU, IT and PT in EQ_index (differences ranged between -17% to -28%, p<0.05, d=0.80 to 1.30), HandT differences ranged between -29% to -69%, p<0.000; d=2.60 to 3.98); and 6MW (differences ranged between -72.33% to -82%, p<0.000; d=4.58 to 12.03), for both sexes. In all counties the EQ_index was moderately and positively correlated with HandT (r=0.453; p=0.000) and 6MW (r=0.533; p=0.000). However the pattern was not cross-country homogeneous, as HU showed lowest correlations (r=0.124; p=0.400; 6MW, r=0.116; p=0.913).

Abstracts were prepared by the authors and printed as submitted.

A pilot study of professional video gamers reveals the presence of subclinical cardiovascular disease

PURPOSE: Sedentary behavior in contemporary society is typically coupled with extended screen time (i.e. hours spent in front of a television / computer screen). In November 2016, the commercial video game developer, Blizzard Inc.™ announced the creation of the Overwatch League (OWL), an international e-gaming association built on the model of a traditional professional sports league. The purpose of this pilot study was to establish the feasibility of a larger project and to evaluate for the presence of subclinical pathology in members of the OWL team representing Boston.

METHODS: The members of the Boston Uprising (n=10, age=20±2) were tested using electrocardiography, cardiac imaging (echocardiography), vascular function testing (applanation based tonometry) and multiple neurocognitive tests (testmybrain.org).


Body mass index (BMI) is a worldwide used method for obesity identification. It is an easy and low-cost method recommended for large samples assessment. Concerns exited regarding the risk of classification when BMI is calculated based on reported height and weight as compared to the measured height and weight for BMI calculation.

PURPOSE: We compared the prevalence of obesity categorized by measured BMI (m-BMI) and reported BMI (r-BMI) among Brazilian civil servants. METHODS: We evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in

CONCLUSION: In this sample, leisure time PA was inversely associated with the presence of back pain. Supported by São Paulo Research Foundation (FAPESP) Grant 2015/17777-3 and 2016/1140-6.

Body mass index (BMI) is a worldwide used method for obesity identification. It is an easy and low-cost method recommended for large samples assessment. Concerns exited regarding the risk of classification when BMI is calculated based on reported height and weight as compared to the measured height and weight for BMI calculation.

PURPOSE: We compared the prevalence of obesity categorized by measured BMI (m-BMI) and reported BMI (r-BMI) among Brazilian civil servants. METHODS: We evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m², from a federal labor court. Volunteers reported weight and height in
Conclusions: Different environments promote different life quality in aged population. BL evidences poorer quality of life and fitness status than other European countries. HU seems to well promote healthy life style. Further investigation is need to better understand the present findings.

The biological mechanisms underlying the beneficial effects of regular physical activity (PA) on prevention of chronic diseases are not fully understood. It is currently suggested that N-linked enzymatic glycosylation, a post-translational modification modulating the biological function of several proteins, may contribute to disease development. Nevertheless, the influence of PA on N-glycans in humans has never been explored. PURPOSE: To explore serum N-glycan profile in a sample of community-dwelling older women with different objectively assessed PA levels and metabolic risk status. METHODS: Components of the metabolic syndrome (MetS) and serum N-glycans analyzed using DSA-FACE technology were assessed in 109 older community-dwelling women (65-70 yrs). Ten peaks, each representing a unique N-glycan structure were detected. Adherence to PA guidelines was determined using accelerometry. Participants daily engaged in 30 minutes of MVPA were classified as meeting PA guidelines. RESULTS: Significant differences in N-glycan peaks were indicated when comparing women adhering to the PA guideline to those less active: when adjusted by MetS, a 12% (p = 0.006) and a 13% (p = 0.004) lower level of NA3 (peak 8) and NA4 (peak 10), respectively, were evident among the physically active women compared to those less active. In contrast to findings based on the MVPA threshold, no differences in N-glycan peaks were observed between PA groups when based on the lower intensity threshold, which may indicate that the influence on N-glycan levels by PA is intensity-sensitive. CONCLUSIONS: Adherence to PA guidelines is related to a favorable N-glycan profile, regardless of metabolic risk status. This proposed effect on N-glycans only occurs above the moderate PA-intensity threshold. Our findings support the promotion of a physically active lifestyle as a supporting non-pharmacological public health approach.

D-62 Free Communication/Poster - Protein Metabolism
Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

PROTEIN INGESTION AND COOLING STRATEGIES DURING RECOVERY FROM RESISTANCE-TYPE EXERCISE IMPAIR THE MYOFIBRILLAR PROTEIN SYNTHESIS RATES.

Cas J. Fuchs, Imre W.K. Kouw, Tyler A. Churchward-Venne, Joey S.J. Smeets, Joan M. Senden, Wouter D. van Marken Lichtenbelt, Lex B. Verdijs, Luc J.C. van Loon, Maastricht University, Maastricht, Netherlands. (Sponsor: Janice Lee Thompson, FACSM)
Email: cas.fuchs@maastrichtuniversity.nl
(No relevant relationships reported)

Purpose: To explore the effects of consuming a normal or high-protein diet containing isolated whey protein (IWP) in conjunction with resistance training (RT) is little known. This study aimed to determine the effects of IWP on performance, biochemical, hormonal and tissue parameters in rats completing a vertical ladder training protocol.

Methods: Thirty-two 45-day-old male Wistar rats were divided into four groups (n=8/group): normal protein diet (14% IWP) sedentary (NS), trained (NT), high-protein diet (35% IWP) sedentary (HS) and trained (HT). RT consisted of 8 vertical ladder climbs/3x a week, over 6 weeks. In weeks 1-2, rats carried a load equivalent to 70% of the maximal load, determined by a maximal load test (MLT), performed on the first and last days of training. The load was adjusted to 80% and 85% of the MLT, respectively, every 2 weeks. At the conclusion of the study, the animals were anesthetized and euthanized after 12h of fasting. Quadriceps (Q), anterior tibial, gastrocnemius (G), soleus and long finger extensor, kidneys, liver and heart tissues were excised and weighed (g).

Results: Performance values (g) on the last MLT improved in HT (964.8 ± 117.6) compared to HS (730.6 ± 89.7), NT (472.6 ± 72.7) and NS (323.0 ± 63.7). There was no difference in plasma levels of testosterone, IGF-1, hepatic enzymes, creatinine, and ß-hydroxybutyrate, as well as hematological parameters. Levels of HDL-c (p < 0.001) were higher in HT (104.4 ± 26.0) and HS (100.7 ± 12.0). There was an observed difference in the relative weights of the kidneys (HS=0.72 ± 0.05, HT=0.70 ± 0.04, > NS=0.58 ± 0.04, NT=0.59 ± 0.02, p<0.0001), liver (HT=2.93 ± 0.21 > NS=2.62 ± 0.19, NT=0.59 ± 0.02, p<0.004) and heart (HS=0.32 ± 0.02 > NS=0.28 ± 0.02, NT=0.27 ± 0.01, p<0.003). In relation to the relative muscle weight of G (p<0.05) and Q (p<0.02), HT (1.16 ± 0.09; 1.67 ± 0.09) showed higher values in comparison to NT (1.04 ± 0.08; 1.53 ± 0.09).

Conclusions: A high-protein diet of 35% IWP in combination with RT improved performance as well as increased muscle and organ weight without damaging tissues related to protein metabolism (confirmed by unchanged hematological parameters). This finding may help to minimize the risk of developing cardiometabolic disorders in certain populations.
a paucity of research supporting any benefits. PURPOSE: To compare the satiating effect of two protein diets on resistance-trained individuals in short-term energy deficit. METHODS: Following University ethical approval and 16 resistance-trained participants (age: 28 ± 2.1 yrs; height: 1.72 ± 0.03 cm; body mass: 88.83 ± 5.54 kg; body fat: 21.85 ± 1.82%) were randomly assigned to a moderate (PROmod) 1.8 g·kg⁻¹·d⁻¹ or high protein (PROhigh) 2.9 g·kg⁻¹·d⁻¹ matched calorie-deficit diet for 7 days in a cross-over manner, including 4-week wash-out. Venous samples were collected (time-points T0, 60, 120 mins) for assessment of plasma ghrelin and protein YY concentrations to a fixed-protein (0.7 g·kg⁻¹) meal, along with perceived satiety ratings, following each diet. RESULTS: Following PROhigh, mean ghrelin concentration (pg·ml⁻¹) significantly reduced post-meal (T0: 972.8±130.4, T60: 659.7±86.4, T120: 613.6±114.3; p<0.003 compared to T0). Similar observations were reported for PROmod (T0:1088.2±158.8, T60: 786.6±117.3, T120: 850.6±147.7; p<0.015). However, T120 responses differed between conditions, and further confirmed when data were normalised for relative change (PROhigh -0.40±0.06, PROmod -0.26±0.06; p<0.015). YY concentrations (pg·ml⁻¹) increased post-meal across time-points (PROhigh 84.9±8.9 to 147.1±11.9 and PROmod 100.6±9.5 to 143.3±12.0; p<0.001), with no differences reported between diets. Perceived ‘hunger’, ‘fullness’ and ‘satiety’ were comparable between diets (p>0.05). However, ‘desire to eat’ remained significantly blunted at T120 post-meal for PROhigh only (p<0.048). CONCLUSIONS: PROhigh does not confer additional satiating benefits in resistance-training individuals during short-term energy deficit. Ghrelin response to a test-meal support the contention that satiety was sustained with PROmod with implication that high protein meals may be adequate to increase acute satiety when following a PROmod energy-restricted diet.

2015 Board #171 May 30 2:00 PM - 3:30 PM

Effect Of Branched-chain Amino Acid Plus Glucose Supplement Timing On DOMS And Related Indicators After Eccentric Exercise

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(Please report any relationships)

PURPOSE: Nutrient timing is a strategic approach to maximize training effects, reduce risk of injury, and help with recovery. The present study examined the effect of BCAA plus Glucose on markers of muscle damage and Inflammation after eccentric exercise in male college students.

METHODS: 18 healthy college students were divided into control (PLA) group and supplement (BCAA+G) group randomly. Each group was randomly assigned 4 people for pre-exercise supplementation and 4 people after exercise for the first time, and changed for the second time. Before or after supplementation, volunteers performed an eccentric exercise protocol. Muscle soreness(VAS), creatine kinase (CK), C-reactive protein (CRP) and interleukin-6 (IL-6) and 3-methylhistamine (3MH) assessments were performed before exercise and after 30min, 24, 48 hours.

RESULTS: The VAS score of the subjects increased significantly 24 hours after high-intensity eccentric exercise(2.86 vs 1.66, p<0.05), and the increase of serum CK level(364.45 vs. 151.02U/L, CRP(4.77 vs. 3.28mg/L) and IL-6(279.00 vs. 110.63pg/ml) increased significantly(p<0.05). BCAA plus G supplement significantly reduced the VAS score(1.27 vs 2.86, p<0.05) and CK(258.74 vs 364.45U/L), CRP(3.75 vs. 4.77mg/L) and IL-6(164.09 vs. 279.00pg/ml) levels(p<0.05), compared with pre-supplementation group, post-supplementation had lower VAS score(1.27 vs. 2.63), CRP(3.75 vs. 4.26mg/L) and IL-6(164.09 vs. 226.66mg/ml) and CRP(105.07 vs. 131.67mg/L) response at 24 h after eccentric exercise(p<0.05).

CONCLUSIONS: High-intensity eccentric exercise caused DOMS with the elevation of damage and inflammatory markers as CK, CRP, IL-6. BCAA plus G supplementation can effectively reduce the level of DOMS, decrease muscle damage and inflammatory factors and protein breakdown. Compared with pre-exercise supplementation, post-exercise supplementation has a better effect on reducing inflammatory factors and protein breakdown caused by DOMS.

2016 Board #172 May 30 2:00 PM - 3:30 PM

Acute Effect Of The Order Of Resistance Exercise And Nutrient Intake On Muscle Breakdown

Wataru Kume, Jun Yasuda, Maki Yoshikawa, Takeshi Hashimoto, FACSM. Ritsumeikan University, Shiga, Japan.

(Sponsor: Takeshi hashimoto, FACSM)

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(No relevant relationships reported)

Combined resistance exercise (RE) and nutrient intake synergistically interacts with muscle hypertrophic effect (MHE) (Phillips et al., 2006). Indeed, muscle breakdown (MB) is suppressed with acute RE and proper nutrient (amino acid + carbohydrate), reflected by decreases in 3-methylhistidine (3-MH), a MB marker in 24h urine collection. The study also suggested that the response of MB marker upon acute RE may reflect MHE in chronic RE training (Bird et al., 2006). However, the effect of the order of nutrient intake and RE on acute MB response remains unclear. Given that MB acutely responds to RE (Louis et al., 2007), it is important to assess acute changes in MB markers upon nutrient intake and RE. PURPOSE: The aim of this study was to investigate the effect of the order of nutrient intake and RE on acute changes in urinary MB marker and thus MHE.

METHODS: Twelve healthy men were divided into three conditions: 1) nutrient intake before RE condition (Pre), 2) nutrient intake after RE condition (Post), and 3) RE without nutrient intake condition (No). They performed 5 types of multiple RE at 70%RM intensity. In all conditions, RE was performed from 8:30 to 9:30. The time of nutrient intake in the Pre was at 7:00, while in the Post was at 9:30. The standard Japanese lunch menu with 21 g of whey protein and 200 ml of milk (total energy, 1019 kcal; Protein, 53.4 g; fat, 25.1 g; carbohydrate, 139.5 g) was provided. Urinary samples were collected at 7:00, 10:00, 12:00, 15:00, and 18:00, and urea nitrogen (UN), creatinine (Cre), and 3-MH concentrations were measured, and 3-MH and UN were normalized by Cre.RESULT: The acute responses of MB markers were validated by the result that the time-course change in the total amount of UN and UN normalized by Cre were consistent at any given time point. The area under the curve (AUC) of 3-MH was significantly higher in Pre than that in No (P<0.01). There was no significant difference between Post and No in the AUC of 3-MH. The AUC of UN was significantly higher in Pre than that in Post (P<0.05) and No (P<0.01).

CONCLUSION: These results suggest that nutrient intake before RE may have no substantial MHE. Supported by Grant-in-Aid for Scientific Research from the Japanese Ministry of Education, culture, Sports, Science, and Technology (Grants 26702029 and 15KK0358).
The Association Between The Number Of Meals With Adequate Protein Intake And Maximal Deadlift Strength

Alessandro Gaytan-Gonzalez, Roberto Gabriel Gonzalez-Mendoza, Sergio Alejandro Copado-Aguila, Juan Antonio Jimenez-Alvarado, Marisol Villegas-Balcazar, Francisco Torres-Narango, Juan R. Lopez-Taylor. Universidad de Guadalajara, Guadalajara, Mexico

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(No relevant relationships reported)

PURPOSE: To analyze the association between the number of meals with adequate protein intake and maximal deadlift strength in college athletes.

METHODS: We evaluated 250 (107 women) college athletes previous to a national contest. Maximal strength was assessed with one repetition maximum (1RM) on deadlift and was adjusted for body mass (kg lifted weight/kg body mass). The protein intake per meal was assessed with 24-h dietary recalls. The reported protein intake was expressed as absolute (g) and relative (g/kg body mass). Adequate protein intake per meal was deemed as ≥0.3 g/kg and ≥0.3 g/kg. Next, we calculated the number of meals that achieved these thresholds and were grouped as ≤2, 2, 3, ≥4 meals for each criterion. Then, 1RM was compared between groups with and without adjustment for covariates (age [years], lean body mass [kg, bioelectrical impedance], height [cm], sex, relative protein intake [g/kg/d]) for each criterion.

RESULTS: For ≥0.3 g criterion, the ≥4 meals group showed significantly higher 1RM than ≤1 group for the unadjusted model. When it was corrected for age, lean body mass, height, and sex, it remained significant. However, the differences were no longer significant when the model was also adjusted for relative protein intake. As the model was adjusted, the number of meals decreased their contribution to the model. The same pattern was observed with the ≥0.3 g/kg criterion (Table).

CONCLUSIONS: The number of meals with adequate protein intake is associated with higher deadlift 1RM. However, its importance decreased when were adjusted for relative protein intake. Therefore, the association between protein intake and deadlift 1RM could be mediated by total relative protein intake, and the number of meals with adequate protein intake could serve as a strategy to eat more protein rather than playing a “timing” role.

### Table. Comparison of maximal deadlift strength by number of meals with adequate protein intake.

<table>
<thead>
<tr>
<th>Meals</th>
<th>Protein Intake (g)</th>
<th>R²</th>
<th>R²#</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1.35 ±0.055</td>
<td>0.008</td>
<td>0.047</td>
</tr>
<tr>
<td>3</td>
<td>1.52 ±0.047</td>
<td>0.020</td>
<td>0.04</td>
</tr>
<tr>
<td>≥4</td>
<td>1.51 ±0.046</td>
<td>0.586</td>
<td>0.008</td>
</tr>
<tr>
<td>20 g/meal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 RM</td>
<td>1.35 ±0.055</td>
<td>0.001</td>
<td>0.067</td>
</tr>
<tr>
<td>1 RM</td>
<td>1.36 ±0.063</td>
<td>0.032</td>
<td>0.036</td>
</tr>
<tr>
<td>1 RM</td>
<td>1.43 ±0.063</td>
<td>0.621</td>
<td>0.007</td>
</tr>
<tr>
<td>≤1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1.34 ±0.053</td>
<td>0.067</td>
<td>0.067</td>
</tr>
<tr>
<td>3</td>
<td>1.53 ±0.045</td>
<td>0.072</td>
<td>0.067</td>
</tr>
<tr>
<td>≥4</td>
<td>1.55 ±0.043</td>
<td>0.001</td>
<td>0.067</td>
</tr>
<tr>
<td>0.3 g/meal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 RM</td>
<td>1.40 ±0.051</td>
<td>0.071</td>
<td>0.092</td>
</tr>
<tr>
<td>1 RM</td>
<td>1.49 ±0.043</td>
<td>0.032</td>
<td>0.036</td>
</tr>
<tr>
<td>1 RM</td>
<td>1.50 ±0.044</td>
<td>0.061</td>
<td>0.007</td>
</tr>
</tbody>
</table>

Data expressed as mean ±standard error. Different letters denote significant differences between groups (p<0.05). 1RM: One repetition maximum (kg of weight lifted/kg body mass). * Unadjusted model. † Adjusted for age, lean body mass, height, and sex. ‡ Adjusted for age, lean body mass, height, sex, and relative protein intake. R for number of meals within the model. R for the model.

More than 5% of U.S. adults 18-35 y self-identify as vegetarian or vegan. While health benefits, including reduced risk for cardiometabolic diseases are promoted, concern remains over the potential of lower protein intake, which can lead to reduced muscle mass and strength.

PURPOSE: To examine the relationship between dietary protein and grip strength in inactive vegetarian and vegan females.

METHODS: Thirty-three self-reported inactive (<150 min exercise/wk) female vegetarians and vegans (31±y; 9.6; n=23 vegan) of at least 1 year were recruited for this study. A 24-h dietary recall was administered by a trained researcher and protein intake calculated using Food Processor software. Dominant handgrip strength was measured 3 times using a handheld dynamometer, and greatest score recorded. An a priori α of 0.05 was used and partial Pearson Product Moment correlation was determined between protein intake and grip strength when controlling for diet type (vegetarian vs. vegan). Independent samples t-tests were conducted to compare protein intake and grip strength between protein intake and grip strength vs. vegans. RESULTS: Results showed significantly greater grip strength in vegans (26±7±4.7 kg) as compared to vegetarians (23.5±2±9.8 kg), t(20.46) p<0.05, and no difference in protein intake between groups (t(368)=7.16). Results show no correlation between protein intake (45.7±15.2 g PRO/d) and grip strength (25.7±4.4 kg) while controlling for diet type (r(30)=1.18, n=33, p=0.50). It is noteworthy that mean grip strength in the sample was significantly below the reference value for North American females (31 kg). CONCLUSION: This study provides evidence that there was no significant association between protein intake and grip strength in inactive female vegetarians; yet, the grip strength for this population fell significantly below region/gender-specific reference ranges.

Anterior cruciate ligament (ACL) rupture results in significant quadriceps weakness, which will then cause abnormal gait and knee instability. Eccentric training (ET) can produce larger effects on muscle strength than concentric training, which may be further augmented by protein supplementation. Purpose: To examine the effects of combining whey protein supplement with preoperative isokinetic ET on quadriceps strength and function after ACL rupture. Methods: Thirty-seven male subjects aged 18-40 years with ACL rupture were randomly assigned to isokinetic ET (IET; N=19) group or isokinetic ET with whey protein isolate (IET+WP; N=18) group. Both groups received preoperative isokinetic ET for six weeks, containing 3-4 sets per day with 8-10 repetitions for each set, twice a week. Subjects in IET+WP consumed whey protein isolate 22 g per day. Cross-Sectional Area (CSA) of quadriceps was scanned by MRI, and strength and knee function were measured before and after the trials. Results: After intervention, CSA of the involved quadriceps increased by 3.7% (NS) in IET and 7.6% (P=0.012) in IET+WP. The ratio of side-to-side increased by 3.9% (NS) in IET and 4.8% (P=0.002) in IET+WP. The peak torque of quadriceps during eccentric contraction at 60 degrees/s, concentric contraction at 60, 180 and 300 degrees/s increased by 27.9% (P=0.001), 35.9% (P=0.001), 34.3% (P=0.002) and 27.3% (P=0.003) in IET, and increased by 44.2% (P<0.001), 42.3% (P=0.001), 37.4% (P=0.002) and 36.7% (P=0.001) in IET+WP, respectively, with no differences between the two groups. Lysholm and IKDC2000 knee function score in IET+WP increased 27.3% (P=0.003) in IET, and increased by 44.2% (P<0.001), 42.3% (P=0.001), 37.4% (P=0.002) and 36.7% (P=0.001) in IET+WP, respectively, with no differences between the two groups. Conclusions: Combining whey protein supplement with ET tends to be more effective on improving CSA of quadriceps, knee function and quadriceps strength when compared to ET alone after ACL rupture, even though the results did not reach statistical differences. References [1], Douglas, J., et al., 2017. [2] Cermak, N.M., et al., 2012. Supported by The National Key Research and Development Program (No.2016YFD0400603)
The Effect of Protein Supplementation on Recovery From Exercise-Induced Muscle Damage

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Purpose: To determine whether or not a carbohydrate plus protein (CHO-P) supplement (containing branched chain amino acids) invoked improved recovery from exercise-induced muscle damage (EIMD) when compared to an isocaloric carbohydrate (CHO) only control supplement, while simultaneously controlling for diet. Methods: Twenty resistance-trained college males (22 ± 3.9 yrs, 176.0 ± 6.9 cm, 84.2 ± 17.6 kg) participated in a ten-day, double-blind, randomized trial. Subjects consumed a provided diet (60%±5% carbohydrate, 25%±4% fat, 15%±3% protein) and a daily supplement of 60 g carbohydrates or 40 g carbohydrates plus 20 g protein for eight days. On the fifth day, subjects completed a 100-box jump EIMD protocol. Measures of creatine kinase and myoglobin were obtained prior to EIMD and at 12, 24, 48, and 72 hours post-EIMD. Results: Creatine kinase levels (U/L) were elevated at 12 (227 ± 18.5), 24 (216 ± 17.0), 48 (197 ± 15.1), and 72 (166 ± 11.8) hours post-EIMD when compared to baseline (121.4 ± 15.2). Myoglobin levels (ng/mL) were elevated at 12 (60.4 ± 56.6) hours post-EIMD when compared to baseline (8.7 ± 5.6). Although the elevations in creatine kinase and myoglobin indicate that EIMD was produced, there were no significant differences in creatine kinase or myoglobin between CHO and CHO-P groups at any time points measured. Additionally, there were no significant differences in lower body muscle force production between the CHO and CHO-P conditions. Conclusion: These data suggest that a CHO-P supplement does not elicit greater recovery from EIMD when compared to a CHO supplement alone.

Association of Dietary Protein Intake, Physical Activity, and Muscle Quality in Young Adults

Chester Sokolowski, Simon Higgins, Megha Vishwathan, Michael Schmidt, Richard Lewis, Ellen Evans. Florida State University, Tallahassee, FL; Elon University, Elon, NC. Email: cs184@my.fsu.edu

Purpose: To determine the associations between dietary protein intake quantity and muscle mass in young men and women, which may impact muscle capacity and quality; however, research in recreationally active young adult cohorts is lacking. Methods: This study was to determine the associations between dietary protein intake quantity and muscle mass and strength in young men and women. (n=122, 18-22 yr; 54% female) were assessed for a) total protein intake (g) across 3 meals, b) physical activity (MVPA, RT, or MQ-P), and c) muscle mass (MC-S, MC-P, MQ-S) with R2 values calculated by regression. Results: Higher dietary protein intake (g/BW) was positively related to muscle mass and strength. Conclusion: The study demonstrates that higher dietary protein intake is related to muscle mass and strength in young adults. Further research is needed to determine the role of protein intake quality and timing with muscle mass and strength.

Association of Protein Intake at Three Meals With Muscle Mass in Healthy Young Subjects

Jun Yasuda, Mai Asako, Takuma Arimitsu, Satoshi Fujita. Ritsumeikan University, Shiga, Japan.

Purpose: In addition to importance of total daily protein intake for regulation of muscle mass, protein intake over 0.24 g/BW at least one meal may lead to decreased muscle mass across the lifespan. Dietary protein intake is also known to influence muscle health. Data suggest that MVPA, RT, and dietary protein intake differ in young men and women, which may impact muscle capacity and quality; however, research in recreationally active young adult cohorts is lacking. Methods: This study was to determine the associations between dietary protein intake quantity and muscle mass in young men and women, which may impact muscle capacity and quality; however, research in recreationally active young adult cohorts is lacking. Results: Higher dietary protein intake (g/BW) was positively related to muscle mass and strength. Conclusion: The study demonstrates that higher dietary protein intake is related to muscle mass and strength in young adults. Further research is needed to determine the role of protein intake quality and timing with muscle mass and strength.

Effects Of Soy Milk Ingestion On Running Anaerobic Sprint Test (RST) Performance

Govindasamy Balasekaran, FACSM, Pan Shi Yu. Nanyang Technological University, Singapore, Singapore. Email: govindasamy.b@ntu.edu.sg

Purpose: To investigate the effects of soy milk ingestion on anaerobic performance using the RAST. Methods: Ten males (age: 23.2 ± 1.23 years, height: 174.3 ± 5.84 cm, weight: 65.39 ± 6.44 kg) participated in the study. They performed two RAST with a soy milk intervention (SOY: 500 mL soy milk + 4 g stevia sweetener) and a placebo control (CON: 500 mL water + 4 g stevia sweetener) over a 7-day period. The RAST consisted of six 35 m sprints with 10 seconds recovery between each sprint; sprint times, heart rate (HR), rating of perceived exertion (RPE), hunger and fullness, blood glucose and lactate levels, mean power output (MP) and fatigue index (FI) were measured. Results: The total effort time (seconds) was not significant (SOY: 32.77 ± 1.23 and CON: 33.28 ± 1.71, p = 0.179). FI in SOY (31.64 ± 5.20) was significantly lower than CON (37.30 ± 5.70, p = 0.023). MP (Watts) (SOY: 499.27 ± 62.72; CON: 486.39 ± 86.13, p = 0.410) and relative power output (Watts/Soy: 9.34 ± 1.02, CON: 9.55 ± 1.51, p = 0.461) were not significant. No significance were found between trials for the peak blood lactate (PBL) (mmol/L) (SOY: 7.95 ± 1.61; CON: 10.24 ± 1.90, p = 0.488) and peak blood glucose (PBG) (mmol/L) (SOY: 23.94 ± 3.90, CON: 25.09 ± 4.61, p = 0.497) levels. PBL (SOY: 0.662) concentrations were inversely associated with MP in the SOY trial. No significance were found in mean HR (SOY: 111 ± 40.43; CON: 112 ± 38.69, p = 0.484) and median RPE (p = 0.391) between both trials. There were no significant differences in the ratings for hunger (p = 0.844) and fullness (p = 0.853) between both trials. Conclusion: The soy milk intervention in RAST significantly lowered the FI, but had no significance in any of the variables investigated. The significant decrease in FI and earlier peak lactate levels post-exercise may indicate the possibility of soy milk reducing fatigue. Future studies are required to examine the ergogenic effects of soy milk.
Cyclic fluctuations in ovarian hormone (estrogen and progesterone) levels that play an important role in reproductive function are a unique characteristic of adult women. However, these changes in ovarian hormone levels affect physical and mental condition. Previous studies have reported that levels of branched-chain amino acids (BCAAs) and aromatic amino acids (AAA) in the blood are related to fatigue. PURPOSE: This study investigated the effects of the menstrual cycle on the concentration of BCAA and AAA during endurance exercise and the recovery period in female athletes. METHODS: Seven eumenorrheic female athletes (lacracry players; age, 21.7 ± 0.5 years; height, 1.57 ± 0.1 cm; weight, 52.7 ± 4.8 kg), who usually exercised 4 h/day, 5 days/week, were recruited. Subjects performed endurance exercise on a cycle ergometer for 60 min at 65% of their VO2peak, measured in a preliminary trial, during the follicular phase (FP) and luteal phase (LP) of their menstrual cycles. After exercising, subjects rested in a chair for 60 min and their post-exercise recovery was observed. Blood samples were taken: pre-exercise (0 min); 30 min after the start of exercise (30 min); 45 min after the start of exercise (45 min); immediately post-exercise (60 min); 30 min post-exercise (90 min); and 60 min post-exercise (120 min). Levels of estradiol, progesterone, BCAAs (valine, leucine, isoleucine), and AAA (tyrosine, phenylalanine) in the blood were assessed. The Fischer ratio (BCAA/AAA) was calculated using the following formula: BCAA/AAA = (valine + leucine + isoleucine)/(tyrosine + phenylalanine). RESULTS: Estradiol and progesterone levels were significantly lower in the FP than in the LP (estradiol: 40.2 ± 15.4 pg/mL vs. 170.8 ± 75.2 pg/mL, p<0.01; progesterone: 0.5 ± 0.1 ng/mL vs. 11.3 ± 6.5 ng/mL, p<0.05). The Fischer ratio significantly decreased from exercise initiation to exercise conclusion during both phases (FP: 3.6 ± 0.4 (0 min), 3.2 ± 0.3 (60 min), p<0.05; LP: 3.6 ± 0.4 (0 min), 3.3 ± 0.6 (60 min), p<0.05); however, no significant differences were observed between the FP and LP. CONCLUSION: No differences in the levels of the BCAA and AAA in the blood were observed between the FP and LP of the menstrual cycle pre-, during, or post-exercise.

D-63 Free Communication/Poster - Cognition and Emotion

Thursday, May 30, 2019 1:00 PM - 6:00 PM
Room: CC-Hall WA2

An extent literature suggests that regular participation in long-term exercise enhances cognitive function. However, less is known about the beneficial effects of acute exercise on semantic memory.

PURPOSE: This study investigated brain activation during a semantic memory task after a single session of exercise in healthy older adults (ages 55-85) using functional magnetic resonance imaging (fMRI). Results: A within-subjects counterbalanced design where 26 participants (ages 55-85) underwent two experimental visits on separate days. During each visit, participants engaged in a single 20 min aerobic exercise session (50% VO2max) or a control session of rest. Experimental visits were separated by 2-3 days. fMRI data was acquired using an 1.5T General Electric (Gyroscan) scanner with a standard 8-channel head coil. A baseline resting state was acquired followed by a semantic memory task. Objective: The semantic memory task consisted of a word generation task in which participants were asked to generate words associated with each of 18 semantic categories. A post-hoc analysis showed significantly greater activation in the bilateral hippocampus after exercise compared to rest. CONCLUSIONS: Greater brain activation following a single session of exercise suggests that exercise may increase neural processes underlying semantic memory activation in healthy older adults. These effects were localized to the known semantic memory network, and thus do not appear to reflect a general or widespread increase in brain blood flow. Coupled with our prior exercise training effects on semantic memory-related activation, these data suggest the acute increase in neural activation after exercise may provide a stimulus for adaptation over repeated exercise sessions.

2027 Board #183 May 30 2:00 PM - 3:30 PM
The Effects of Continuous and Interval Exercise on Cognitive Performance in Young Adults

Emily Tagesen1, David Bellari2, Ellen L. Glickman, FACSM1. 1Kent State University, Kent, OH. 2University of Louisiana Lafayette, Lafayette, LA.

Exercise has been shown to increase cognitive performance. However, there are few studies that have compared exercise types to determine different effects. PURPOSE: The purpose of the present investigation was to compare changes in cognitive function after two different forms of work matched exercise. METHODS: The participants were 22 healthy college age males. Participants were randomly assigned an order of intervention consisting of work matched continuous (CONT) and interval exercise (INT) protocols. The continuous exercise treatment consisted of 20.24 min of 50% VO2max on the cycle ergometer. The interval exercise treatment consisted of 6 cycles of 2.00 min 40% VO2max and 1.00 min 90% VO2 max on the cycle ergometer for a total of 18 minutes. Pre and post exercise blood samples were collected to quantify branched-derived neurotrophic factor (BDNF) and participants completed a battery of assessments on theCogState software platform. The cognitive function battery exam included tests of reaction skills, memory skills, psychomotor skills, visual attention, working memory, and spatial working memory. Additionally, blood pressure was continuously measured during the 2 hours post exercise using a non-invasive finger cuff system. RESULTS: Repeated measures ANOVA analysis did not reveal any differences in serum BDNF levels by time (F=0.237, p=0.629; pre: 388.9±196.4, post: 464.3±222.4) or treatment by time (F=0.896, p=0.349). Non-parametric analysis of cognitive data revealed significant (p<0.02) changes in attention (identification speed test) in both CONT and INT (baseline: 460.6±69.3 sec, post CONT: 513.8±83.2 sec, post INT: 504±85.6 sec). The executive function (Groton’s maze) only the INT resulted in a significant increase (p<0.01) from baseline: 48.2±11.7, post INT: 38.4±13.8. There were significant correlations between systolic blood pressure during recovery for both INT and CONT and improvements in executive function (CONT r=0.567, p<0.01; INT r=0.570, p<0.01). CONCLUSION: It appears that both CONT and INT exercise promote some increases in cognitive function related to elevated recovery systolic blood pressure and independent of serum BDNF. Moreover, INT exercise may increase executive function more that aerobic exercise, though more investigation into this effect is warranted.

2028 Board #184 May 30 2:00 PM - 3:30 PM
The Effects Of A 30-min Moderate Aerobic Exercise On Autonomic And Inhibitory Control - ERP Study

Yiu Man Lee, Stanley Sai-chuen HUI, FACSM. Chinese University of Hong Kong, Hong Kong, Hong Kong. (Sponsor: Prof. Stanley Sai-chuen HUI, FACSM)

PURPOSE: The current study aimed at exploring whether inhibitory control would be changed after a 20 min bout of moderate cycling exercise plus 5 min warm-up and 5 min cool-down. The study hypothesized that subjects who demonstrated greater high frequency heart rate variability (HF-HRV) reactivity (i.e. larger HF-HRV decrease) under a mental stress evoked by a Stroop color-word test, would perform better on the Stroop tasks after acute aerobic exercise. METHODS: 40 young male adults (age =21.3 ± 2.1 yr. old) were randomly assigned to either an exercise intervention or no exercise (control) condition. Participants of intervention were asked to engage in a 20 min cycling exercise at 60%VO2max while computerized Stroop color-word test was conducted before and after the cycling to examine the acute effects of aerobic exercise on inhibitory control. HRV was measured during the Stroop tasks by using the Electrocardiogram (ECG), which was recorded via two bipolar electrodes that were placed on the left and right chest of the participants. The electroencephalogram (EEG) signal was recorded continuously from a 32 scalp electrodes arranged according to the International 10-20 system. The EEG data was re-referenced offline to average of mastoid electrodes, and bandpass filtered at 0.1 to 20 Hz. Target-locked ERP analysis was restricted to the frontocentral midline electrodes (Fz, Cz, Pz) as Stroop interference effect were known to be maximum at the midline.

RESULTS: Two-way repeated measures MANOVA showed significant Intervention X Time interaction on Stroop interference at Pz location (p < 0.03). Meanwhile, significant Intervention X Time interaction on HRV differences was revealed between the exercise intervention and control groups on the Stroop tasks (p < 0.01). Exercise group performed significantly lower score on Stroop interference and lower HRV reactivity at post-test than the control group (p < 0.05). Lower scores reflecting more adaptive response and enhanced cognitive performance.
CONCLUSIONS: A 30-min acute moderate aerobic exercise could elicit inhibitory control for young adults. The studies manifested the potential physiological mechanism by HRV index.

2029 Board #185 May 30 2:00 PM - 3:30 PM
Aerobic and Muscular Fitness Associations with Adolescent Cognitive Control
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Email: shigeta.ti@husky.neu.edu

Purpose: Physical activity supports greater cardiorespiratory fitness (CRF); a correlate of cognitive control. The relation of muscular fitness (MF) and cognitive control are less clear. The present study investigated the differential relationship of CRF and MF with cognitive control in older adolescents; a population subjected to social and academic stressors.

Methods: Students (15-17 years, N = 289, 122 females) from ten secondary schools completed tests of inhibition, working memory (WM), CRF (PACER), and MF (standing long jump, push-ups).

Results: Stepwise regression analyses accounted for demographic factors in step 1, and either CRF or MF in step 2. CRF predicted flanker response accuracy (RA) and reaction time (RT) in the 2-back WM task, CRF predicted greater RA, greater d’, and shorter non-target RT (β’s ≥ 0.15, p’s < 0.05). In the 2-back WM task, CRF predicted greater non-target RA and d’ (β’s ≥ 0.14, p’s < 0.05). Comparatively, MF only predicted 2-back target accuracy (β = 0.14, p = 0.02). Follow-up 3-step regressions assessed significant outcomes from the 2-step models to account for the contrasted fitness variable in step 2, and the fitness variable of interest in step 3. CRF remained a significant predictor for most cognitive outcomes (β’s ≥ 0.17, p’s < 0.05). However, with MF entered in step 2, CRF marginally predicted incongruent flanker RA and 1-back non-target accuracy (β’s ≥ 0.16, p’s ≥ 0.06), and no longer predicted greater 2-back d’ (β = 0.11, p = 0.20). Comparatively, MF marginally predicted 2-back target accuracy with CRF accounted (β = 0.12, p = 0.06). Conclusion: MF was unrelated to cognitive performance, especially with CRF included in the model. CRF’s predictability of WM decreased with MF accounted for, particularly during conditions requiring greater WM demands. CRF was generally related to faster processing speed and greater RA during a task modulating inhibitory demands, suggesting that increased CRF may improve cognition via modulation of older adolescents’ inhibitory control. Such findings highlight physical activity’s value in aiding cognition underlying older adolescents’ academic performance.

Project funded by the National Health and Medical Research Council (APP1120518).

2030 Board #186 May 30 2:00 PM - 3:30 PM
Cortical Activation during Walking While Smartphone Texting: a Dual Task Based INRIS Study
Kun Wang, Zhangyan Deng, Qian Gu, Jimeng Zhang, Tao Huang, Zuosong Chen. Shanghai Jiao Tong University, Shanghai, China.
Email: wangkunz@sjtu.edu.cn

Background: Previous studies demonstrated that gait performance was decreased when walking while performing a cognitive task such as thinking on a smartphone, which reflects a cognitive-motor dual-task interference. The neural bases of the interference are not well studied. Purpose: To investigate the cortical activations during a dual task of walking while smartphone texting in young healthy adults using the functional near-infrared spectroscopy (fNIRS). Methods: In a crossover study design, 39 right-handed college students (21.3 ± 2.5 years, 46.1% females) randomly undertook the following three task conditions separated by a minimum of 48 hours: smartphone texting only (T task), walking only (W task), and dual task (T task) smartphone texting while walking (TW task). Cortical oxygenation during the three tasks was monitored using a 38-channel INRIS (NIRx Medical Technologies LLC, USA). Walking was conducted on a treadmill with a speed of 2.0 km/hour. Texting task was performed with a typing APP on a smartphone. Results: There was no significant difference in texting speed between T task and TW task (T71.7 ± 10.4 vs. T71.0 ± 12.9 chars/min, P > 0.05). Texting enhanced hemodynamic response in frontalopolar area (e.g., Ch1, task vs. rest, 1.01±1.93 vs. -0.12±0.14, a.u, P < 0.01; Ch13, task vs. rest, 0.89±1.05 vs. -0.12±0.14, a.u, P < 0.01) and dorsolateral prefrontal cortex (e.g., Ch6, task vs. rest, 0.24±0.43 vs. -0.15±0.42, a.u, P < 0.01; Ch6, task vs. rest, 0.21±0.33 vs. -0.13±0.42 a.u, P < 0.01) and Broca’s area (e.g., Ch35, task vs. rest, 0.99±0.81 vs. 0.47±0.72 a.u, P < 0.01). In addition, T task evoked an increased activation in temporopolar area (e.g., Ch8, task vs. rest, 0.04±0.12 vs. 0.75±3.10 a.u, P < 0.01) and superior temporal gyrus (e.g., Ch15, task vs. rest, 0.22±0.64 vs. 0.76±0.84 a.u, P < 0.01) than T task. There were no significant differences in those regions between T task and TW task. CONCLUSIONS: The findings indicated that walking on a low speed requires less cognitive resources from the prefrontal cortex, while the temporal lobe is involved. When walking while texting on a smartphone, the brain areas (temporopolar area and superior temporal gyrus) involved in gait were activated, and areas in prefrontal cortex were also activated. Thus, more cognitive resources were allocated to smartphone texting during the dual task.

2031 Board #187 May 30 2:00 PM - 3:30 PM
Can Repeated Bouts Of Exercise Improve Equally Post-exercise Inhibitory Control As Single Bout Of Exercise?
Takeshi Sugimoto1, Tadasu Suga2, Hayato Tsukamoto, Tadao Isaka1, Takeshi Hashimoto, FACSM1. 1Ritsumeikan University, Kusatsu, Shiga, Japan. 2University of South Wales, Pontypridd, United Kingdom. (Sponsor: Takeshi Hasimoto, FACSM)
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Purpose: We previously demonstrated that post-exercise improvements of inhibitory control (IC) are associated with increase in exercise volume (Tsukamoto et al. Med Sci Sports Exerc. 2017). Previous studies reported that repeated bouts of moderate-intensity exercise (Repeated), which is performed with a short rest interval during exercise program, may be a useful strategy in improving metabolic function, potentially by enhancing lipid metabolism compared with volume-matched single bout of moderate-intensity exercise (Single) (Goto et al. J Appl Physiol. 2007). However, it remains unknown whether Repeated would be effective in improving post-exercise IC. In this study, we compared the effect of Repeated and Single on post-exercise IC.

Methods: Fifteen healthy men (age: 20.6 ± 0.4 years) performed Repeated and Single in randomized order. The Repeated was consisted of twice moderate-intensity cycling exercise (60% VO2max) for 20 min which was separated by a 20-min resting rest, while the Single was performed for 40 min without rest. To evaluate IC, the Stroop task was administered before exercise, immediately after exercise, and every 10 min during the 30-min post-exercise recovery period. At the same time points, blood was collected for glucose and lactate measurement, and psychological arousal level was assessed by the felt arousal scale. Results: The exercise-induced increase in mean arterial pressure was significantly lower in Repeated than in Single (P < 0.05), but not heart rate and ratings of perceived exertion. Psychological arousal increase in post-exercise recovery did not differ significantly between the two conditions. Similarly, there were no significant differences for blood glucose and lactate immediately after exercise and post-exercise recovery between conditions. IC was significantly improved immediately after both Repeated and Single (P < 0.05), but it did not differ significantly between two conditions. Conclusion: The present findings suggest that Repeated can similarly elicit IC improvements as Single.

2032 Board #188 May 30 2:00 PM - 3:30 PM
The Differential Relationships Between Physical Activity and Adiposity with Cognitive Function in Preadolescent Children.
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Purpose: To identify the effects of adiposity and a physical activity (PA) intervention on cognitive and neuroelectric indices of inhibitory control in preadolescent children. Methods: Children were randomly assigned to either a 9-month afer-school physical activity (PA) or a wait-list control (CON) group. Children completed a task that manipulated inhibitory control at pre- and post-test while measures of task performance and the P3-event related potential (ERP) were assessed. Children were further grouped according to weight category. 76 children with obesity (39 PA; 37 CON) completed testing. A sample of normal weight children (NW) (n = 76) were matched to the sample of children with obesity based on treatment allocation and demographic variables of age, sex, IQ, SES, and fat free mass. Changes in adiposity measures included whole body percent fat (%Fat), subcutaneous abdominal adipose tissue (SAAT), and visceral adipose tissue (VAT). The influence of physical activity and adiposity on task performance and brain function was examined. Results: Children in the PA group decreased %Fat from pre- to post-test (p < 0.01), an effect not observed in the CON group. Children in the CON group gained SAAT and VAT from pre- to post-test (p ≤ 0.001), whereas children in the PA group did not. The PA group showed larger P3 amplitude from pre- to post-test (p < 0.026); an effect not seen in the CON group. P3 amplitude did not differ between groups at pre-test for children with obesity; however, the PA group demonstrated larger P3 amplitude compared to the CON group at post-test (p < 0.006). Children with obesity in the CON group had smaller P3 amplitude at post-test compared to pre-test (p < 0.003), an effect not seen in NW children. Results suggest that physically inactive children with obesity

Abstracts were prepared by the authors and printed as submitted.
have increased adiposity and smaller P3 amplitude over 9 months. Furthermore, results suggest that a PA intervention may be particularly beneficial for children with obesity, as they showed increased P3 amplitude from pre- to post-test. CONCLUSION: PA is beneficial for brain function in pre-adolescent children, especially in those with obesity. Given that childhood obesity is a public health concern with an array of health complications, these results have important implications for the physical and cognitive health of children.

2033 Board #189
May 30 2:00 PM - 3:30 PM
Association of School Day Segmented Physical Activity with Children’s Physical and Cognitive Health
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(No relevant relationships reported)

Purpose: Around 32% of children are overweight or obese and do not meet the 60-minute moderate-to-vigorous physical activity recommendation (MVPA; SHAPE America, 2016). Given that physical activity is highly variable between children across the school day and during specific segments (CDC, 2013), it is unclear which segmented MVPA during school contributes the most physical and cognitive health benefits. This study aimed (1) to investigate associations between time spent in MVPA during recess, lunch, physical education (PE), and physical fitness components (BMI, cardiorespiratory and muscular fitness), as well as cognitive health, respectively; and (2) to test the indirect effect of segmented MVPA on cognitive health through physical fitness among 8-9 years old children.

Methods: Participants were 340 8-9 years old children (M = 8.40, SD = 0.49) recruited in the southwest region of the U.S. Time spent in MVPA during recess (RE_MVPA), lunch (LU_MVPA) and PE (PE_MVPA) segments were measured by accelerometers across five school days. The FITNESSGRAM® test battery was used to assess physical fitness components including PACER, curl-up, push up, and BMI. Children’s cognitive health was measured by also the 6-item Pediatric Self-Reported Cognitive Functioning Scale (Varni et al., 2011).

Results: The time spent in MVPA during recess was positively associated with physical fitness (cardiorespiratory and muscular fitness; r = 27, r = 40, p < 0.01) and had low, but positive correlation with cognitive function (p < 0.05). Both cardiorespiratory (r = 26, p < 0.01) and muscular fitness (r = 12, p < 0.05) were significantly related to cognitive health. The structural equation modeling analyses suggested a significant indirect effect of time spent in MVPA during recess and PE on children’s cognitive function through physical fitness with sound goodness-of-fit indices: χ²/df = 109.46/58, CFI = 0.93, RMSEA = 0.051; (90% CI [0.04, 0.07]).

Conclusion: The results suggest that school segmented MVPA in PE and recess provide children with opportunities to maintain appropriate levels of physical fitness and cognitive health. This study fills the research gap by identifying unstructured physical activity periods such as recess that can provide greater room to implement physical activity and health promotion strategies in school-age children.

2034 Board #190
May 30 2:00 PM - 3:30 PM
Relationship Between Fitness and Active-Sedentary Behavior with Cognitive and Emotional Recognition in Elderly: Core Study
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(No relevant relationships reported)

The decline in cognitive function and emotional regulation in aging have broad negative implications for independence, social competence and behavior that affect health. These impaired conditions can be exacerbated by increased sedentary behavior (SB) and lower levels of physical activity (PA) and fitness. However, it is not clear which of these have a higher relationship with cognitive function and emotional regulation in elderly.

PURPOSE: To investigate the relationship between cognitive function and emotional regulation with physical fitness, PA and SB in the elderly.

METHODS: This preliminary analysis of the Cardiovascular, Cognitive and Exercise Study in the Elderly (CORE) included 60 volunteers (64±3.47 years; female n: 39), who performed a cognitive task (Wisconsin cards sorting test) and an emotional facial recognition task, physical fitness test (senior fitness test and handgrip strength), PA level (Minnesota Leisure-time Physical Activity Questionnaire) and sedentary behavior questionnaire (Longitudinal Aging Study Amsterdam). Bivariate correlations using Spearman’s rho were calculated with statistical significance set at 5%.

RESULTS: Significant relationship between cognitive performance with, leg strength (total correct response, r=0.28; total errors, r=0.28; and non-perseverative errors, r=-0.28), 6-min walking test (total correct response, r=0.31; total errors, r=-0.31; and non-perseverative errors, r=-0.30) and SB (perseverative errors r(displaystyle \rho ) = 0.27). Also, the reaction time (RT) during the emotional facial recognition had a significant relationship with upper body strength (RT, posit. r=0.26; RT negative r=-0.33) and PA level (MET, hr/w) (RT negative r=-0.31). Also, a significant relationship between worse cognitive performance with handgrip strength (non-perseverative errors, r=0.26) and SB (perseverative errors, r=0.27).

CONCLUSIONS: These preliminary results suggest that physical fitness and SB are associated with cognitive performance. Also, PA level and upper body strength are associated with emotional performance. These findings suggest the importance of the balance of maintaining an active behavior and the inclusion of aerobic and resistance exercises to improve cognition and emotional regulation in the elderly.

2035 Board #191
May 30 2:00 PM - 3:30 PM
Cardiovascular Risk Moderates Aerobic Training Efficacy on Executive Function in Older Adults
Email: lauren.marccotte@alumni.ubc.ca
(No relevant relationships reported)

PURPOSE: To examine whether the Framingham Cardiovascular Risk Profile Score (FCRP) moderates the effect of a 6-month progressive aerobic training program (AT) on executive function in older adults with mild subcortical ischemic vascular cognitive impairment.

METHODS: This is a secondary analysis of a proof-of-concept randomized controlled trial in 71 older adults, who were randomized to either a 6-month, thrice-weekly, progressive AT program (AT), or usual care plus an education program (CON). At baseline and trial completion, three executive processes were measured: 1) response inhibition by Stroop Colour Word Test; 2) working memory by digits backward test, and 3) set shifting by the Trail Making Test (B-A). Baseline cardiovascular risk was calculated using the FCRP, and participants were classified as either low risk (<20% FCRP score; LCVR) or high risk (>20% FCRP score; HCVR). A complete case analysis (n=57) was conducted using an analysis of covariance (ANCOVA) to evaluate between-group differences in the three executive processes. Age, baseline Montreal Cognitive Assessment score, education, and baseline score for the outcome variable were entered as covariates in all models.

RESULTS: A significant interaction was found between FCRP and group (AT or CON) for the digit span backward (F(1,49)=4.67, p=0.03) and the Trail Making Test (F(1,50)=4.09, p=0.04). There was no significant interaction for the Stroop Colour Word Test (F(1,48)=802 p= 0.38). On the digit span backward test, AT improved performance compared to CON (3.74±.33 vs. 2.75±.46) in those with LCVR, while in those with HCVR, AT did not improve performance compared to CON (2.97±.45 vs. 3.76±.41). Similarly, for the Trail Making Test (B-A), AT improved performance compared to CON (32.66±13.27 vs. 80.12±17.82) in those with LCVR, while AT was not beneficial compared to CON in those with HCVR (98.80±18.06 vs. 59.92±17.09).

CONCLUSION: We found that cardiovascular risk significantly moderates the efficacy of aerobic exercise on working memory and set shifting in older adults with vascular cognitive impairment. Our findings highlight the importance of intervening early in the disease course of vascular cognitive impairment, when cardiovascular risk may be lower, to reap maximum benefits of aerobic exercise.

2036 Board #192
May 30 2:00 PM - 3:30 PM
A Single Bout of Exercise Improves Accuracy in Video Gaming: a Pilot Study
Bernat de las Heras, Orville Li, Lynden Rodrigues, Jean-Francois Nepveu, Marc Roig. McGill University, Montreal, QC, Canada.
Email: bernatdelas@gmail.com
(No relevant relationships reported)

There are 2.3 billion of video gamers worldwide and this number is expected to grow to more than 2.7 billion by 2021. Research has demonstrated negative associations between the number of hours spent in front of a screen and physical inactivity. Video gamers are thus at a great risk of experiencing long-term health issues associated to excessive sedentarism. Cardiovascular exercise has been proven to be an effective intervention in reducing the risk of cardiometabolic clinical conditions as well as enhancing brain health and function. However, whether exercise has positive effects on video game performance is not known.

PURPOSE: To investigate the effects of a single bout of cardiovascular exercise on video game performance is not known.

METHODS: There are 2.3 billion of video gamers worldwide and this number is expected to grow to more than 2.7 billion by 2021. Research has demonstrated negative associations between the number of hours spent in front of a screen and physical inactivity. Video gamers are thus at a great risk of experiencing long-term health issues associated to excessive sedentarism. Cardiovascular exercise has been proven to be an effective intervention in reducing the risk of cardiometabolic clinical conditions as well as enhancing brain health and function. However, whether exercise has positive effects on video game performance is not known.

PURPOSE: To investigate the effects of a single bout of cardiovascular exercise on the performance of “League of Legends” (LoL), a video game played daily by more than 30 million players. METHODS: 14 healthy young (18-28 yo) LoL gamers played an individual LoL task of 20 min preceded by either 15 min of a high-intensity interval exercise or rest. The two conditions were administered on two separate days in a counterbalanced fashion. Video game performance was assessed as the number of targets destroyed, as well as accuracy, defined as the ability to destroy a target with only one attack. Attacks that required more than one attempt to destroy a target
were counted as error accuracy. RESULTS: Exercise improved the capacity of participants to successfully destroy targets, but differences between exercise (119.43 ± 4.23) and rest (111.50 ± 3.99) did not reach statistical significance (paired t-test; t= -1.31; p=0.19). Exercise enhanced accuracy, with fewer errors after exercise than after rest (paired t-test; t= -2.38; p=0.033). Self-reported sitting time was negatively associated with total score after the rest condition (r= -0.55; p=0.04). Neither other variable (cardio-respiratory fitness, BMI, cognitive level) was associated with game performance.

CONCLUSION: Exercise performed before playing LoL improves video game performance increasing accuracy. The fact that players with less sitting time showed better performance reinforces the importance of reducing sedentary behaviors in this group. The implementation of exercise routines in video games may improve their general health and their gaming performance. Supported by FRQS Junior 1 Salary Award (MR) and by the McGill Faculty of Medicine (OL).

2039 Board #195 May 30 2:00 PM - 3:30 PM Exploring The Relationships Between Personality And High-Intensity Exercise-affect In Men And Women
Shelby E. Dietz, Allyson G. Box, Annmarie Chizewski, Steven J. Petruzello, FACSIM, University of Illinois Urbana-Champaign, Urbana, IL. (Sponsor: Steven J. Petruzello, FACSIM)

In general, men are more likely to meet physical activity guidelines in comparison to women, and tend to report exercising at higher-intensities. However, less is understood in regards to how men and women differ in feeling states (e.g., core affect) during a high-intensity exercise bout. PURPOSE: Determine whether sex differences exist in personality traits and high-intensity exercise-affect. METHODS: Male (M= 63) and female (F; n=101) undergraduates (n=164, 20±2yrs, 24±4 body mass index (BMI), 62% female, 82% regular exercisers) completed several personality surveys along with a 15-minute high-intensity circuit (HIC). Core affect (via Feeling Scale & Felt Arousal Scale) was assessed prior to, every 3-minutes during, and 20-minutes post (P20) condition. RESULTS: Multivariate ANOVAs revealed significant differences (P<0.05) in the personality traits extraversion (F= 46.2, M= 42.2, d= -0.84), neuroticism (F= 47.4, M= 45.1, d= -1.44), openness (F= 14.5, M= 15.6, d= -0.496), neuroticism (F= 26.2, M= 29.0, d= -0.533) and intensity-tolerance (F= 25.2, M= 28.4, d= -0.651). No sex differences (P>0.05) were observed for exercise-affect prior to, during, and following the HIC. CONCLUSIONS: Although sex differences exist in various personality traits, these differences did not influence how one felt prior to, during, and following a HIC. These findings support the notion that men and women respond similarly to exercise stimuli. More research is needed to understand why women exercise less and at lower-intensities in comparison to men.

2040 Board #196 May 30 2:00 PM - 3:30 PM Acute After-School Screen Time in Children Decreases Impulse Control: A Randomized Crossover Trial
Bruce W. Bailey, Mary Efraid, Chance McCutcheon, Hunter LaCouture, Harrison Marsh. Brigham Young University, Provo, UT.

PURPOSE: This study examined the effect of three hours of after school active play vs. sedentary screen time on executive function in children.

METHODS: This study used a crossover design with treatment conditions that were randomized and counter-balanced. There were two experimental conditions: three hours of active play compared to three hours of sedentary screen time. Participants included 32 boys and girls aged 8-9 yrs. Physical activity patterns were measured using an actigraph accelerometer. Executive control was measured using the Stroop color and word test. RESULTS: The mean age and BMI were 8.7 ± 0.4 years and 16.9 ± 2.2. On the active day, children spent 95 ± 28 minutes in MVPA after school compared to 3 ± 3 minutes on the sedentary day (F = 252.1, P < 0.0001). There was no difference detected between days in the Stroop Task performance for word reading or color naming. However, there was a significant difference between conditions for the incongruent task, with children performing better on the active day (F = 6.79, P < 0.015). CONCLUSIONS: The results of this study demonstrate that active play after school improves executive function in children by increasing their ability to inhibit cognitive interference.

2041 Board #197 May 30 2:00 PM - 3:30 PM Acute Exercise Alters Functional Connectivity During Cognitive Task
Soichi Ando1, Sota Saito1, Nobuaki Mizuguchi2, Mizuki Sudo1, Kazunori Ohkawara1, Atsushi Sudo3,4, The University of Electro-Communications, Tokyo, Japan. 2Keio University, Tokyo, Japan. 3Meiji Yasuda Life Foundation of Health and Welfare, Tokyo, Japan. 4Tokyo Metropolitan University, Tokyo, Japan. Email: soichi.ando@uec.ac.jp

PURPOSE: There is a growing body of evidence to show that acute aerobic exercise improves cognitive performance. Nevertheless, it remains largely unknown how acute exercise mediated neural adaptation through increased blood flow and processing speed was detected. CONCLUSIONS: Acute exercise below 70% aerobic intensity increased brain blood flow during a post-exercise cognitive task. Therefore, it may be beneficial for those who engage in any cognitive related activity to perform a brief bout of low intensity exercise prior to the task. This may include people who participate in academic-based testing, cognitive behavioral therapy, or motor training.
Exercise improves cognitive performance. The purpose of this study was to test if alteration in functional connectivity is involved in improving cognitive performance induced by acute exercise.

**METHODS:** Participants were 10 healthy right-handed young men (age: 21.6 ± 1.4 yr., peak oxygen uptake = 46.5 ± 8.7 ml/kg/min). Experiments were conducted in a randomized crossover design. In the Exercise condition, subjects cycled at 40% peak oxygen uptake for 30 minutes. In the Control condition, subjects rested for 30 minutes without any exercise. Blood samples were collected before, immediately after, and 30 minutes after the exercise and control trials. The control trial consisted of a reading session. A computerized Stroop test was given to assess choice reaction time, and blood samples were obtained before, immediately after, and 30 minutes after the exercise and control trials.

**RESULTS:** Exercise did not alter the relationship between exercise and auditory processing speed and flexibility, as there was no significant main effect of condition on any dependent variable (P > 0.05). The results of this study show that there is no significant relationship between exercise and auditory processing speed and flexibility, and calculation ability post exercise. These results suggest that exercise at a moderate or vigorous intensity does no hinder a person’s ability to perform complex cognitive tasks.

**CONCLUSION:** The purpose of this study was to determine how exercise, at a moderate and vigorous intensity, alters auditory processing speed and flexibility, and calculation ability. METHODS: One hundred and thirty-six men and women between the ages of 18-45 were recruited for this randomized crossover study. Participants were randomly assigned to one of the following exercise conditions: moderate (35% VO2 max), vigorous (70% VO2 max), and sedentary (no exercise). Each condition lasted 40 minutes and was separated by 7 days. After the exercise condition, a battery of cognitive tests were administered. The Paced Auditory Serial Addition Test (PASAT) was one of these tests and was used to measure the relationship between exercise intensity and auditory processing speed and flexibility. RESULTS: Eighty-one men (age=23.2, BMI=23.9 ± 3.2) and fifty-five women (age=20.9, BMI=22.4 ± 2.8) completed the study. There was no main effect of condition for the number of problems answered correctly (F = 1.24, P=0.2900), the number of problems attempted (F = 1.48, P=0.2291) and the percent of problems correctly answered (F = 1.69, P = 0.1865). There was a main effect for gender for the number of problems answered correctly (F = 21.7, P < 0.0001), the number of problems attempted (F = 19.5, P < 0.0001) and the percent of problems answered correctly (F = 7.06, P = 0.0084). However, there was no significant gender by condition interaction for any variable of interest (P = 0.65). CONCLUSIONS: The results of this study show that there is no significant relationship between exercise and auditory processing speed and flexibility, and calculation ability post exercise. These results suggest that exercise at a moderate or vigorous intensity does no hinder a person’s ability to perform complex cognitive processing tasks.
Acute aerobic exercise exerts a small beneficial effect on cognition. A majority of studies have examined cognitive function following acute bouts of exercise, while very few have evaluated changes that may occur during exercise. The limited effects on cognitive performance depending on methodological decisions including exercise intensity and duration. PURPOSE: The primary purpose of this study was to examine the effects of low-intensity cycling on cognitive function, measured by behavioral performance (response accuracy and reaction time) and neuroelectric indices of attentional processing (P3 amplitude and latency). METHODS: Twenty-seven (Mage = 22.9 ± 3.0 years old) college-aged individuals were counterbalanced into low-intensity exercise (EX) and seated control (SC) conditions. During each condition, participants completed a 10-minute resting baseline period, 20 minutes of either sustained cycling or seated rest, and a 20-minute recovery period. Electroencephalography (EEG) data were recorded during a modified oddball paradigm in order to assess primary cognitive outcome measures at 10-minute intervals (5 blocks total) throughout each condition. RESULTS: Individuals in EX and SC conditions displayed lower accuracy to rare trials across conditions, F(4,23) = 4.54, p = .008, η² = .44, suggesting reductions in performance to more difficult trials as testing sessions progressed. There were no significant differences in reaction time between EX and SC conditions. Significant reductions in P3 amplitude and latency were observed during the 20-minute cycling period compared to seated rest. F(4,23) = 3.50, p = .023, η² = .38, while no differences in P3 latency were observed between EX or SC conditions. CONCLUSIONS: Taken together, results indicate that exercise at lower doses may have small but significant effects on behavioral and neuroelectric outcomes of cognitive performance. These changes may be due in part to the shifting of attentional resources from the cognitive task to the maintenance of exercise. Information gathered from this study may aid in the development of appropriate exercise prescription for populations looking to specifically target cognitive function deficits through acute aerobic exercise.

2047
Board #203
May 30 2:00 PM - 3:30 PM
Impact of Stress on Resting Skeletal Muscle Oxygen Consumption with and without Prior Exercise
Email: mncgp91@uga.edu
(No relevant relationships reported)

The effects of acute exercise on muscle metabolism are well established, however the impact of mental stress (MS) on muscle metabolism is not well understood. PURPOSE: To assess muscle oxygen consumption (mVO2) after acute MS and evaluate the effect of acute exercise prior to MS on mVO2. METHODS: Participants (N=15 males, 22.1 ± 2 yr, VO2peak 40.8 ± 5.7 ml/kg/min) served as their own control in a randomized counterbalanced design. Participants completed a total of three visits over 3-5 weeks. On the initial visit, a maximal oxygen uptake test on a cycle ergometer was performed. Near-infrared spectroscopy (NIRS) was used during a five-minute cuff occlusion and the initial slope during the occlusion was used to assess mVO2 in the gastrocnemius muscle. mVO2 was assessed at baseline (BL), after rest (CON), and after mental stress (MS). On two separate days, participants either rested for 25 minutes (CON) or completed 25 minutes of exercise (EX) at 90% ventilatory threshold on cycle ergometer. MS was evoked by a serial subtraction test administered by two research assistants dressed in white lab coats. Data were analyzed using a 2x3 repeated measures ANOVA with Fishers LSD post hoc tests, and are presented as means ± standard deviation. RESULTS: Significant interaction effect of Condition x Time on mVO2 was observed(F=6.3 p<0.05;η²=0.326). Post hoc comparisons indicated mVO2 was significantly increased after EX compared to CON by 21.8% ± 26.0% (p<0.05). Within CON, MS increased mVO2 by 12.6 ± 14.8% (p<0.05). Differences in P3 latency were noted between EX or SC conditions. CONCLUSION: These data are the first to suggest that acute MS increases the metabolic rate of resting skeletal muscle. Interestingly, the combination of prior EX and MS does not further augment metabolic activity beyond MS alone.

2048
Board #204
May 30 2:00 PM - 3:30 PM
Affective and Perceptual Responses to High-Intensity Interval Training: Comparing Graded Walking to Ungraded Jogging
Abby Fleming, Nic Martinez, Maureen Chiodini-Rinaldo, Larry Collins, Candis Ashley, Marcus Kilpatrick, FACSM. University of South Florida, Tampa, FL.
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(No relevant relationships reported)

Benefits associated with high-intensity interval training (HIIT) are well-established. Research has also demonstrated that HIIT can be well-tolerated in a variety of populations, protocols, and modalities. Treadmill-based HIIT has almost exclusively included running interspersed with walking. Research to date has not investigated the delivery of HIIT by way of graded walking interspersed with ungraded walking. PURPOSE: Compare the effects of ungraded jogging to graded walking as a modality of HIIT on perceived exertion, affect, and enjoyment. METHODS: Nine healthy participants (5 males, 4 females; mean BMI = 25; mean age = 26) completed two 20-minute counterbalanced HIIT trials after completion of maximal testing. Both trials alternated between workloads associated with 85% of VO2max and a brisk and comfortable walking speed (mean = 3.2 mph). The interval times of the trials were performed at elevated grade (mean = 17%) for the WALK-HIIT trial and elevated speed (mean = 6.7 mph) for the RUN-HIIT trial. Affect, enjoyment, and perceived exertion, both overall (RPE-O) and legs only (RPE-L), were measured throughout each trial. Enjoyment was measured upon completion of each trial. RESULTS: Data was analyzed using independent t-tests. RPE-O, RPE-L, affect, enjoyment, and HR (all p-values > 0.05; all ES values < 0.50) were not significantly different between the WALK-HIIT and RUN-HIIT trials. CONCLUSIONS: Findings indicate that WALK-HIIT and RUN-HIIT trials produce similar perceptual and affective responses, with each providing a significant exercise stimulus sufficient to improve cardiometabolic health. The production of relatively similar responses suggests that graded walking is a viable alternative to running for the delivery of the many benefits associated with interval-based exercise without negative impacts on the exercise experience.

2049
Board #205
May 30 2:00 PM - 3:30 PM
The Impact of Qigong Baduanjin on Cognitive Function & Mental State in Patients with type 2 Diabetes
Yan Zhao. Chengdu Sport Institute, Chengdu, China.
(No relevant relationships reported)

This study aims to assess the clinic efficacy of Qigong Baduanjin (QBDB) on cognition and mental status in patients with type 2 diabetes. METHODS: sixty-seven type 2 diabetic patients with mild cognitive impairment (MCI) (31 males and 36 females; aged 47-68 years; the educational background of all participants were above middle and school) were screened and randomly divided into two groups: the QBDB group (n=34), and the control group (n=33). Both groups were based on the routine treatment of diabetes. The QBDB group received Baduanjin exercise forty minutes a time and five times per week for three months, whereas the control group without special exercise intervention. Cognitive Assessment (MoCA) and Hamilton Anxiety Scale (HAMA) were used to evaluate patients’ mental status in all patients. All data were analyzed using SPSS Statistics for Windows v 17.0. Group differences in baseline characteristics were tested using the χ² test and the T test. For the outcome measures, independent-sample T test was performed to compare the changes between the QBDB and control groups. The paired T test was used to compare the effects before and after treatment. The level of significance was established at p<0.05. RESULTS: There was no significant difference in the scores of MoCA and HAMA between two groups before the intervention. After 3 months of Baduanjin practice, the total score of MoCA, the score of visuospatial/executive, and the score of delayed recall were significantly higher in the QBDB group than in the
control group (P<0.05). QBDJ training also contributed to improving the ability of emotion regulation. Compared with the control group, participants in the QBDJ group had significantly lower total HAMA score (P<0.05). CONCLUSIONS: These results indicate that regular QBDJ exercise can effectively improve cognitive function and produce positive effects on mental state in type 2 diabetic patients with MCI.

### TABLE 1. COMPARISON OF SCORES FOR ALL MsCA SUBTESTS IN TWO GROUPS

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Control group (n=33)</th>
<th>QBDJ group (n=34)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before intervention</td>
<td>After intervention</td>
<td>Before intervention</td>
</tr>
<tr>
<td>Visuospatial/excutive</td>
<td>3.01±0.74</td>
<td>2.06±0.52</td>
</tr>
<tr>
<td>Naming</td>
<td>2.51±0.63</td>
<td>2.25±0.71</td>
</tr>
<tr>
<td>Attention</td>
<td>4.4±1.07</td>
<td>4.60±1.01</td>
</tr>
<tr>
<td>Language</td>
<td>3.02±1.44</td>
<td>2.04±1.53</td>
</tr>
<tr>
<td>Abstraction</td>
<td>0.90±1.27</td>
<td>1.01±1.06</td>
</tr>
<tr>
<td>Delayed recall</td>
<td>1.94±0.66</td>
<td>2.02±0.71</td>
</tr>
<tr>
<td>Orientation</td>
<td>5.78±1.60</td>
<td>5.81±1.42</td>
</tr>
<tr>
<td>Total score</td>
<td>20.03±3.14</td>
<td>21.14±1.52</td>
</tr>
</tbody>
</table>

When the difference is significant (p<0.05), the F-test is carried out with 1°(QBDJ group vs. Control group) and 2° (compared with before intervention in QBDJ group).

When the difference is significant (p<0.05), the F-test is carried out with 1°(QBDJ group vs. Control group) and 2° (compared with before intervention in QBDJ group).

Successful execution of operational tasks requires accurate and efficient action boundary perception. An action boundary is the task- and individual-specific threshold where an action is possible. The inability to accurately perceive changes in action possibilities due to changing action boundaries may increase the risk adopted during a task, possibly compromising mission success. Astronauts must maintain effective operational performance in isolated, confined and extreme (ICE) environments for extended timeperiods, similar to those expected on the proposed mission to Mars. It is unknown how these environments affect action boundary perception. PURPOSE: Investigate changes in action boundary perception behavior during a 30-day Human Exploration Research Analog (HERA) mission. METHODS: Sixteen subjects completed six trials of the perception-action coupling task (PACT), a novel tablet-based action boundary perception task, in the afternoon of days 3, 10, 17, 24 and 5 days post-mission. The 15-minute PACT presents a series of virtual balls and apertures varying in ball to aperture size ratio (B-AR) from 0.2 to 1.8 with a ratio of 1 representing the action boundary. Subjects determined whether the ball could fit through the aperture, then responded based on their perception of this action possibility. 8 (ratio) x 5 (time) repeated measures ANOVAs were performed to assess changes in response time (RT), accuracy (ACC) and lapses. RESULTS: No significant ratio x time interactions were observed. RT (F(1, 25) = 3.631, p = 0.010, n² = 0.109) was faster on day 24 (0.738 ± 0.088s) than day 17 (0.768 ± 0.092s). No differences were observed between other timepoints. ACC and lapses did not vary during the mission (p > 0.05). RT (F(1, 25) = 42.815, p < 0.001, n² = 0.741) and ACC (F(1, 25) = 42.815, p = 0.002, n² = 0.407) were sensitive to changes in B-AR; responses were slower and less accurate near the action boundary. CONCLUSION: Minimal change in action boundary perception performance was observed in HERA ICE analog, with improvements in RT detected. Faster RT may reflect more efficient responses or behavioral changes due to ICE environments, suggesting action boundary perception is not compromised by a 30 day ICE analog assessment. This material was based on work supported by NASA (NNX15AC11G) PIs: Alfano and Simpson

### 2050 Board #206 May 30 2:00 PM - 3:30 PM

Self-Reported Physical Activity and Memory Performance Among Adolescent Cannabis Users

Ileana Pacheco-Colon, Maria J. Salamanca, Raul Gonzalez.

Florida International University, Miami, FL.

Email: ipach008@fiu.edu

(NO relevant relationships reported)

Prior work has found that heavy cannabis use (CU) is associated with learning and memory impairments, whereas physical activity (PA) has been linked to enhanced memory, and cognition.

**PURPOSE:** To determine whether PA moderates the link between CU and memory among adolescents, such that CU leads to greater memory deficits in those who report less PA.

**METHODS:** Participants were 387 adolescents (ages 15-19) from a larger study, 198 of whom completed the Sports & Activity Involvement Questionnaire added in the past 6 months as our measure of PA. Frequency of CU (in days) was assessed over the last 6 months; 70% endorsed some CU. Participants completed the California Verbal Learning Test-II and Wechsler Memory Scales-IV Logical Memory and Designs subtests. We used composite scores from these tests’ immediate and delayed free recall trials to derive latent constructs of immediate and delayed memory, respectively.

We examined the independent influence of CU and PA on our latent constructs of immediate and delayed memory in separate regression models. To assess whether PA moderates the association between CU and memory performance, we ran separate models for each memory construct with both predictors and their interaction term. We repeated these analyses controlling for lifetime alcohol, nicotine, and CU frequency.

**RESULTS:** Greater past 6-month CU frequency was associated with poorer immediate, β = −.22, p < .001, and delayed memory, β = −.23, p < .001. However, past 6-month PA was not associated with immediate, β = −.01, p = .90, or delayed memory, β = −.07, p = .19. The PA x CU interaction effect was not significant for either immediate, β = −.03, p = .88, or delayed memory, β = −.03, p = .85. Results were unchanged after controlling for other substance use and lifetime CU frequency, which accounted for significant variance on immediate, β = −.27, p = .03, but not delayed memory, β = −.11, p = .39.

**CONCLUSION:** Our findings replicate the well-established link between CU and memory. However, self-reported PA did not influence this association in our adolescent sample. Future work should employ objective measures of PA to account for factors like activity intensity, aerobic fitness, and social biases inherent in self-report. Supported by NIH Grants R01 DA031176 & U01 DA041156.

**2052 Board #208 May 30 2:00 PM - 3:30 PM**

Associations Of Cognition With Physical And Vascular Function In Patients With Chronic Kidney Disease.

Ulf G. Bronas1, Mary Hannan1, James P. Lash1, Joe X. Zhou1, Alana Steffen1, Melissa Lamar1. 1University of Illinois at Chicago, Chicago, IL. 2 Rush University Medical Center, Chicago, IL.

Email: Bronas@uiuc.edu

(NO relevant relationships reported)

Cognitive impairment is prevalent in patients with chronic kidney disease (CKD), but little is known about its relationship with physical and vascular function. PURPOSE: To investigate the relationship between cognitive function, and physical and vascular function in older adults with stage 3-4 CKD and preclinical cognitive impairment. We hypothesized that physical and vascular function would be related to cognitive function. METHODS: Participants (n=28) with CKD and preclinical cognitive impairment (57% female, 68% black, eGFR 43.7, age 65) completed the Trail Making Test (TMT-A: psychomotor speed, and TMT-B executive control), and digit symbol coding (DSC) (visuomotor speed/complex attention). These are standard measures that are sensitive to cognitive decline. Physical function was determined via the short physical performance battery test (SPPB) and the 6-minute walk test (6MWT). Vascular function was determined via brachial artery flow mediated vasodilation (FMD) following 5-minutes of forearm occlusion. Correlations were assessed via Pearson’s bivariate correlation. RESULTS: All participants scored below the fifth percentile of age and sex specific normative values on the TMT; 32% scored below the tenth percentile on the TMT-A and 50% scored below the tenth percentile for TMT-B. Age, years of education, sex, or race did not correlate with TMT-A, TMT-B, or DSC. TMT-A were inversely correlated with 6MWD (r=-.5, p=.007), SPPB score (r=-.5, p=.007) and delayed memory, (β = -.27, p = .03, but not delayed memory, β = -.11, p = .39). Conclusion: Our findings replicate the well-established link between CU and memory. However, self-reported PA did not influence this association in our adolescent sample. Future work should employ objective measures of PA to account for factors like activity intensity, aerobic fitness, and social biases inherent in self-report. Supported by NIH Grants R01 DA031176 & U01 DA041156.

### 2051 Board #207 May 30 2:00 PM - 3:30 PM

Action Boundary Perception Across 30 Days in an Isolated and Confined Environment

Alice LaGoy1, Aaron Sinnott1, Kellen Krajewski1, Richard J. Simpson2, Joanne L. Bowes1, Candice A. Alfano1, Christopher Connably1. 1University of Pittsburgh, Pittsburgh, PA. 2University of Arizona, Tucson, AZ. 3De Montfort University, Leicester, United Kingdom. 4University of Houston, Houston, TX.

Email: adl59@pitt.edu

(NO relevant relationships reported)
Physical education classes provide an opportunity for students to be physically active and also to help in school learning. **PURPOSE:** To compare the effects of physical education program combined with scholar contents named “Playing actively and Learning (PAL)” on selective attention performance in boys and girls. **METHODS:** 39 children with low academic achievement (9.5±0.9 yr) from an elementary public school of vulnerability area at Brasilia - Brazil, undertook Stroop test before and after intervention. The anthropometric data (weight and stature) were assessed for characterization of the sample. The stimuli at Stroop test GO/No-go was a colored bar and a colored word in congruent (e.g., RED in red ink) or incongruent (e.g., RED in blue ink) color ink. The participants had to match the color of the bar to the meaning of the word and press the correct key as soon as the stimuli appeared at computer screen. Nineteen boys (BG; n=19; 32.1±4.5 kg; 138±0.4 cm; 16.7±1.7 kg.m⁻²) and twenty one girls (GG; n=21; 31.1±7.3; 137±0.4 cm; 16.4±3.5 kg.m⁻²) participated on the study. Both BG and GG attended to 24 classes (60 min, twice a week for three months) during school journey. At those classes they learned the content of Portuguese and Mathematics while doing active plays (running, jumping and aerobic dance) (PAL) at moderate intensity (154.6±17.2 bpm). ANOVA mixed was used to compare data before and after intervention. **RESULTS:** No differences were observed in congruent or incongruent conditions between groups. The reaction time decreased in incongruent Go condition in both groups after intervention for boys (958.3±113.3ms to 922.6±109.9ms; P=0.004) and girls (976.6±91.5ms to 904.6±86.7ms; P=0.005) (Figure 1). **CONCLUSION:** Three months of PAL resulted in improvement in a similar way in boys and girls at the most difficult part of Stroop test. To support these results studies with a neuroelectric analysis (i.e. event related potential component) can be recommended.

**THURSDAY, MAY 30, 2019**

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<th>Board #209</th>
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<tr>
<td>Effects Of Three Months Of A “Playing Actively And Learning” Program On Selective Attention Performance In Boys And Girls</td>
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<tr>
<td>Isabela A. Ramos¹, Eduardo B. Fontes², Claudia Dias³, Gustavo L. Guedes⁴, Carmen S G Campbell⁵, Rodrigo A V Browne², ¹University Catholic of Brasilia, Brasilia, Brazil. ²Federal University of Rio Grande do Norte, Natal RN, Brazil. ³UniProjeção, Brasilia, Brazil. ⁴Catholic University of Brasilia, Brasilia, Brazil.</td>
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**THURSDAY, MAY 30, 2019**

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<th>Board #210</th>
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<td>Physical Activity from Childhood to Adulthood and Cognitive Performance in Midlife</td>
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<td>Juuso O. Hakala¹, Suvi P. Rovio¹, Katja Pahkala¹, Jaakko Nevalainen², Markus Juonala¹, Nina Hurri-Kühönen², Olli J. Heinonen¹, Mirja Hirvensalo¹, Risto Telama³, Jorma SA Viikari¹, Tuja H. Tamminen¹, Olli T. Raitakari¹, ¹University of Turku, Turku, Finland. ²University of Tampere, Tampere, Finland. ³Turku University Hospital, Turku, Finland. ⁴University of Jyväskylä, Jyväskylä, Finland. ⁵LIKES Research Centre for Physical Activity and Health, Jyväskylä, Finland.</td>
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(No relevant relationships reported)

The prevalence of cognitive deficits is increasing worldwide, making risk factor reduction a crucial target on the global public health agenda. Adulthood physical activity (PA) is suggested to protect against old-age cognitive deficits, but the independent role of childhood/youth PA for adulthood cognitive performance is unknown. **PURPOSE:** We investigated the association between PA from childhood to adulthood and midlife cognitive performance. **METHODS:** This study is a part of the Cardiovascular Risk in Young Finns Study. From 1980, a population-based cohort of 3,596 children (baseline age 3-18 years) have been followed-up for 31 years in 3-9-year intervals. PA was assessed in all study phases. Cumulative PA was determined in childhood (age 6-12 years), adolescence (age 12-18 years), young adulthood (age 18-24/25 years) and adulthood (age 24-37 years). Cognitive performance was assessed using computerized neuropsychological test in 2011 among 2,026 participants aged 34-49 years. **RESULTS:** High PA level in childhood (β=0.119, 95% confidence interval (CI) 0.055-0.182, p=0.0002), adolescence (β=0.125 SD, 95% CI 0.063-0.188, p=0.0001), young adulthood (β=0.135 SD, 95% CI 0.063-0.207, p=0.0002) and adulthood (β=0.045 SD, 95% CI 0.013-0.077, p=0.006) was independently associated with better reaction time in midlife. Additionally, an independent association between high PA level in young adulthood (β=0.101, 95% CI 0.001-0.200, p=0.048) and adulthood (β=0.064 SD, 95% CI 0.018-0.110, p=0.006) and better visual processing and sustained attention in midlife was found among men. Associations for other cognitive domains were not found. **CONCLUSIONS:** Cumulative exposure to PA from childhood to adulthood was found to be associated with better midlife reaction time both in men and women. Furthermore, cumulative PA exposure in young adulthood and adulthood was associated with better visual processing and sustained attention in men. These associations were independent of PA levels in other measured age frames. Therefore, physically active lifestyle should be adopted already in early childhood, and continued into midlife to ensure the plausible benefits of PA on midlife cognitive performance. Concluding, this study provides novel insight into cost-effective and well-timed promotion of cognitive health.

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<td>Patient Perceptions of a Cancer Rehabilitation Program Which Provides 12 Weeks Of Individualized Exercise Prescription</td>
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<tr>
<td>Travis Yahner¹, Karen Wonders, FACS¹, Stephen LoRusso¹. ¹Saint Francis University, Loretto, PA. ²Maple Tree Cancer Alliance, Dayton, OH.</td>
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Email: tpy100@francis.edu
(No relevant relationships reported)
Clearly they are satisfied with the program which is a program which provides individuated personalized exercise prescription and a cancer trainer for support and motivation.

D-64 Free Communication/Poster - Hydration/Fluid Balance
Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2056 Board #212 May 30 2:00 PM - 3:30 PM Impact of Nutrient Intake During Exercise on Hydration Markers Following Exercise and Rehydration Colleen X. Munoz1, Evan C. Johnson1, Laura J. Kunces2, Amy L. McKenzie3, Michael Wingerin1, Cory Butts4, Aaron Caldwell5, Adam Seal6, Brendon P. McDermott, FACSM7, Jakob L. Vingren7, FACSM7, James Boyette5, Colin Melford8, Abigail Colburn9, Skylar Wright10, Ekow Dadzie11, Virgilio Lopez12, Lawrence E. Armstrong, FACSM13, Elaine C. Lee13. 1University of Hartford, West Hartford, CT. 2University of Wisconsin, La Crosse, WI. 3Thorne Research, Summerville, SC. 4Vita Health, San Francisco, CA. 5University of Arkansas, Fayetteville, AR. 6University of Arkansas, Fayetteville, AR. 7University of North Texas, Denton, TX. 8University of Connecticut, Storrs, CT. (Sponsor: Lawrence Armstrong, FACSM)

Impact of Nutrient Intake During Exercise on Hydration Markers Following Exercise and Rehydration

Durability athletes commonly strive for optimal hydration status during and after events, and have vast nutrition options available to support performance and wellbeing. PURPOSE: We aimed to evaluate relationships among nutrients consumed during exercise and markers of hydration status. METHODS: Fifty-one cyclists (age mean=51y and range=21-72y; 49 males, 2 females) completing a 161km event (mean=26°C, 76%RH; maximum=30°C, 93%RH) recorded all dietary intake during the ride. Five hydration markers (urine color and specific gravity, plasma osmolality (P), plasma corticopin (P), and body mass change (BM)) were collected before and after (POST) the ride, and one hour after a 650mL water bolus (POST1h). Linear regressions tested associations between hydration markers and eight predictor terms derived from nineteen nutrients merged into a reduced-dimensionality dataset through serial k-means clustering. As an indicator of water retention signaling, P tertiles were analyzed via two-way ANOVA to evaluate nutrient intake influence. RESULTS: Five predictor clusters were significantly associated to hydration markers (number of associated hydration markers in parenthesis): 1) glycemic load + carbohydrates + sodium (one), 21 protein + fat + zinc (one), 3) magnesium + calcium (two), 4) pinitol (three), and 5) water (four); caffeine, potassium, fiber, betaine, and three sugar-alcohols did not associate with hydration markers. All hydration markers (except P tertiles) were associated at least one nutrient predictor. P tertile (13.5±5.9, 34.4±7.4, and 76.8±17.0% respectively) differed by sodium (1st vs. 3rd tertile p=0.0047; 2217±1295 and 1747±1214 mg, respectively) and water intake (1st vs. 3rd and 2nd vs. 3rd, all p=0.001; 1st vs. 2nd tertile p=0.001); 4910±1722 vs. 4910±1011, 3837±1097 g). P tertile (7.4±3.0, 22.0±5.4, and 34.2±36.7 mg/mL respectively) differed by water intake (1st vs. 2nd and 3rd vs. 3rd, all p=0.001; 1st vs. 2nd tertile p=0.001; 4921±1652, 4953±1063, and 3795±1072 g). CONCLUSION: These data suggest that some nutrients impact fluid-electrolyte balance and hydration markers. Nutrient intake appears to mediate urinary markers more than P tertile and P tertile more than BM. Further, sodium and water appear to best mitigate water retention signaling following exercise and rehydration.

2057 Board #213 May 30 2:00 PM - 3:30 PM Effects of Caffeine Dose Timing on Total Urine Excretion during Sodium-Aided Hyperhydration Protocols. Shelby L. Greene1, Elizaveta Roslanova1, Phillip Wickenheiser1, David M. Morris1. 1University of Texas, Odessa, TX. 2University of Texas, Odessa, TX. Email: shelbylgreene@outlook.com (No relevant relationships reported)

When used alone, both caffeine and sodium-aided hyperhydration (SAH) can be ergogenic. Although caffeine use in conjunction with SAH promotes diuresis, hyperhydration can be achieved, albeit at lower levels compared to SAH alone. Previous caffeine and SAH work has suggested most of the caffeine induced diuresis occurs within 15 min following ingestion of a bolus dose. This response suggests that caffeine-induces diuresis for only 15 min following its consumption, and/or that the diuretic effects of caffeine are dependent on hydration levels. PURPOSE: to determine the effects of caffeine, consumed at different time-points, on diuresis during SAH protocols. METHODS: Subjects were 17 healthy males (23 ± 5 yr, 177 ± 8 cm, 83.4 ± 15.3 kg). Each performed 4, 90 min hyperhydration trials in a randomized, double-blind fashion. Protocols began with a bladder void and measurement of urine specific gravity (USG) followed by ingestion of 15 mL H2O - kg -1 with one of four treatments: Placebo (PL), 70.5 mg NaCl - kg -1 (Na), or a combination of NaCl and caffeine consumed in two different strategies: 70.5 mg NaCl + 5 mg caffeine - kg -1 taken at the start of the trial (NaCa75), or 70.5 mg NaCl - kg -1 taken at the start and 5 mg caffeine - kg -1 taken at 75 min of the trial (NaCa75). After consuming the water, subjects rested for 90 min performing a measured bladder void every 15 min. Total urine excreted (TUE) was expressed as a percentage of the total fluid consumed during the hyperhydration protocols. USG and TUE were compared using one-way repeated measures ANOVA with Sidak post hoc analyses. Levels of significance were set a priori at P < 0.05. RESULTS: USGs were 1.007 ± 0.003 (PL), 1.008 ± 0.003 (Na), 1.007 ± 0.004 (NaCa75), and 1.009 ± 0.004 (NaCa75P) (P < 0.05). TUE for PL (87 ± 30%) was significantly higher than all other protocols (P < 0.05). TUE for NaCa75 (73 ± 16%) was significantly higher than Na (56 ± 18%, P < 0.02) and NaCa75 (52 ± 13% P < 0.01). NSD in TUE was observed between Na and NaCa75. CONCLUSION: The results reaffirm that, when caffeine is consumed at the beginning of a SAH strategy, hyperhydration can be achieved, but at a lower level compared to SAH without caffeine. The results also suggest that waiting to consume caffeine until 75 min after water is consumed does not result in caffeine induced diuresis during a SAH protocol.

2058 Board #214 May 30 2:00 PM - 3:30 PM Dehydration Impacts Accuracy and Increases Brain Activity During a Rhythmic Bimanual Choice Reaction Time Task. Matthew T. Witbrodt1, Michael N. Sawka, FACSM2, J. C. Mizelle3, Ragen R. Lawson1, Lewis A. Wheaton1, Mindy L. Millard-Stafford, FACSM1. 1Georgia Institute of Technology, Atlanta, GA. 2East Carolina University, Greenville, NC. (Sponsor: Mindy L. Millard-Stafford, FACSM)

Dehydration impairs motor coordination but the influence on other fundamental cognitive-motor functions is unclear. PURPOSE: To determine the impact of dehydration on rhythmic bimanual choice performance (accuracy & reaction time) and brain function (electroencephalography). METHODS: Ten aerobically fit men (22.4 ± 2.5 y) completed three experimental sessions: control (seated rest; CON), dehydation (EHS-DEH) induced by 2.5 h intermittent walking in the heat (45°C, 15% RH), and euhydration (EHS; 2.5 h intermittent walking in the heat but matching sweat loss with water ingestion). Performance during a bimanual probabilistic choice reaction time task (PCRT; 32 min) consisting of randomly presented dominant (~67%) and non-dominant (~33%) stimuli was examined concurrently with visual evoked potentials. Perceived PCRT mental workload (NASA-TLX, 21-point scale) was assessed following task completion. RESULTS: PCRT reaction time was not different (p = 0.40) averaged across trials (CON: 538.3 ± 37.7, EHS: 542.6 ± 39.2, DEH: 532.6 ± 39.2 ms). EHS-DEH (67.3 ± 14%) reduced PCRT accuracy during non-dominant (less frequent) responses vs. CON (83.7 ± 5.8% p = 0.04) but not compared with EHS (74.6 ± 11.0% p = 0.18). Accuracy during dominant stimuli were not different across trials (p = 0.05). N1 amplitude in the occipital electrodes (perceptual processing) was higher following EHS-DEH (385.2 ± 141.3 uV/sms) compared to CON (241.8 ± 168.6 uV/sms; p = 0.001) but not vs. EHS (300.3 ± 171.1 uV/sms; p = 0.60). EHS and CON were not different from each other (p = 0.06). No differences (p > 0.05) were observed among trials for the contingent negative variation (movement anticipation) or N2 (stimulus categorization). EHS-DEH (6.4 ± 5.0) elicited greater levels of perceived effort vs. CON (3.7 ± 2.4 p = 0.03) and frustration vs. EHS (11.8 ± 5.0, 7.5 ± 5.1; p = 0.0004). CONCLUSIONS: Dehydration increased perceived effort, frustration, and perceptual processing demands, resulting in impaired accuracy for this cognitive-motor task requiring vigilance during prolonged fine motor movements. Prevention of dehydration during exercise-heat stress preserved cognitive-motor performance, brain activity, and mental workload similar to control conditions. Supported by Carl V. Gisolfi Memorial Fund ACSM Foundation Grant
Purpose: Motor-racing drivers compete in hot, humid environments imposing high physiological strain. Dehydration may impact a driver’s health, safety and race performance. This study examined the effects of dehydration on performance and physiological outcomes during a simulated motor-race.

Methods: Fifteen healthy men (age: 25.2±5.4 y; body mass: 84.8±10.7 kg; VO2peak: 43.7±7.8 mL.kg⁻¹.min⁻¹ (mean±SD)) participated in this controlled crossover study. Participants were randomised (counter-balanced) to a no fluid trial [1.9±0.1% body mass loss (BML) via sauna exposure (wet bulb globe temperature (WGBT): 43.6±2.8 °C)] and fluid trial [1.0±0.5% body mass gain via room temperature water consumption every 10 min during sauna exposure]. All participants completed ~60 min of Australian simulated motor-racing in a heated (WGBT: 33.7±0.7 °C) laboratory with no fluid provided to both trials which resulted in a 1.3±0.2% BML for the fluid and no fluid trials respectively. Lap time, physiological strain, heart rate and core/ skin temperature were measured throughout the task. Urine [specific gravity (USG), and osmolality (Uosm)], body mass, and serum [sodium (Na), osmolality (Uosm), and plasma volume (PV)] samples were collected pre- and post- sauna and race.

Results: Mean lap time was not different between trials (fluid=134.981±2.402 s, no fluid=134.781±2.412 s; p=0.293). The no fluid trial resulted in significantly higher (p<0.05) peak heart rate (129±16 vs. 121±16 beats·min⁻¹), core temperature (38.0±0.2 vs. 37.7±0.3 °C), physiological strain (4.1±1.1 vs. 3.5±1.1), sodium (310±300 vs. 500±4 mOsm·kg⁻¹), Na (138±7.2 vs. 135±8.5 mmol·L⁻¹), USG [median (interquartile range): 1.025 (1.024-1.027) vs. 1.006 (1.004-1.013)], Uosm (942 (879-1010) vs. 221 (186-288) mOsm·kg⁻¹], total body mass loss (2.7±0.3 vs. 0.9±0.4%) and change in PV (7.9±4.2 vs. -33±4.2%) than the fluid trial.

Conclusion: Dehydration of ~2.7% BML without fluid replacement had no influence on simulated race performance measured by mean lap time, despite significantly increased alertness.

RESULTS:
Groups were similar for thirst and alertness between groups from V1 to V2 and V2 to V3. The prescribed increase in water intake (V3) resulted in a main effect of time for both thirst and alertness (both p<0.01). Consensus data revealed a significant interaction of time and group for both thirst and alertness (both p<0.01).

CONCLUSION:
An inverse relationship was observed between self-reported alertness and thirst. Following fluid restriction, drinking a larger volume of water (750-1000 mL) in the morning decreased thirst and increased alertness. Investigation funded by Danone Research.
fluid provided established different hydration levels as indicated by the different urine specific gravity (USG) levels post-exercise (LV: 1.017 ± 0.002 vs. HV: 1.002 ± 0.001, p < 0.001) with pre-exercise USG were similar between conditions (LV: 1.018 ± 0.002 vs. HV: 1.015 ± 0.001, p = 0.09). The percentage of fluid lost was higher in LV (1.2 ± 0.2 %) compared to HV (0.4 ± 0.1 %) (p = 0.02), however, mean percent change in the 3 apparatuses was not different between conditions (LV: 8.72 ± 0.21 vs. HV: 6.68 ± 0.20, p = 0.57). CONCLUSIONS: By ingesting fluid equivalent to about 50% of the body mass over a 3-hour period, dehydration of 12 years old maintain short-term hydration levels and avoid excessive dehydration (> 2 %). Ingesting a higher amount of fluid equivalent to about 1.5 times the fluid lost does not provide an additional benefit in terms of performance evaluation.

2063 Board #219 May 30 2:00 PM - 3:30 PM The Effects of Mode of Rehydration on Subsequent Exercise-heat Challenge Performance Linda M. Yamamoto1, Elaine C. Lee2, Brendan P. McDermott3, Kathleen N. Beasley2, Holly Emmanuel2, Jeff S. Volek2, Douglas J. Casa, FACSM2, Lawrence E. Armstrong, FACSM1, William J. Kraemer, FACSM4, Carl M. Maresh, FACSM4. 1Central Connecticut State University, New Britain, CT. 2University of Connecticut, Storrs, CT. 3University of Arkansas, Fayetteville, AR. 4The Ohio State University, Columbus, OH. (Sponsor: Carl M. Maresh, FACSM)

Email: lindayamamoto@hotmail.com

(No relevant relationships reported)

PURPOSE: Athletes and soldiers routinely exercise in the heat for extended periods of time without matching fluid intake to sweat rate, risking impaired physiologic function and performance decrements. Intravenous and oral rehydration are both used to overcome performance decrements associated with dehydration. The purpose of this study was to examine the efficacy of mode of rehydration using athletically relevant dehydration-rehydration-exercise scenarios.

METHODS: Ten healthy, active men (age 23.3 ± 1.1 yr, height, 177.8 ± 2.8 cm; body mass, 81.4 ± 1.3 kg; body fat, 11.0 ± 1.0%; VO2max, 58.8 ± 1.3 ml kg−1·min−1) completed four trials consisting of overnight dehydration, exercise dehydration, rehydration, observation, and an exercise-heat challenge (EHC) in a hot environment (35.6 ± 0.2 °C, 35.0 ± 1.8% relative humidity) differing only in rehydration mode. Participants were rehydrated to -2% of baseline weight over 30 minutes with intravenous (IV), oral (ORAL), ½ IV + ½ ORAL (I+O), or oral (ORAL) half-normal saline. For the EHC subjects completed a 25 min submaximal run followed immediately by an all-out maximal 0.5 mile run, five minutes rest, and five minutes of repetitive box lifting (RBL). Run time and number of boxes lifted per minute were recorded. Performance data was analyzed with a two-way repeated measures ANOVA.

RESULTS: Total number of boxes lifted was significantly lower in the ADL and ORAL (IV) conditions compared to I+O (52.3 ± 1.1), but not IV (49.9 ± 1.2). Boxed lifted during minutes 1 and 5 were significantly higher than minutes 2, 3, and 4 for all trials. Performance times for the 0.5 mile run were not different among trials.

CONCLUSIONS: Partial rehydration via IV and oral fluids appears to have an ergogenic effect on high-intensity, total-body exercise in the heat possibly due to a combination of more rapid plasma volume restoration, oropharyngeal and gastric distention, hydration, and thermoregulatory mechanisms. Further work is warranted to define the temporal aspects of nonoxidative performance and to examine differences between the genders in terms of nonoxidative performance.

2065 Board #221 May 30 2:00 PM - 3:30 PM Effects Of Caffeine Dose Timing On The Time-course Of Diuresis During Sodium-aided Hyperhydration. David M. Morris1, Shelby Greene2, Elizaveta Roslanova1, Philip Wickenheiser3. 1University of Texas, Odessa, TX. 2University of Texas, Odessa, TX. Email: morris_da@utep.edu (No relevant relationships reported)

When used alone, both caffeine and sodium-aided hyperhydration (SAH) can be ergogenic. Caffeine, when used with SAH, promotes diuresis, but hyperhydration can be achieved, albeit at lower levels than with SAH alone. In previous caffeine and SAH work, caffeine induced diuresis occurred only within 15 min of consumption of a bolus of caffeine, NaCl, and H2O. This suggests that caffeine-induced diuresis may occur for only 15 min after its consumption, and/or that the diuretic effect of caffeine is dependent on hydration levels. Caffeine has been shown to be ergogenic when taken as little as 5 min before exercise; thus, determining the temporal aspects of caffeine induced diuresis in conjunction with SAH may lead to better pre-exercise nutritional strategies. PURPOSE: To determine the effect of caffeine, consumed at different time-points, on diuresis over a 90 min SAH protocol. METHODS: Subjects were 17 males (23 ± 5 yr, 177 ± 8 cm, 83.4 ± 15.3 kg). Each performed 2, 90 min SAH trials beginning with a bladder void and measurement of urine specific gravity (USG) followed by ingestion of 15 mL H2O kg−1·min−1 with one of two treatments: 70.5 mg NaCl + 5 mg caffeine kg−1·min−1 taken at the start of the trial (NaCaf0), or 70.5 mg NaCl - kg−1·min−1 taken at the start and 5 mg caffeine kg−1·min−1 taken at 75 min of the trial (NaCaf75). After consuming the H2O, subjects performed a measured bladder void every 15 min for 90 min. USGs were compared using a paired t-test. Urine excretions (UE) for each bladder void and the volume of the trial were expressed as a percentage of the total H2O consumed and compared with a two-way repeated measures ANOVA and Sidak post hoc analyses. RESULTS: USGs were 1.007 ± 0.004 (NaCaf0), and 1.009 ± 0.004 (NaCaf75) (P = 0.30). UE for NaCaf0, and NaCaf75, respectively at the urine collection points were 15.9 ± 7.6% (15 min, P < 0.01), 15.3 ± 7%, 9 ± 2% (30 min, P < 0.01), 18 ± 5%, 14 ± 4% (45 min, P < 0.05), 15 ± 5%, 11 ± 6% (60 min, P < 0.05), 10 ± 5%, 8 ± 6% (75 min, P = 0.25), and 7 ± 5%, 6 ± 3% (90 min, P = 0.88). CONCLUSIONS: Although consuming caffeine at the start of the trial resulted in significantly greater diuresis for the first 30 min of the trial, waiting to consume caffeine until 75 minutes after the consumption of the water and NaCl did not result in caffeine induced diuresis 15 min after consumption of the caffeine.
Participants provided a 24 h urine sample across 7 (n=13) or 3 (n=19) consecutive days (148 ±10.1 days for assessment of urine volume (Uvol), urine osmolality (Uosm), urine specific gravity (USG), and urine color (Ucol). Differences in 24 h hydration status between sex and ethnicity were assessed using linear mixed effects models with associated Bonferroni post hoc analyses. Significance was set a-priori p<0.05.

RESULTS: Uvol was significantly lower in BL (0.8±0.43 L) compared to WH college students (2.0±0.70 L) (p=0.001). Conversely measures of Uosm, USG, and Ucol, were significantly greater in BL (716±263 mOsm/kg, 1.020±0.007, and 4.2±1.4, respectively) compared to WH college students (473±194 mOsm/kg, 1.013±0.006, 3.0±1.2, and respectively) (p<0.05). Independent of race, women were significantly less hydrated than men by measures of UVOL(MD [95% CI]; -0.56 L [-0.823, -0.308], p<0.001), UOSM(107 mOsm•kg\(^{-1}\) [24, 190], p=0.012), USG(0.003 [0.001, 0.005], p=0.017), and UCOL(-0.6 [-1.2, -0.1], p=0.012).

CONCLUSIONS: Based on 24 h urinary hydration markers, college-aged non-Black men and women were inadequately hydrated compared to their non-Black White counterparts when assessed over consecutive days. Furthermore, women were significantly less hydrated than men, independent of racial background. Given the importance of hydration on acute and long-term health, identifying populations that are inadequately hydrated may allow for the development of targeted strategies to improve habitual fluid intake. Future research examining 24 h hydration status coupled with fluid intake behaviors across a broader sample of races or ethnicities is warranted to further understand the determinants that guide drinking behaviors.

METHODS: Among 541 healthy children (age: 3-13 y, female: 45%, BMI: 17.7±4.0 kg m\(^{-2}\)), equivalent test was performed by comparing UOsm from specific time windows [mean urine (0600-1159), early afternoon (1200-1559), late afternoon (1600-1959), evening (2000-2359), overnight (2400-0559), and first morning (0600-0959)] to 24-h urine sample. The equivalency was determined when the mean difference and the confident interval between the spot and 24-h urine sample fell below the bound of 80 mmol kg\(^{-1}\).

RESULTS: Equivalence test showed that the late afternoon (1600-1959) spot urine sample UOsm value was equivalent to the 24-h UOsm value in children (P=0.05; mean difference: 62; CI: 45-78). The overall diagnostic ability of urine osmolality assessed at late afternoon (1600-1959) to diagnose elevated urine osmolality (>800 mmol kg\(^{-1}\)) on the 24-h sample was “good” (area under the curve: 87.4%; sensitivity: 72.6%; specificity: 90.5%; threshold: 814 mmol kg\(^{-1}\)).

CONCLUSIONS: These data suggest that in free-living healthy children, 24-h urine hydration concentration can be approximated from a late afternoon spot urine sample.

D-65 Free Communication/Poster - Thermoregulation/Hyperthermia

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

Various skin preparation methods, ranging from MINIMAL (alcohol wipes) to more THOROUGH (e.g., shaving and cleaning), have been used to remove surface contamination prior to patch application for sweat electrolyte measurements. Using MINIMAL cleaning methods could improve athlete participation and the efficiency of sweat testing in the field, but it is unknown if this would result in higher sweat [Na\(^+\)], [Cl\(^-\)], and [K\(^+\)] due to insufficient removal of surface contamination. PURPOSE: To compare the effect of MINIMAL vs. THOROUGH skin cleaning methods on regional sweat [Na\(^+\)], [Cl\(^-\)], and [K\(^+\)].

METHODS: Thirteen subjects (7 male, 6 female; 23-45 y; 74.6±15.8 kg) cycled at ~80% HR\(_{max}\). Each time window. Other spot urine samples after the first spot urine within each time window were not used to avoid unequally weighting data.

RESULTS: Equivalence test showed that the late afternoon (1600-1959) spot urine sample UOsm value was equivalent to the 24-h UOsm value in children (P=0.05; mean difference: 62; CI: 45-78). The overall diagnostic ability of urine osmolality assessed at late afternoon (1600-1959) to diagnose elevated urine osmolality (>800 mmol kg\(^{-1}\)) on the 24-h sample was “good” (area under the curve: 87.4%; sensitivity: 72.6%; specificity: 90.5%; threshold: 814 mmol kg\(^{-1}\)).

CONCLUSIONS: These data suggest that in free-living healthy children, 24-h urine hydration concentration can be approximated from a late afternoon spot urine sample.
2070 Board #226 May 30 2:00 PM - 3:30 PM
Epifluidic Colorimetric Patch for On-Skin Analysis of Regional Sweat Chloride Concentration during Laboratory-based Exercise
Lindsay S. Baker, FACSM1, Ryan P. Nuccio1, Corey T. Ungaro1, Shyretha Brown1, Adam J. Reimel1, Alexander J. Aranyosi2, Stephen P. Lee2, Jeffrey B. Model1, Roozbeh Ghaffari2, Kelly A. Barnes1, 1Griffith University, Gold Coast, Australia. 2Bond University, Gold Coast, Australia. (Sponsor: Louise Burke, FACSM)
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PURPOSE: Skin tattoos have been shown to reduce sweat rate and increase sweat sodium concentration when sweating is artificially stimulated. This study investigated whether similar responses are observed with exercise-induced sweating. PURPOSE: To determine the accuracy and reliability of a novel epidermal microfluidic patch with built-in colorimetric assay (Epifluidic patch) to measure regional sweat [Cl-]. METHODS: Twenty-three subjects (15 male, 8 female; 18-42 y; 72.3±11.2 kg) cycled at 85% HRmax in a laboratory (30°C, 50% rh) while sweat was collected from the right and left ventral forearms with an Absorbent patch (3M Tegaderm+Pad) and Epifluidic patch (Epico Biosystems, Inc.), respectively. A subset of subjects (n=9) completed two identical trials 2-4 days apart to determine test-retest reliability. Immediately after removal of the Absorbent patch, an image was taken of the Epifluidic patch-on-skin with a digital single-lens reflex camera for analysis of [Cl-] via colorimetry. Sweat from the Absorbent patch was extracted via centrifuge and subsequently analyzed for [Cl-] by ion chromatography. Data are shown as mean±SD RESULTS: There was no difference in sweat [Cl-] between Absorbent and Epifluidic patches (32.9±16.8 vs. 34.5±19.6 mmol/L, p=0.21). Bland-Altman Limits of Agreement between methods was -10.1 to 13.3 mmol/L. There was a significant correlation between correlations (r=0.96, p<0.0001) and the coefficient of determination (r2) for predicting Absent from Epifluidic patch (Cl) was 0.92. Based on Deming regression analysis, the slope and intercept of the regression line describing Absent vs. Epifluidic patch sweat [Cl-] were not different than 1 and 0, respectively. Sweat [Cl-] was not different between repeat trials for the Absorbent (1.4±4.4 mmol/L, p=0.36) or Epifluidic patch (0.4±6.1 mmol/L, p=0.51) and test-retest CVs were 12% and 4%, respectively. CONCLUSIONS: The Epifluidic patch provides accurate and reliable data for forearm sweat [Cl-] estimation during exercise in controlled laboratory conditions. Future research is needed to evaluate the Epifluidic Colorimetric Patch for on-skin analysis of sweat [Cl-] at other regional sites as well as during live practices and games.

2071 Board #227 May 30 2:00 PM - 3:30 PM
Skin Tattoos Do Not Affect Exercise-induced Sweat Rate Or Sodium Concentration.
Ethan Rogers1, Gregory Cox2, Chris Irwin1, Danielle McCartney1, Ben Deshbow2, 1Griffith University, Gold Coast, Australia. 2Bond University, Gold Coast, Australia. (Sponsor: Louise Burke, FACSM)
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PURPOSE: Skin tattoos have been shown to reduce sweat rate and increase sweat sodium concentration when sweating is artificially stimulated. This study investigated whether similar responses are observed with exercise-induced sweating. METHODS: Twenty-two healthy individuals (25.1±4.8 y (Mean±SD), 14 males) with a unilateral tattoo ≥11.4 cm in size, >2 months in age, and shaded ≥50% participated in the study. Whether similar responses are observed with exercise-induced sweating. RESULTS: Twenty-three subjects (15 male, 8 female; 18-42 y; 72.3±11.2 kg) cycled at 85% HRmax in a laboratory (30°C, 50% rh) while sweat was collected from the right and left ventral forearms with an Absorbent patch (3M Tegaderm+Pad) and Epifluidic patch (Epico Biosystems, Inc.), respectively. A subset of subjects (n=9) completed two identical trials 2-4 days apart to determine test-retest reliability. Immediately after removal of the Absorbent patch, an image was taken of the Epifluidic patch-on-skin with a digital single-lens reflex camera for analysis of [Cl-] via colorimetry. Sweat from the Absorbent patch was extracted via centrifuge and subsequently analyzed for [Cl-] by ion chromatography. Data are shown as mean±SD RESULTS: There was no difference in sweat [Cl-] between Absorbent and Epifluidic patches (32.9±16.8 vs. 34.5±19.6 mmol/L, p=0.21). Bland-Altman Limits of Agreement between methods was -10.1 to 13.3 mmol/L. There was a significant correlation between correlations (r=0.96, p<0.0001) and the coefficient of determination (r2) for predicting Absent from Epifluidic patch (Cl) was 0.92. Based on Deming regression analysis, the slope and intercept of the regression line describing Absent vs. Epifluidic patch sweat [Cl-] were not different than 1 and 0, respectively. Sweat [Cl-] was not different between repeat trials for the Absorbent (1.4±4.4 mmol/L, p=0.36) or Epifluidic patch (0.4±6.1 mmol/L, p=0.51) and test-retest CVs were 12% and 4%, respectively. CONCLUSIONS: The Epifluidic patch provides accurate and reliable data for forearm sweat [Cl-] estimation during exercise in controlled laboratory conditions. Future research is needed to evaluate the Epifluidic Colorimetric Patch for on-skin analysis of sweat [Cl-] at other regional sites as well as during live practices and games.

2072 Board #228 May 30 2:00 PM - 3:30 PM
Comparison of Sports-Oriented Sweat Prediction Equation Performances During Running
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PURPOSE: This study compared the performance of three sports-oriented sweat prediction equations against measurements made during outdoor running or indoor treadmill running with adequate airflow. METHODS: Eleven open literature studies were identified where runner sweating rates (L/h) were carefully measured and reported from changes in body mass (n = 109). For studies that did not correct for non-sweat losses of body mass, a standardized correction of 0.20 g/kcal was subtracted from the reported sweating rates. Body mass, air temperature, relative humidity, running speed and distance or duration was provided in the published reports. A prospective field study of n = 78 was completed with n = 40 separate sweat rate observations made. Outdoor track testing was completed through a range of environmental conditions (temperature range: 10-31.3°C). The performance of three sports-oriented sweat prediction equations (H2Q™, Putnam, and Barr & Costill) was compared to measured sweating rates. RESULTS: Measured sweating rates from the literature ranged from 0.417 to 2.129 L/h; track sweating rates ranged from 0.293 to 1.739 L/h. Agreement between measured (x-axis) and predicted (y-axis) sweating rates were assessed using the concordance correlation coefficient (CCC; ≥ 0.800). The relative error (RE; < 1.000) and accuracy (percent agreement; ≥ 70%) were also assessed. Using the 250 L/h as an error acceptance threshold. For retrospective data (n = 109), the CCC ranged from 0.377 to 0.809; RE from 0.732 to 1.208; accuracy from 43 to 70%. For prospective data, the CCC ranged from 0.455 to 0.882; RE from 0.564 to 1.105; accuracy from 58 to 88%. In all instances the three equations performed better on the more highly controlled prospective data set. One equation (H2Q™) performed best on all three agreement parameters and on all data sets. CONCLUSIONS: These results illustrate the difficulty of accurately predicting sweating rates in runners, but also the possibility of achieving good accuracy with the right equation.

2073 Board #229 May 30 2:00 PM - 3:30 PM
Validity And Reliability Of The Cortemp™Telemetric Pill During 50 H Of Reuse.
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PURPOSE: The aim of the study was to examine the validity and reliability of CorTemp™ TPs during repeated use in a water bath for a duration of 50 h. METHODS: Three TPs already used for less than 5 h each in a previous human study were tested in a water bath during 20 trials ranging from 1 to 5 h each, for a total of 50 h with temperature variations ranging from 37 to 40°C. Trials were conducted in a randomized manner and temperatures of the TPs were compared to those of a wired rectal probe (YSI401, WRP). After each trial, TPs were immersed in a 2.5% glutaraldehyde solution for 20 min to achieve high-level disinfection, as recommended when a probe is used with a condom. The WRP and each TP were calibrated before the start of the experiment. Acceptable agreement between sensors was taken as a bias of ± 0.2°C (sum of both instrument measurement errors). RESULTS: 50 h mean biases and random errors between TP 1, 2 and 3 and the WRP were of -0.09°C/±0.12°C, -0.10°C/±0.14°C and -0.12°C/±0.15°C, respectively. Mean biases and random errors at 17 h, 34 h and 50 h of reuse were of respectively -0.01°C/±0.11°C, -0.06°C/±0.10°C and -0.11°C/±0.11°C for TP 1 vs. WRP, -0.09°C/±0.13°C, -0.08°C/±0.12°C and -0.13°C/±0.16°C for TP 2 vs. WRP and -0.14°C/±0.17°C, -0.10°C/±0.13°C and -0.11°C/±0.12°C for TP 3 vs. WRP. CONCLUSION: Our results indicate that the CorTemp™ TP can be reused up to at least 50 h while still providing valid and reliable temperature readings. Furthermore, the CorTemp™ TP can undergo high-level disinfection repeatedly while maintaining the Telemetric Pill.
Recent technology has included development of ingestible pills and vests designed to monitor core and skin body temperatures. If accurate, they can be ideal in many field settings. However, little research has been performed to demonstrate the accuracy (validity) of this new technology. PURPOSE: We compared these new technologies with traditional modalities during 60 min of continuous cycle ergometer exercise at room (20°C) temperature. METHODS: Study participants included a convenience sample (N=18, 14 female, age:23.8±3.4 yr, wt: 70.4±11.6 kg, ht: 175.5±9.3 cm). Intensity for the first 30 min was set at a Power (watts, W) corresponding to individual participant RPE values of 12-13. Intensity increased to an RPE of 15-16 for the final 30 min of cycling, and W were adjusted accordingly. Heart rate (HR) was measured continuously (Polar). Core temperature was measured via a rectal (PROBE-C) thermistor and an ingestible pill (PILL). Skin temperature (PROBE-S) was measured at the arm, chest, thigh, and calf, and a mean value was calculated (Ramanathan, 1964). Core and skin temps were also estimated from a sensor electronics module located in a vest (VEST, Equisofit) worn by each participant. Vest temps were calculated according to equations developed previously (Buller et al., 2013). Repeated measures ANOVA, Pearson correlations, and dependent t-tests were used to examine relationships among the various temperature measurement modalities (Alpha = p<0.05). RESULTS: HR averaged 125±25 and 151±18 b/min for the first and second 30 min of exercise, respectively. Likewise, Power averaged 81.2±22 and 97.2±22 W. While core temperatures were nearly identical at onset of exercise (~37.3°C), the three modalities differed after 60 min of cycling (PROBE-C; 37.9±0.8, PILL; 38.3±0.3, VEST; 38.6±0.4°C (p<0.05). Skin temperatures differed between PROBE-S and VEST at both beginning (31.2±1.1 vs 33.8±1.2°C) and end (32.9±1.5 vs 37.0±0.6°C) of exercise (p<0.01). Correlations among the various modalities were significant (p<0.05) and ranged from R=0.95 - 0.77, but did not differ from each other. CONCLUSION: The major study finding was that the vest estimated higher core and skin temperatures during exercise compared to traditional temperature measuring devices, overestimating work intensity at study ambient conditions.

Vasodilation is thought to originate from increased nitric oxide bioavailability, thus increasing blood flow into the limb. However, the different aspects of the downstream microvascular oxygen delivery (i.e. perfusive and diffusive) to the exercising muscle have yet to be described. PURPOSE: The purpose of this study was to determine the effect of seven days of passive heating on oxygen delivery during handgrip exercise. We tested the hypothesis that, 7 days of passive heating would result in a decrease in the diffusive oxygen delivery (total-[heme]) and an increase in the perfusive oxygen delivery (deoxy-[heme]) in the exercising muscle. METHODS: Participants (3 women, 23.0±1.0 yrs, 70.9±1.5 kg, 171±1.0 cm) participated in this study. Peak power was determined by an incremental two-hand grip exercise test. Subjects performed 10 minutes of dynamic handgrip exercise at 40% peak power pre and post 7 days of passive heating. Absolute concentrations of deoxy-[heme] and total-[heme] of the flexor digitorum superficialis muscle were measured continuously via frequency-domain multi-distance near-infrared spectroscopy (OxiplexTS, ISS). The passive heating protocol consisted of immersion up to the shoulder in a 40°C hot tub until rectal temperature reached 38.5°C or increased by 1°C for 60 minutes. Data reported as mean ± SE. RESULTS: From baseline to the last 30 seconds of exercise there was no significant difference in the Δ deoxy-[heme] (perfusive oxygen delivery) for pre (52.3±2.2 μM) and post passive heating (47.7±1.6 μM; p=0.02). However, the total-[heme] (diffusive oxygen delivery) was significantly lower following passive heating (p<0.001). Pre and post passive heating Δ total-[heme] was 75.1±13.8 μM and 30.7±13.3 μM, respectively. CONCLUSION: The significant decrease in Δ total-[heme] after passive heating suggests that the diffusion of oxygen into the exercising muscle was decreased. This finding, along with no change in the perfusive oxygen delivery as represented by the Δ deoxy-[heme], suggests that the oxygen uptake of the exercising muscle was decreased.
A wet bulb globe temperature (WBGT) policy with suggestions for practice modifications can potentially help decrease the number of exertional heat illnesses (EHI) reported in high school football. It is unknown what impact such a policy would have on the number of outdoor football practices that would be cancelled or modified. **Purpose:** To assess WBGT during a full season of football at various high schools in Florida to determine how a regional WBGT policy would have impacted football practices. **Methods:** Environmental data was collected daily throughout the duration of the regular football season by athletic trainers stationed at 10 high schools in west central Florida. WBGT measures were recorded at approximately 4PM (R1) and again at 6PM (R2) to correspond with practice start and end times. These measures were then allocated into 5 previously defined, regional WBGT categories which corresponded to different activity modifications ranging from no modifications the duration of the regular football season by athletic trainers stationed at 10 high schools in Florida to determine how a regional WBGT policy would have impacted football practices.

Under current Federation Internationale de l’Automobile (FIA) rules, in endurance sports car racing, if ambient temperatures inside the cockpit of a racing car exceed dangerously elevated WBGT was not limited to preseason practices in August. Finally, the cancellation of outdoor practices on only a few days. It is also clear that the risk of performance declines on an individualized basis. This investigation was partially funded by Kent State University Research Council.

**RESULTS:** Significant correlations were observed between water intake with Tcore (r = 0.469, p = 0.003) and Twb (r = 0.511, p = 0.001), though no significant correlation was observed for Tsk (p = 0.059). Time spent with a Tcore above 35°C related to total water intake (r = 0.521, p = 0.001), though no critical Tre temperature was observed. TTE performance was significantly correlated with and Twb (r = -0.338; p = 0.036), but not with Tcore (p = 0.179) or Tsk (p = 0.058). Time spent with a Tcore above 37°C and Twb above 38°C was related to TTE performance (r = 0.409; p = 0.010; r = 0.481; p = 0.002, respectively). **Conclusions:** Data indicate that total water intake is driven by Tcore and likely not influenced by TTE performance, however, is influenced by both Tcore and Twb. Future research should focus on establishing critical body temperatures to determine the points at which performance declines on an individualized basis. This investigation was partially funded by Kent State University Research Council.

**METHODS:** Four male racing drivers had heart rate (HR), core temperature (Tcore), and physiological strain index (PSI) measured continuously during over 38 driving sessions including testing, practice, qualifying and a race.

**RESULTS:** Cockpit temperature elicited a positive relationship, with each measured variable (slope ± SE, r2, p-value); HR (1.842 ± 0.0165, 0.62, <0.001), Tcore (0.08519 ± 0.00273, 0.32, <0.001), PSI (0.1899 ± 0.00706, 0.24, <0.001). There were no significant differences in slope with AC on or AC off when compared in each variable. HR with AC on (1.867 ± 0.0191) displayed no significant difference to AC off (1.784 ± 0.0137, p = 0.1332). Tcore with AC on (0.8546 ± 0.002751) exhibited no change compared to AC off (0.7572 ± 0.01899, p = 0.6118). Lastly, PSI with AC on (0.1910 ± 0.003055) showed no difference with AC off (0.1561 ± 0.06305, p = 0.5828).

**CONCLUSIONS:** Air conditioning systems that are administered through the driver’s helmet do not change the thermal strain caused by an increase in cockpit temperature. This includes that the FIA’s current use of cockpit temperature remains the most accurate way to estimate the thermal strain on the driver.
The heat tolerance test (HTT) assesses cardiorespiratory and thermoregulatory capacity during heat stress using heart rate (HR) and core temperature (T_core) as pass/fail criteria. Additional information regarding physiological stress and heat tolerance may be derived from the physiological strain index (PSI), which provides a singular physiological strain value using HR and T_core measurements. To our knowledge, the change in PSI during the physiological strain index (PSI), which provides a representation for classifying heat tolerance/intolerance during HTT. PURPOSE: The purpose of this study was to establish a criterion threshold for ΔPSI and report on its ability to classify heat tolerance/intolerance during an HTT. METHODS: Seventy-seven US military men (age: 25 ± 5 yr, ht: 178.5 ± 7.1 cm, wt: 84.8 ± 10.1 kg) completed up to 120 min of continuous treadmill walking (3.3 mph, 4.0% grade) in 40°C and 40% relative humidity and were classified for their heat tolerance (n = 64) or heat intolerance (n = 13) using an independent sample t-test. A maximal normal accepted value for ΔPSI was calculated by taking the mean value of ΔPSI for HT subjects plus two standard deviations. RESULTS: ΔPSI was significantly less in HT subjects than in HI subjects (0.54 ± 0.64 vs 1.95 ± 0.72; p < .001). For HT subjects, a ΔPSI maximal accepted value was determined to be 1.82. CONCLUSION: Findings indicate that ΔPSI appropriately differentiated HT from HI subjects during an HTT in this population of military personnel. Therefore, we report that exceeding a ΔPSI of 1.82 may serve as an additional criterion for classifying heat intolerance during HTT. Further work on the validation of this maximal normal accepted value for ΔPSI is needed.

Purpose: The high intensity (HI) exercise stimulates greater heat production than moderate intensity (MI) exercise, but also reduces perceptual thermal sensitivity. Thus, thermal behavior may differ between HI and MI exercise. We tested the hypothesis that thermal behavior is greater during HI compared to MI exercise and recovery. METHODS: In a 27.0 ± 0.4°C, 21.3 ± 2% RH environment, 20 subjects (10 females) cycled for 30 min at MI (53 ± 6% VO2peak) and HI (78 ± 6% VO2peak), followed by 120 min seated recovery. Mean skin (10 site) and core (intestinal) temperatures, mean skin wettedness (8 site), neck device temperature, skin blood flow and local sweat rate (ventilated capsule) were measured continuously. RESULTS: There were no sex differences in heat production during exercise (F: 3.99 ± 6.8, M: 429 ± 62 W/m², p = 0.39). During exercise, core and mean skin temperatures, skin wettedness, skin blood flow and local sweat rate increased, while neck device temperature decreased (all p < 0.01). There were no sex differences in core (F: 37.7 ± 0.2, M: 37.9 ± 0.3°C, P = 0.50), mean skin (F: 32.6 ± 0.3, M: 32.6 ± 0.7°C, P = 0.99) or neck device (F: 12.1 ± 10.6, M: 11.9 ± 10.2°C, P = 0.25) temperatures, mean skin wettedness (at 30 min: F: 0.50 ± 0.06, M: 0.53 ± 0.04 au, P = 0.99), skin blood flow (F: 163 ± 50, M: 172 ± 36 PU, P = 0.99) or local sweat rate (F: 0.72 ± 0.20, M: 0.85 ± 0.27 mg/cm² min, P = 0.33) during exercise (data reported at 30 min). During recovery, core and mean skin temperatures, mean skin wettedness, skin blood flow and local sweat rate decreased, and neck device temperature increased back towards pre-exercise levels (all P < 0.01). There were no differences in the dynamics of these changes between sexes (all P ≥ 0.16). Conclusions: Thermal behavior during and following high intensity aerobic exercise does not differ between males and females.

This study was funded by lululemon athletica inc.
Purpose: The purpose of this investigation was to examine the recruitment of classical monocytes during prolonged aerobic exercise in high temperature and humidity conditions. METHODS: Seven recreationally active men (23.4 ± 3.0 yrs; 180.9 ± 5.8 cm; 85.1 ± 11.3 kg; 3.7 ± 0.27 kg·m⁻¹·h⁻¹) completed five trials: a graded exercise test, and four cycling trials in 37°C/23% Relative Humidity (RH)(HTH), 37°C/35%RH (HTM), 24°C/38%RH (MTM), and 24°C/51%RH (MTTH) in a counterbalanced fashion. During the exercise protocol, participants rested supine for 15 minutes before completing 60-min of cycling at 60% VO₂max, a 15-min rest, and cycling until exhaustion at 90% VO₂max (TTE), before 60 minutes of recovery. Blood samples were collected before exercise (PRE), after 60 minutes of cycling (60H), after the TTE (90H) and following one hour of recovery (REC). Blood was assayed for plasma concentrations of Monocyte Chemoattractant Protein 1 (MCP-1) via ELISA, and CCR2 expression on classical monocytes (CD14++CD16-) via flow cytometry. Briefly, CCR2 expression was determined as fold change over fluorescence minus one (FMO). Data were analyzed using within-subjects repeated measures ANOVA. RESULTS: A main effect for time was observed (F = 8.9; p < 0.003; η² = 0.506) for MCP-1 in circulation. MCP-1 increased from PRE (183.8 ± 59.7 pg·mL⁻¹) to 60 (215.8 ± 74.1 pg·mL⁻¹; p = 0.009), 90 (231.6 ± 83.8 pg·mL⁻¹; p = 0.006), and REC (216.0 ± 88.3 pg·mL⁻¹; p = 0.019). Concentrations also increased from 60 to 90 (p = 0.018). A main effect of time was also observed (F = 11.6 ± 0.009; η² = 0.659) for CCR2 expression on classical monocytes. No differences in CCR2 expression were observed between PRE (147.4 ± 50.6), and 60 (146.0 ± 70.8; p = 0.869), however decreases from PRE were observed at 90 (131.1 ± 39.7; p = 0.023), and REC (102.2 ±37.1; p = 0.001). CONCLUSION: These data indicate that high temperature and/or humidity conditions do not impact recruitment of classical monocytes. Furthermore, prolonged cycling appears to increase circulating MCP-1 and decrease CCR2 expression on classical monocytes. Collectively, this may indicate a limited effect of aerobic exercise on the overall recruitment of classical monocytes, although further research is warranted. This investigation was partially funded by the Kent State University Research Council.

**Purpose:** The purpose of this study was to examine metabolic recovery response during seated rest in a hot and moderate environmental condition after a prolonged cycling bout. **Methods:** Eleven recreationally active men (23.6 ± 2.6 yrs; 180.9 ± 6.8 cm; 85.3 ± 10.8 kg; 3.8 ± 0.42 lm·min⁻¹) completed a recovery session under two conditions: 22°C/45%RH (MT) and 35°C/45%RH (HT). Prior to recovery session, each participant completed a 60-min cycling trial at 60% VO₂max and a time-to-exhaustion trial at 90% VO₂max. Data were collected during the 3min (M3), 15min (M15) 30min (M30), and 60min (M60) of the 60-min recovery. Metabolic variables assessed were VO₂, RER, VE, and HR. Data were analyzed using within-subjects repeated measures ANOVA. RESULTS: A significant interaction was observed for VO₂ (F = 2.788; p = 0.043; η² = 0.258). Post-hoc analysis indicated a main effect of time during the VO₂ (F = 8.097; p < 0.001; η² = 0.503), but not HT condition (F = 2.433; p = 0.065; η² = 0.213). Specifically, during the MT, VO₂ was significantly lower at M15 (p < 0.001), M30 (p = 0.015), M45 (p < 0.001) and M60 (p < 0.001) compared to M3. Furthermore, VO₂ was significantly lower during the HT condition at M15 (p = 0.003), M30 (p = 0.001), M45 (p < 0.001) and M60 (p < 0.001) compared to MT. No significant interaction was observed for VE (F = 1.384; p = 0.261; η² = 0.148). A significant main effect of time was observed (F = 11.818; p < 0.001; η² = 0.596). M15, M30, M45, and M60 were significantly lower compared to M3 (p < 0.05). No significant interaction was observed for RER (F = 1.566; p = 0.207).
2090 Board #246 May 30 2:00 PM - 3:30 PM Wireless Real-Time Transistor-Based Skin Temperature Data Acquisition System
Audrey Johnson, Nisha Charkoudian, FACSM. USAIEM, Natick, MA. (Sponsor: Nisha Charkoudian, FACSM)

Environmental physiology studies rely on the accurate measurement of skin and internal temperatures. Many traditional skin temperature systems utilize thermistor or thermocouple measurements. However, utilizing a transistor-based sensor allows for a more linear data set, which could provide more stability, thus allowing for a more robust and accurate measurement over a range of environmental conditions. Field Programmable Gate Arrays (FPGA) are relatively low cost and low power consuming programmable hardware devices that allows for a signal to be processed and viewed in real time. Combining the processing power of the FPGA and the heightened accuracy of transistor-based analog temperature sensors, a modernized data acquisition (DAQ) system could provide linearized real time data. PURPOSE: To design and build a prototype wireless transistor-based skin temperature DAQ system that will provide a more accurate and linear set of data for measurement in hot/humid/cold/altitude environments, and will be sufficiently robust for outdoor field studies.

METHODS: We designed and built a prototype wireless transistor-based skin temperature DAQ that implements a precision analog temperature sensor to acquire skin temperature and FPGA technology for signal processing. The tested accuracy for the precision analog temperature sensor is ±0.05-0.1°C in a temperature range of 20°C to 42°C. By utilizing FPGA technology, the system will process, pack, and wirelessly send data to a computer for real time monitoring.

RESULTS: In preliminary testing, the FPGA system showed an overall lower power consumption in addition to less variability in Voltage (V), the signal upon which temperature measurements depend. Over a 5°C temperature change it was seen that the FPGA system had a variance of 3.7*10^-11 V, while a thermometer based system had a variance of 1.3*10^-3 V. In most settings, this result will in a substantially lower power consumption using our new system.

CONCLUSION: Our data suggest that our new FPGA approach is superior to traditional skin temperature measurements in its ability to rapidly attain and maintain accurate temperature readings. Next steps include field testing the device over a wide range of temperature, wind and humidity conditions.

Funded by USAMRMC; author views not official US Army or DOD policy.

2091 Board #247 May 30 2:00 PM - 3:30 PM Prefrontal Cortex Oxidation and Haemodynamics during a Long Duration Incremental Exercise Protocol while Wearing Personal Protective Equipment
Lynnette Stuart-Hill,1 Cory Coechno,1 Patrick Neary,2 Olave Kirgolson,1 1University of Victoria, Victoria, BC, Canada. 2University of Regina, Regina, SK, Canada.

PURPOSE: To design a wireless patch-type transistor-based skin temperature DAQ system that will provide a more accurate and linear set of data for measurement in hot/humid/cold/altitude environments, and will be sufficiently robust for outdoor field studies.

METHODS: We designed and built a prototype wireless transistor-based skin temperature DAQ system that implements a precision analog temperature sensor to acquire skin temperature and FPGA technology for signal processing. The tested accuracy for the precision analog temperature sensor is ±0.05-0.1°C in a temperature range of 20°C to 42°C. By utilizing FPGA technology, the system will process, pack, and wirelessly send data to a computer for real time monitoring.

RESULTS: In preliminary testing, the FPGA system showed an overall lower power consumption in addition to less variability in Voltage (V), the signal upon which temperature measurements depend. Over a 5°C temperature change it was seen that the FPGA system had a variance of 3.7*10^-11 V, while a thermometer based system had a variance of 1.3*10^-3 V. In most settings, this result will in a substantially lower power consumption using our new system.

CONCLUSION: Our data suggest that our new FPGA approach is superior to traditional skin temperature measurements in its ability to rapidly attain and maintain accurate temperature readings. Next steps include field testing the device over a wide range of temperature, wind and humidity conditions.

Funded by USAMRMC; author views not official US Army or DOD policy.
Participating in marathons in hot and humid weather may lead to fatigue, syncope, injury or even death. In the diagnosis and monitoring of delayed onset muscle soreness and fatigue status, infrared thermography (IRT) has been used as a non-invasive method for the assessing skin temperature as a response of muscle hyperthermia after exercise.

**Purpose:** Analyze the effect of running a marathon in a hot and humid environment on skin temperature.

**Methods:** Seventeen amateur runners (age: 35.82 ± 7.03 years, weight: 66.79 ± 11.97 kg, height: 168.44 ± 10.59 cm, VO2peak: 52.88 ± 7.90 ml/kg/min) had their lower limb skin temperature measured using trough IRT (FLIR T450) after running a marathon (80-80 m.a.s.l.) in a hot (thermal index 28.34 ± 3.27 °C) and humid environment (~81%), the measures were taken in a temperature controlled room (23°C). Both dominant (D LL) and non-dominant (ND LL) lower limbs were divided for analyses into fourteen different areas and mean temperature of each area was used for analysis. A one-way ANOVA were used to compare thermal images taken 15 days and before marathon and 24 hours after marathon.

**Results:** We found significant differences in skin temperatures: knee (DLL: F(1,16) = 5.14, p = 0.004); Vastus lateralis (DLL: F(1,16) = 7.191, p < 0.01; ND LL: F(1,16) = 4.885, p = 0.003); Rectus femoris (DLL: F(1,16) = 5.956, p < 0.002; ND LL: F(1,16) = 5.521, p = 0.002); Vastus medialis (DLL: F(1,16) = 5.079, p = 0.004; ND LL: F(1,16) = 7.214, p < 0.001); Adductor (DLL: F(1,16) = 4.097, p < 0.01; ND LL: F(1,16) = 5.702, p = 0.002); biceps femoris (DLL: F(1,16) = 18.952, p < 0.01; ND LL: F(1,16) = 15.105, p < 0.01); popliteal fossa (DLL: F(1,16) = 11.103, p < 0.01; ND LL: F(1,16) = 11.598, p = 0.003); semitendinosus (DLL: F(1,16) = 14.382, p < 0.01; ND LL: F(1,16) = 15.060, p = 0.001); lateral gastrocnemius (DLL: F(1,16) = 15.007, p < 0.001; ND LL: F(1,16) = 10.316, p < 0.01); and medial gastrocnemius (DLL: F(1,16) = 7.567, p = 0.01). Significant differences in all areas mentioned were found between measures: pre 15d < post 24h, pre marathon < post 24h y post 24h > post 6d.

**Conclusions:** Running a marathon in hot, humid environment leads to significant increases in lower limb skin temperature and the temperature levels returned to baseline values after 6 days of recovery.
Evidence tying ultraviolet (UV) light exposure to endogenous vitamin D synthesis presents a possibility for naturally enhancing serum testosterone via endogenous vitamin D.

**PURPOSE:** 1) Determine the effect of an acute bout of UV light exposure on post-resistance exercise serum testosterone in older men and 2) to investigate whether serum testosterone was influenced by endogenous vitamin D. **METHODS:** Six older adult men (age 62.1±7.9 yrs., height 179.9±1.12 cm., body mass 83.7±9.12 kg., BMI 25.95±1.15 kg/m²) participated in two identical resistance exercise sessions followed by a 30-minute recovery. Two minutes apart and 5-minute exercise interval consists of 4 sets of 10 repetitions of leg press, chest press, and back row with one minute of rest between sets. After the second exercise session, participants were exposed to an UV light source during the first 10 minutes of recovery. Serum testosterone and vitamin D were measured pre- and post-resistance exercise in 5-minute increments during the 30-minute recovery. **RESULTS:** Exercise alone did not significantly affect serum testosterone or vitamin D. Exercise combined with acute UV light exposure significantly increased serum testosterone area under the curve (p<0.05) but did not significantly alter serum vitamin D. **CONCLUSION:** These findings suggest that acute UV light exposure may positively impact serum testosterone response following a single bout of resistance exercise in older adult men.

**2099** Board #255 May 30 3:30 PM - 5:00 PM

**The Effects of Acute Ultraviolet Light Exposure on Post-Resistance Exercise Serum Testosterone in Older Men**

Alex Wallace, Shuyan Emanjomeh, Luis Segura, Josh A. Cotter, PhD, Evan E. Schick, PhD. California State University, Long Beach, Long Beach, CA.

No relevant relationships reported.

Salivary cortisol (Cₜ) represents the free cortisol concentration of serum cortisol (Cₛ). It has been suggested that Cₜ is approximately 5-10% of total Cₛ, however, the impact of diurnal variation in Cₜ and how this pattern affects the proportion of Cₜ relative to Cₛ at each time point. Multiphase growth models with varying fixed/random coefficients were tested and compared (AIC). The final cubic growth model controlled for condition and freely estimated the intercept, velocity, and acceleration terms while the initial trajectory of Cₛ was fixed across all individuals. **RESULTS:** The IQR of Cₛ was 3.56-6.29%. The greatest Cₛ values were consistently observed during nighttime sampling with the magnitude of Cₛ being greatest at 2300hrs. The cubic growth models were determined to best-represent 24-hr changes in Cₛ. The final model showed a significant effect for exercise (β = 1.37, p = 0.036; AIC = 1030.781). **CONCLUSION:** The greatest Cₛ at 2300hrs appears to be driven primarily by elevations in Cₛ. This shift may be influenced by night time cortisol secretion interactions with binding proteins, alterations in salivary flow rate, or salivary gland enzymatic activity. Exercise appears to influence Cₛ dynamics, especially during late afternoon and nighttime hours. It is therefore recommended that cortisol profiles be constructed from both total and free Cₛ for the most accurate monitoring of the HPA-axis, especially within an exercise context.
Low muscle strength and decline in the power are associated with low walking speed and with mobility limitations, disabilities and falls among older populations. Whether menopause per se accelerates decline in physical performance in women and in this way contributes to functional limitations in later years remains controversial.

**PURPOSE:** The aim of this study was to examine changes in physical performance in women aged 47 to 55 following the menopausal transition. **METHODS:** This longitudinal study is a part of the Estrogenic Regulation of Muscle Apoptosis study. Women aged 47 to 55 were randomly selected from the Finnish National Registry (n=678) and perimenopausal women (n=228) were followed until postmenopausal. The baseline menopausal status was defined based on menstrual cycle diary and follicle stimulating hormone (FSH) level. The progression of menopausal transition was followed at three-to-six months intervals for early perimenopausal and late perimenopausal women, respectively. When FSH >30 IU/L was recorded, the measurement was repeated within two-to-four weeks and if FSH was determined in two consecutive blood samples to be elevated and no bleeding had occurred in past 6 months participant was considered to be postmenopausal. To capture a comprehensive understanding of the physical performance, measures of muscle power (vertical jump), muscle strength (grip and knee extension), aerobic capacity (6 min walking distance), and walking speed were carried out. **RESULTS:** A significant decline in hand grip force (−2.9 % (95%CI −4.5, −1.1; d=0.20) in knee extension force for −3.1% (95%CI −4.8, −1.3; d=0.23) and in vertical jumping height for −3.2 % (95%CI −4.6, −1.7; d=0.28) was observed following the menopausal transition. Walking distance significantly increased by 1.9 % (95%CI 1.2, 2.7, d=0.38) while in walking speed changes were 0.24 % (95%CI −1.1, 1.6; d=0.02) non-significant. **CONCLUSIONS:** The menopausal transition influences muscle strength and power, whereas the influence on mobility was less evident and may follow after. Supported by the funding from the European Union’s Horizon 2020 research and innovation Programme under the Marie Skłodowska-Curie grant agreement No75003, and by the Academy of Finland (ERMA study grant agreement 275322).

**2102**

**Board #258**

**May 30 3:30 PM - 5:00 PM**

**Effect of the Menopausal Transition on Physical Performance: A Longitudinal Study**

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Vitamin D deficiency, defined as total hydroxyvitamin D (25(OH)D) <50 nmol/L, is associated with poor bone health, impaired muscle function and increased risk of some diseases. The biologically active form of vitamin D is dihydroxyvitamin D (1,25(OH)2D), but there is emerging evidence that the relative proportion of some diseases. The biologically active form of vitamin D is dihydroxyvitamin D is associated with poor bone health, impaired muscle function and increased risk.

**2103**

**Board #259**

**May 30 3:30 PM - 5:00 PM**

**The Relationship Between Oral Contraceptive Use With Total Hydroxyvitamin D And Its Metabolites In Young Adult Women**

Julie P. Greves1, Jonathan CY Tang1, Sarah Jackson1, Neil P. Walsh, FACSM2, Rachel M. Izard3, William D. Fraser2. 1Army Headquarters, Andover, United Kingdom. 2University of East Anglia, Norwich, United Kingdom. 3Bangor University, Bangor, United Kingdom. 4Army Recruiting and Initial Training Command, Upavon, United Kingdom. (Sponsor: Professor Neil Walsh, FACSM)

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Several studies have investigated markers for exercise-induced fatigue. Physical and mental fatigue induces a secretion of salivary cortisol, and this hormone affects muscle strength and power, whereas the influence on mobility was less evident and may follow after. Supported by the funding from the European Union’s Horizon 2020 research and innovation Programme under the Marie Skłodowska-Curie grant agreement No75003, and by the Academy of Finland (ERMA study grant agreement 275322).

**2104**

**Board #260**

**May 30 3:30 PM - 5:00 PM**

**Changes in Salivary Cortisol and Iga Levels are Associated with Fatigue after Acute Endurance Exercise.**

Natsuka Hashizume1, Natsuki Hasegawa1, Naoki Horii1, Maki Yoshikawa1, Katsunori Tsuji1, Masatake Uchida1, Keiko Iemitsu1, Takeshi Hashimoto1, Kiyoshi Sanada1, Masao Kanamori1, Kohei Watanabe1, Motoyuki Iemitsu2, 1Ritsumeikan University, Kusatsu, Japan. 2National Cancer Center Research Institute, Tokyo, Japan. 3Chukyo University, Aichi, Japan. (No relevant relationships reported)
and sex-specific standard deviation scores (SDS) using the CDC growth charts. In athletes with >1 examination, generalized estimating equations were used for repeated measures analyses of height SDS changes over time.

RESULTS: Data on 2,287 athletes were available, of which 693 had >1 height measurement and formed the study population (70.4% males, mean age 11.5±2.4 years, range 6-18, from 46 sport types). The median duration between the first and last examinations was 1.9 years (IQR 0.99-2.93 years) with a maximum of 9.3 years. Height SDS was not significantly changed throughout the follow-up period in the total cohort (0.13 per year, 95%CI -0.42-0.03, p=0.51), see Figure. In subgroup analyses, no significant change in height SDS was seen among athletes aggregated from classic height-advantageous sports (basketball, volleyball, tennis and swimming, p=0.73), basketball players (p=0.84) or gymnasts (p=0.24). No significant change in height SDS over time was seen when participants were stratified by first measurement age (<9, 9-12, 12+ years) and sex.

CONCLUSIONS: In this large cohort of pediatric athletes with repeated physical examinations, competitive sports were not associated with significant changes in body height relative to age. This finding remained true regardless of age at first measurement and sex, as well as when focusing on sports with typically tall or short statures. Competitive sports do not seem to hinder growth in children.

2107 Board #263 May 30 3:30 PM - 5:00 PM
The Effect Of FTO rs9969309 Polymorphism On Body Composition In Chinese adults
Chunbo Qin1, Xi Jin2, Ji Li1, Daixi Xie1, Xin Zhao3, Mark Loftin, FACSM1. 1The University of Mississippi, University, MS. 2The Sixth Hospital of Shenzhen, Shenzhen, China. 3The University of Mississippi, University, MS. (No relevant relationships reported)

The FTO (fat mass and obesity associated) gene, the first common obesity susceptibility gene in a Caucasian population, was reported by GWAS (genome-wide association studies) in 2007. PURPOSE: The aim of this study was to explore the effect of genotypes of FTO rs9969309 polymorphism on body composition related traits in Chinese adults. METHODS: Forty-three Chinese adults aged from 19 to 55 years old (32 males and 11 females) were recruited from Shenzhen University and a running club of local community. The subjects participated in physical activity at least three times per week with thirty minutes each session. Body composition related traits, including body weight (BW), hip circumference (HC), abdomen circumference (AC), waist-hip ratio (WHR), percentage of body fat (PBF), fat mass (FM), fat free mass (FFM) and body mass index (BMI), were analyzed by bioelectrical impedance analyzer (BI-380 in Beijing Achenway Company). The genotypes of FTO rs9939609 were analyzed by the Beijing Genomics Institute. One-way ANOVA was used to compare between genotypes and body composition related data. RESULTS: There were three genotypes (TT, AT and AA) in rs9939609 polymorphism, in which 24 individuals with TT genotype, 16 individuals with AT genotype and 3 individuals with AA genotype. The body composition related traits, including HC, AC, BMI and FM, were significantly lower in TT genotypes than those in AA genotypes (p=0.017, p=0.004, p=0.002, p=0.006, respectively), and were significantly lower in TT genotypes than those in AT genotypes (p=0.025, p=0.010, p=0.041, respectively). Also, there was a significant difference only between TT and AA genotypes in WHR (p=0.015). No significant differences were found in the three genotypes with BW, PBF and FFM. CONCLUSION: The results indicate differences in several body composition parameters regarding the FTO rs9969309 polymorphism in a small sample of Chinese adults.

2108 Board #264 May 30 3:30 PM - 5:00 PM
The Association Between Mct1 T1470a And Ace I/d Polymorphisms And Athletic Status In Climbing Athletes
Mika Saito, Jou Takahira, Sakura Daiku, Souichiro Miyachi, Naoki Kikuchi. Nippon sport science university, Tokyo, Japan. Email: sa123ka.v@gmail.com (No relevant relationships reported)

Previous studies have shown a relationship between MCT1 T1470a polymorphism and blood lactate concentration during and after high-intensity intermittent exercise. In addition, the I allele seems associated with endurance-orientated events, while the D allele seems like to be the opposite with power-orientated events. In addition, the I allele seems associated with endurance-orientated events, while the D allele seems like to be the opposite with power-orientated events in the ACE I/D polymorphism. Sports climbing also required muscle power and endurance performance, therefore we hypothesis that MCT1 T1470A and ACE I/D polymorphisms associated with athletic performance in climbing athletes.

PURPOSE: To investigate the effects of the MCT1 T1470A and ACE I/D polymorphisms on athletic achievements (national or regional level) in climbing athletes.

METHODS: Sixty-nine climbers (49 men and 20 women) were genotyped for the MCT1 T1470A genotype (rs1049434) and ACE I/D (rs4341) using the TaqMan®Assay. All climbers were assigned to two groups (35 national level climbers and 34 regional level Climbers) based on their results of competitions. The MCT1 T1470A genotype was associated with athletic performance in climbing athletes. The MCT1 T1470A and ACE I/D genotypes may provide useful information (e.g., talent selection and genotype-based customization for training) for athletes, especially well-trained men and their strength and conditioning coaches and sports coaches.

Abstracts were prepared by the authors and printed as submitted.
Association Between Mitochondrial DNA Sequence, Heteroplasmy, And Indels With Response To Aerobic Exercise Training

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(No relevant relationships reported)

PURPOSE: Aerobic exercise training provides numerous biological and physiological health benefits towards the prevention and treatment of various chronic diseases. However, not all individuals increase cardiorespiratory fitness (CRF) with exposure to a given dose of aerobic training: some individuals are highly trainable and increase CRF, while others respond poorly. Genetic background is known to contribute to interindividual variation in adaptations to aerobic training. Our current understanding of genetics and exercise is limited primarily to the nuclear genome as only a few laboratories have investigated the role of the mitochondrial genome. The purpose of this study was to determine whether mitochondrial DNA (mtDNA) sequence, heteroplasmy, and indels differed among individuals previously characterized as elite endurance athletes, and high- or low-responders to aerobic training.

METHODS: DNA was isolated from whole blood in healthy subjects part of the GENATHLETE (world class endurance athletes; n=15) and HERITAGE (CRF response levels: high responders n=15; low responders n=15) study cohorts. mtDNA was amplified by long-range polymerase chain reaction, then tagged with Nextera libraries and sequenced on a MiSeq instrument. Unique mtDNA sequence variants were called when at least two individuals in a group had the variant.

RESULTS: Compared to athletes and high-responders, low-responders had unique mtDNA single nucleotide polymorphisms (SNPs) in D-loop (displacement-loop) hypervariable region (HVR) 2 at positions 72, 152, 185, 188, 228, 295, 462, and 489. Of the HVR2 positions, position 188 was unique only to low-responders. Indels were unique to athletes and high-responders and located in D-loop HVR1 (16179, 16182, 16188, 16192), HVR2 (302), and HVR3 (567) positions. mtDNA Heteroplasmy was not different between groups.

CONCLUSIONS: Our results highlight an area of the mitochondrial genome responsible for DNA replication and transcription that may contribute to an individual’s ability to improve CRF with aerobic training. Ongoing work aims to 1) confirm present findings in low responders through increasing sample size from the HERITAGE cohort, and 2) test for interactions between mitochondrial and nuclear genomes associated with response to a given dose of aerobic training.

Board #265 May 30 3:30 PM - 5:00 PM

Circulating DNA As A Monitoring Tool In Professional Soccer


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(No relevant relationships reported)

PURPOSE: Player monitoring in elite sports settings is becoming increasingly important. Questionnaires or biomarkers, such as circulating, cell-free DNA (cfDNA) are possible approaches for load monitoring. cfDNA concentrations were shown to increase dependent on total distance covered in soccer and cfDNA was associated with overtraining in weightlifters. Thus, the purpose of this study was to examine whether cfDNA is feasible as a monitoring tool in elite soccer Players.

METHODS: Capillary blood from 22 elite male soccer players was collected on 40 time points during 4 months of a regular season. Moreover, 2 time points during pre-season were included. Blood samples were drawn on the day before and on days after season games. Players filled in a Visual-Analogue-Scale (VAS) including the items ‘general perceived exertion’ and ‘muscular fatigue’. Performance was recorded by a GPS based (training) or a camera based (games) tracking system.

RESULTS: We observed a significant increase in mean cfDNA concentrations from the start of pre-season to the end of pre-season (p=0.02). Moreover, cfDNA concentrations were significantly elevated in players on the day after regular season games (1.4-fold; p<0.001) in line with the VAS scores. cfDNA showed significantly higher values during weeks that included an additional midweek game (1.3-fold; p=0.001). While cfDNA concentrations correlated with performance data of the training, the VAS scores were correlated with the tracking of the season games. However, cfDNA concentrations and VAS scores did not significantly correlate with each other.

CONCLUSIONS: Here, we show that cfDNA concentrations at rest and VAS scores are influenced by previous load in professional soccer players. Moreover, a higher load due an additional midweek game led to significantly higher cfDNA concentrations. Future studies will reveal the full potential of cfDNA as a monitoring tool for player load in soccer Players.

Board #267 May 30 3:30 PM - 5:00 PM

A Genome-wide Association Study For Muscle Fiber Composition

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(No relevant relationships reported)

PURPOSE: To perform a genome-wide association study for MF composition and to validate the results in additional studies using sport-related phenotypes. METHODS: MF composition of M. vastus lateralis in 168 physically active healthy Russian subjects (55 females, 113 males) was evaluated with immunohistochemistry. The case-control study involved 214 elite Russian athletes (89 sprinters, 49 strength and 84 endurance athletes). Twenty male wrestlers participated in the Wingate anaerobic test. Micro-array analysis (for detection of 700 K - 1.1 M single nucleotide polymorphisms (SNPs)) or whole-genome sequencing (wrestlers only) was used for genotyping. RESULTS: We first identified 929 SNPs that were associated (P<0.05) with the proportion of fast-twitch MF both in males and females. Next, we found that of the 929 SNPs, 37 variants were associated with sprinter athlete status (i.e. alleles associated with increased proportion of fast-twitch MF were over-represented in sprinters compared to endurance athletes). Of those, sprint-related alleles of 4 SNPs (rs7669580, rs1247330, rs2048968, rs2369665) were also over-represented in strength athletes (vs endurance athletes). Only rs7669580 SNP located in the LDB2 gene (encodes cytoskeletal protein) was found to be associated with the relative peak power in wrestlers. CONCLUSION: We have identified the A allele of the LDB2 rs7669580 SNP that was associated with increased proportion of fast-twitch MF (P=0.00046), ability to become a sprinter (P=0.021) or a strength athlete (P=0.016) and increased peak power of wrestlers (P=0.0187). The study was supported by Grant 17-15-01436.

Board #268 May 30 3:30 PM - 5:00 PM

Genetic Modulation of Hypothalamic Pituitary Adrenal Function in Specialized Military Men

Marcus K. Taylor, FACSM1, Lisa M. Hernández1, D Christine Laver2, Douglas A. Granger3, Naval Health Research Center, San Diego, CA. ‘University of California, Irvine, Irvine, CA. (No relevant relationships reported)

Hypothalamic-pituitary-adrenal (HPA) hormone profiles are informative mediators of health status. Existing studies link candidate genetic variants in the corticosteroid and serotonin systems to basal cortisol function in diverse populations. Potential connections of such variants to the HPA end-product, dehydroepiandrosterone (DHEA), is essentially unexamined and virtually nothing is known of their effects in military populations. PURPOSE: To determine whether candidate genetic variants in the mineralocorticoid receptor (MR [i.e., −2CG]), glucocorticoid receptor (GR [i.e., BclI]), and serotonin transporter (i.e., 5HTTLPR, triallelic version) modulate daily HPA function (cortisol and DHEA) of specialized military men. METHODS: Seventy-three elite military men were studied (mean ± SE age = 33 ± 2.0 yrs). Salivary cortisol and DHEA were collected on 2 consecutive weekdays at awake, wake + 30 min, awake + 60 min, 1600, and 2100. TaqMan® genotyping assays were performed for BclI and −2CG. Variable number tandem repeats analysis were conducted for 5HTTLPR. Unique and combined associations of the genetic variants were assessed with respect to daily patterns of salivary cortisol and DHEA. RESULTS: Homozygous GG carriers of −2CG had higher DHEA concentrations across the day in comparison to C carriers (F11, 55) = 8.7, p = 0.005. Homozygous SS carriers of 5HTTLPR had higher DHEA concentrations of −2C/G had higher DHEA concentrations across the day in comparison to C carriers (F11, 55) = 8.7, p = 0.005). Homozygous SS carriers of 5HTTLPR had higher DHEA concentrations of −2C/G had higher DHEA concentrations across the day in comparison to C carriers (F11, 55) = 8.7, p = 0.005).
Combined effects on DHEA patterns: -2CG + 5HTTLPR (interaction effect, F(7,3, 126.3) = 3.7, p < .001), -2CG + BCI (group effect, F(3, 53) = 4.2, p = .01), and 5HTTLPR + BCI (interaction effect, F(7.8, 134.8) = 3.7, p < .001). Salivary cortisol profiles were not modulated by candidate variants. CONCLUSION: Whereas MR’s affinity for cortisol and aldosterone is well researched, the link between -2CG and DHEA helps to resolve equivocal literature regarding MR’s potential compatibility with DHEA. Also, the connection between 5HTTLPR and DHEA implies the signaling between serotomeric and HPA systems extrapolates beyond the primary end-product, cortisol. Finally, this study demonstrates that genetic modulation of salivary DHEA profiles is additive, if not synergistic.

In endurance athletes, chronic mechanical stress to tendon and ligament induces local inflammation, leading to tendon and ligament injuries. Type 1, 5, and 12 collagen is the major structural component of tendon and ligament and other component is type 3 and 6 collagen. Several studies identified the relationship between tendon or ligament injuries and collagen gene polymorphisms such as, rs1800012 in COL1A1, rs12722 and rs3196378 in COL5A1, rs1800255 in COL3A1 and rs35796750 in COL6A1. However, effect of tendon and ligament inflammations on collagen-related gene polymorphism remains unclear in Japanese endurance athletes. PURPOSE: This study aimed to clarify whether single nucleotide polymorphisms (SNPs) within the collagen genes were associated with the incidence of tendon and ligament inflammations in Japanese male endurance athletes.

METHODS: Twenty-four Japanese elite male long-distance runners participated in a cross-sectional study. All subjects were investigated the onset number of tendon and ligament inflammations in the student period of the university by using a questionnaire. Significant SNPs were genotyped by the Taqman assay and the genotype distributions were analyzed using the Hardy-Weinberg equilibrium (X2). The effect of incidence of tendon and ligament inflammations among genotype groups was analyzed by the χ2 test. The statistical significance level was set at p < .05.

RESULTS: Subjects had GG genotype of rs1800012 in COL1A1 gene. The onset number of tendon and ligament inflammations in the student period of the university by using a questionnaire. Significant SNPs were genotyped by the Taqman assay and the genotype distributions were analyzed using the Hardy-Weinberg equilibrium (X2). The effect of incidence of tendon and ligament inflammations among genotype groups was analyzed by the χ2 test. The statistical significance level was set at p < .05.

CONCLUSIONS: These results suggest that SNPs of rs12722 and rs3196378 in COL5A1 gene and rs1800255 in COL3A1 gene may affect incidence of tendon and ligament inflammations in Japanese male endurance athletes. Supported by Grants-in-Aid for Scientific Research (17H01282 and 16K13059, M. Iemitsu).

To the best of our knowledge, the pertaining sources of information on the Potassium Voltage-Gated Channel Subfamily A Member 4 (KCNA4) gene do not evidence a single study evaluating the possible association between its genotypic and allelic frequencies with endurance performance. PURPOSE: We tested the hypothesis of an association between the prevalence of the genotypic and allelic frequencies distribution of the KCNA4 gene rs1323860 (C/T transition) and endurance performance level in Hispanic male marathon runners (MR). METHODS: The present is an observational study following a genetic epidemiology model using a case-control design. The subjects (n=1876) were adult Hispanic male MR. Fast-MR (Cases; n=938) were between cases and controls. Odds ratio revealed that the C allele was 1.33 times more likely prevalent in the cases than in the controls (95% CI: 1.17, 1.51; P<0.001). The magnitude of the statistical power for the present study was 0.86. CONCLUSIONS: The findings strongly suggest that KCNA4gene rs1323860 (C/T transition) is auxiliary in the complex phenotype of increased running performance level in Hispanic male marathon runners.

Introducing cell-free DNA (cfDNA) has emerged as an important target for liquid biopsies including performance diagnostics. Extracellular vesicles (EVs) are important mediators of cell-to-cell communication and are presented to deliver bioactive material, such as proteins, lipids and nucleic acids, via the circulation. The ability of EVs to transport DNA and, thus, contribute to the pool of cfDNA is controversially discussed. Purpose: To gain more detailed information of the release mechanisms of cfDNA during physical exercise by estimation of the proportion of cfDNA associated with EVs. Methods: Platelet-free plasma was collected prior and immediately after an incremental cycling test to exhaustion from a single healthy male athlete. Using size exclusion chromatography (SEC), two ml of plasma were separated into 16 fractions of 1 ml. cfDNA concentration in plasma and SEC fractions was measured by direct quantitative real-time PCR of the L1PA2-repeat sequence with or without prior treatment of the fractions with DNasel. To take pre-analytical considerations into account, the analysis was performed on freshly prepared plasma in a technical duplicate, and frozen SEC fractions. Vesicular fractions 4 to 7 were defined by the presence of the genuine EV markers CD9 and CD63 as well as the platelet-EV marker CD41b in western blot analysis. Results: Plasma cfDNA concentration increased from 14.05 ng/ml plasma Pre to 157.01 ng/ml Post the cycling test. The amount of DNA, recovered in differently prepared SEC samples (fraction 1-16), was 8.8 ± 0.9 ng in the pre samples and 108.8 ± 22.8 ng post samples. The run of the cfDNA curve in the SEC samples was very similar in the pre and post samples (r = 0.90, 95% CI: 0.82-0.94, p<0.001). In the vesicular fractions (SEC 4-7) 23.8 ± 1.9 % of the recovered DNA occurred. DNAasel treatment only slightly decreased the amount of DNA in fractions (4-7) from 2.18 ± 0.15 ng to 1.72 ± 0.52 ng in the Pre samples and from 24.9 ± 7.0 to 20.3 ± 0.4 ng in the Post samples. In the remaining SEC fractions 79.9 ± 6.4 % of the DNA was digested. Conclusion: About 24% of the cfDNA in human plasma occurs in the vesicular Sec fractions. The larger amount seems to be independent of EVs and is prone to DNasel digest. Further experiments are required to clarify if the DNA is inside of EVs or on the outside, protected from DNasel.

Athletic training education program directors (PDs) are often tasked with setting the tone of their curriculum and prioritizing items of focus for students. Given the current attention on concussion, it is important to understand PDs’ concussion knowledge and strategies for decision making. PDs personal strategies may influence educational content and student practices, implicating clinical practices for new athletic trainers (AT). PURPOSE: To determine whether educator-identified prioritized symptoms for removing an athlete from play align with common concussion-related symptoms experienced by athletes. METHODS: PDs from 32 professional-level athletic training education programs (n = 25 undergraduate; age = 43.8 ± 8.2 yrs experience = 21.1 ± 9.2) completed a validated survey examining concussion knowledge and the three symptoms most likely to cause them to remove an athlete from play. Participants responded to questions regarding symptoms and consequences of concussion on the
scale of 1 (definitely not a symptom/consequence) to 4 (definitely is). Total knowledge was summed for a possible range of 25-100. RESULTS: PDs’ concussion knowledge was moderate (81.1 ± 6.7), primarily due to lack of confidence (“probably” vs. “definitely” is a symptom/consequence) in some items as opposed to being incorrect. The primary symptom reported by PDs as indicating necessary removal from play was headache (n = 23/32) followed by a three-way tie (n = 14/32 each): 1) amnesia/trouble remembering, 2) trouble understanding/confusion, and 3) visual disturbances. Dizziness was the third most common symptom removed from play (n = 11/32). Previous literature supports headache as the most common symptom experienced by athletes, then dizziness and difficulty concentrating. Although after headache, most common symptoms may vary; however, memory problems, confusion, and visual disturbances are typically reported as some of the most common symptoms.

CONCLUSION: These data suggest that in general, PDs are prioritizing the most common symptoms experienced by their players for their removal from play decisions. Thus, encouraging as it suggests that PD’s knowledge on key symptoms is appropriate. Future research should further investigate the role AT knowledge and symptom prioritization plays on content in educational programs.

2117 Board #273 May 30 3:30 PM - 5:00 PM No Effect Of Randomizing Concussion Symptom Presentation On Symptom Number Or Severity Reporting Kathryn L. O’Connor, Lauren Dougherty, Griffin J. Feinberg, Andrew Lapointe, Steven Broglio, FACSM, University of Michigan, Ann Arbor, MI. (Sponsor: Steven P Broglio, FACSM) Email: kloconn@umich.edu (No relevant relationships reported)

Purpose: Concussion symptom evaluations are the most common tool used by clinicians to diagnose an injury. However, the most common post-concussion symptoms reported are also the symptoms that appear first on the Standardized Concussion Assessment Tool (SCAT) symptom list. The purpose of the current study was to evaluate whether SCAT symptom order influenced symptom reporting in healthy young adults with and without a prior concussion.

Methods: Previously concussed and non-concussed young adults completed a survey consisting of demographics, medical history, and SCAT symptoms. Participants were randomized to either complete the original SCAT form or the SCAT with randomized symptom order. Since the individuals were healthy, many participants reported zero symptoms. Thus, logistic regression and zero inflated negative binomial models compared the symptoms scores of the first 5 SCAT symptoms to determine whether presentation order influenced symptom reporting. The first five symptoms evaluated were headache, pressure in the head, dizziness, neck pain, and nausea.

Results: A total of 13 (n = 6 Female) participants completed the surveys who had an average age 25.07 ± 4.73. Participants who completed the randomized SCAT consisted of 2 females (33.3%), 5 males (71.4%), there was no significant effect of sex on likelihood of receiving the randomized SCAT order (p > 0.05). Three participants (60.5%) out of five with a concussion completed the randomized SCAT order. There was a significant effect of prior concussion on likelihood of receiving the randomized SCAT order (p < 0.05). The logistic regression and zero inflated negative binomial models yielded no significant effect of SCAT order on the likelihood to report symptoms or the severity of symptoms (all p’s > 0.05).

Conclusions: In this small sample size of health young adults, SCAT symptom presentation does not appear to influence symptom reporting or severity. Follow up analyses should evaluate for this effect in a larger sample and in acutely concussed individuals.

2118 Board #274 May 30 3:30 PM - 5:00 PM Adult Perception of a Child’s Sport Concussion Risk Allyssa K. Memmni1, Kathryn L. Van Pelt,1 Alissa H. Wicklund,2 Steven P. Broglio, FACSM1. 1University of Michigan, Ann Arbor, MI. 2Orthopaedic and Spine Center of the Rockies, Fort Collins, CO. (Sponsor: Steve Broglio, FACSM) (No relevant relationships reported)

Purpose: With increased media coverage on sport-related concussions (SRC), there has been a growing concern about the risks associated with contact sports. Previous literature reports a decrease in participation numbers stemming from increased perceptions of concussion risk in contact sports such as football. The purpose of this study was to evaluate the effect of adult perception and perception of their child’s concussion risk while participating in contact sports. We hypothesized that adults with a medical background would be more educated about the consequences of SRC, and thus would be less inclined to choose high-contact contact sports participation for their own children compared to those without medical backgrounds.

Methods: Data were collected through an anonymous electronic Qualtrics survey administered to faculty and staff at a large west university and associated medical center between 2017 and 2018 (n=5849, age=39.51±13.802 years). Respondents indicated their gender, age, highest degree awarded, whether or not they were a medical professional, and in what sports they would allow their children to participate. Sports were subdivided into four categories (high-contact, partial-contact, non-contact, and all of the above) and analyzed using chi-square tests, followed by a logistic regression to investigate any differences between professional categories and rate of selection of high-contact sports.

Results: Preliminary chi-square tests indicated no difference between medical (MP) and non-medical professionals (NMP) and the four sport subdivisions (x²=5.58, p=0.03). Between-group nominal logistic regression was non-significant (p=0.20) in examining the interaction of profession and selection of sports. More specifically, there was insignificance between professions and likelihood of choosing high-contact sports (p=0.092).

Conclusion: Initial analyses suggest no difference in the choice of sport participation among children with parents in medical and non-medical backgrounds despite an increased attention on concussion in recent years. Future analyses will investigate the specific sports chosen, as well as additional covariates such as parental sport participation and concussion history.

2119 Board #275 May 30 3:30 PM - 5:00 PM Changes in Fixational Eye Movements following Concussion Anthony P. Kontos1, Bianca T. Leonard1, Valerie C. Snyder1, Cyndi Holland1, Min Zhang1, Ethan S. Bensinger2, Christy K. Sheehy1, Michael W. Collins1, Ethan A. Rossi1. 1University of Pittsburgh, Pittsburgh, PA. 2UC Berkeley, Berkeley, CA. 3UCSF, San Francisco, CA. (Sponsor: Matthew Ganio, FACSM) Email: akontos@pitt.edu (No relevant relationships reported)

Concussions can affect smooth pursuit, saccadic, and vergence eye movements. Fixational eye movements (FEMs) - the small, involuntary motion of the eye that occurs while focusing on a target - are affected by Alzheimer’s, Parkinson’s, and mild cognitive impairment. However, little is known about changes in FEMs following concussions.

Purpose: To compare FEMs in concussed patients to controls using a retinal image-based eye tracking device.

Methods: Participants included 50 patients with a concussion and 39 age- and gender-matched controls aged 13-27 years. FEMs were measured with a tracking scanning laser ophthalmoscope (TSLO) that tracks retinal image motion at 480 Hz with accuracy of <0.2 arcmin. Eye traces were analyzed offline to compute microsaccadic amplitude, peak velocity, and peak acceleration. Fixational spread, using bivariate contour ellipse area (BCEA), intersaccadic intervals, blink rate, and total blink time were also analyzed. Concussed patients completed the Vestibular Oculomotor Screening (VOMS), Post-concussion Symptom Scale (PCSS), and Immediate Post-Concussion Assessment and Cognitive Test (ImPACT) for comparison with FEMs.

Results: Microsaccades were larger (amplitude – controls: 0.397° SD: 0.32, concussion: 0.597° SD: 0.45; p <0.001) and faster (peak velocity: control: 27.9°/sec SD: 22.2; concussion: 39.7°/sec SD: 30.3; p=0.001; peak acceleration: control: 6.27°/sec² SD: 9.29; concussion: 9.47°/sec² SD: 14.1) in concussed participants. Although concussed patients and controls made equal numbers of microsaccades during a 30 sec recording, concussion patients had a greater proportion of larger, faster microsaccades - with 19% more microsaccades at amplitudes greater than 0.75° and 22% more microsaccades ≥30°/sec. The BCEA was 221% larger in concussed patients (0.56°) compared to controls (0.26°).

Conclusions: These findings support changes in FEMs following concussion as measured using retinal image-based eye tracking. Microsaccades in concussed patients were larger in amplitude, peak velocity, and peak acceleration compared to controls. Specifically, fixation is less precise, with a larger spread (i.e., increased BCEA). Retinal imaging and eye-tracking of FEMs may be useful in identifying and monitoring recovery following concussion.
Fourteen participants (n=6 CON 22.87 ± 2.13 years, 3.16 ± 2.14 concussions, 4.49 ± 1.66 years from concussion, n=8 NC 26.42 ± 5.25 years) completed the 2-Minute Walk (2Walk), and Timed Up and Go (TUG) gait tasks while equipped with 10 IMU’s. Exclusion criteria included any orthopedic injuries in the past year or condition that impedes gait, or the ability to jump. Additionally, control participants were excluded if they presented with any concussion history. Independent t-tests were utilized to examine the relationship between concussion history and motor function utilizing turn velocity, angle acceleration, as well as double support gait percentage and TUG duration. For all TUG variables, the results from the participants’ three trials were averaged before computation. Results: There was a significant difference amongst groups for turn duration (p<0.01), turn velocity (p=0.04), during the TUG gait task. Additionally, there was a significant difference for percentage of gait cycle in double support for the 2Walk (p=0.011). Turn velocity was faster for the concussed participants (mean CON = 0.74 sec; NC = 0.79 sec) while turn duration was shorter (mean CON = 1.66 ± 0.1sec, NC = 1.90 ± 0.13 sec) compared to controls. Concussed participants spent approximately 3.5% less of their gait cycle in double support during the 2Walk. However, no significant differences were noted in turn velocity and duration in the 2Walk task. Conclusion: Preliminary findings show altered gait and turning strategies among those with a concussion history. These differences may be explained by concussion history. Alternatively, differences in activity levels and sporting experience may also contribute. Future analyses will reassess these changes in addition to other kinematic metrics as sample size increases.

**Board #277 May 30 3:30 PM - 5:00 PM**

**Interrater And Intrarater Reliability Of The Standard Assessment Of Tackling Technique (SATT) On Secondary School Football Athletes**

Scott Dietrich1, Braden Lawson2, Jane McDevitt1. Kansas State University, Manhattan, KS. 

**Purpose:** To evaluate interrater and intrarater reliability of the SATT.

**Methods:** Fifteen healthy subjects were videotaped while performing a tackle during a training session. Of this study was to evaluate interrater and intrarater reliability of the SATT. Five critical elements of an American football tackle are each rated on a four-point scale from 1 (poor) to 4 (excellent). Interrater reliability was assessed by two raters, following a 45 minute training session and more experienced raters. Intrarater reliability was measured by two raters, following a 45 minute training session and more experienced raters. Additionally, control participants were excluded if they presented with any concussion history. Independent t-tests were utilized to examine the relationship between concussion history and motor function utilizing turn velocity, angle acceleration, as well as double support gait percentage and TUG duration. For all TUG variables, the results from the participants’ three trials were averaged before computation. Results: There was a significant difference amongst groups for turn duration (p<0.01), turn velocity (p=0.04), during the TUG gait task. Additionally, there was a significant difference for percentage of gait cycle in double support for the 2Walk (p=0.011). Turn velocity was faster for the concussed participants (mean CON = 0.74 sec; NC = 0.79 sec) while turn duration was shorter (mean CON = 1.66 ± 0.1sec, NC = 1.90 ± 0.13 sec) compared to controls. Concussed participants spent approximately 3.5% less of their gait cycle in double support during the 2Walk. However, no significant differences were noted in turn velocity and duration in the 2Walk task. Conclusion: Preliminary findings show altered gait and turning strategies among those with a concussion history. These differences may be explained by concussion history. Alternatively, differences in activity levels and sporting experience may also contribute. Future analyses will reassess these changes in addition to other kinematic metrics as sample size increases.

**Board #278 May 30 3:30 PM - 5:00 PM**

**Effects Of 3D Multiple Object Tracking On Head Impacts During A Collegiate Ice Hockey Season**

Anna Sessa, Daniel Antonoff, Jordan Goss, Taylor Langevin, Christopher G. Neville1, Michael VanNostrand1, Andrew Brandile2, Brian Rieger1. Upstate Medical University, Syracuse, NY. 

**Purpose:** To determine the concurrence reliability and validity of the XLNTbrain Balance Test compared to the BESS.

**Methods:** Thirty-seven physically active participants (15 males, 22 females, 20.73 ± 2.02 yrs, 169.60 ± 10.28 cm, 70.12 ± 14.15 kg) completed the BESS and XLNTbrain Balance Test in a counterbalanced order. A subset of the sample (n=33) repeated the tests one week later. Concurrent validity was established through correlation analysis examining the relationship between scores on the BESS and XLNTbrain Balance Test. Reliability was established using paired-samples t-tests and Intraclass Correlation Coefficients (ICC3,1) computed for the BESS and XLNTbrain Balance Test.

**Results:** A significant moderate relationship was found between the total scores of the Balance and XLNTbrain Balance Test (r=0.41, p=0.008), and between the firm tandem stance condition of the BESS and the eyes closed tandem stance condition of the XLNTbrain Balance Test (r=0.41, p=0.013). There were no statistically significant differences in scores between testing sessions for the BESS total score (Time 1: 16.44 ± 8.01, Time 2: 16.4 ± 6.38, t26 = 1.64, p=0.11), or the XLNTbrain total score (Time 1: 12.85 ± 5.89, Time 2: 14.77 ± 10.30, t26 = -1.02, p=0.31). There was a moderate reliability score for the BESS total score (ICC3,1 = 0.54, p<0.005) and a low reliability score for the XLNTbrain Balance Test (ICC3,1 = 0.17, p=0.17).

**Conclusions:** Although the XLNTbrain Balance Test appears to demonstrate moderate concurrent validity against the BESS, it did not demonstrate improved reliability. Future research should determine if the XLNTbrain Balance Test demonstrates validity against force plates. Additionally, the sensitivity of the BESS and XLNTbrain Balance Test to the effects of concussion should be explored.

**Board #280 May 30 3:30 PM - 5:00 PM**

**Balance And Cognitive Recovery Following Concussion Injury Is Associated With Initial Symptom Severity**

Christopher G. Neville1, Michael VanNostrand1, Andrew Brandile2, Brian Rieger1. Upstate Medical University, Syracuse, NY. 

**Purpose:** To determine the concurrence reliability and validity of the XLNTbrain Balance Test compared to the BESS.

**Methods:** Thirty-seven physically active participants (15 males, 22 females, 20.73 ± 2.02 yrs, 169.60 ± 10.28 cm, 70.12 ± 14.15 kg) completed the BESS and XLNTbrain Balance Test in a counterbalanced order. A subset of the sample (n=33) repeated the tests one week later. Concurrent validity was established through correlation analysis examining the relationship between scores on the BESS and XLNTbrain Balance Test. Reliability was established using paired-samples t-tests and Intraclass Correlation Coefficients (ICC3,1) computed for the BESS and XLNTbrain Balance Test.

**Results:** A significant moderate relationship was found between the total scores of the Balance and XLNTbrain Balance Test (r=0.41, p=0.008), and between the firm tandem stance condition of the BESS and the eyes closed tandem stance condition of the XLNTbrain Balance Test (r=0.41, p=0.013). There were no statistically significant differences in scores between testing sessions for the BESS total score (Time 1: 16.44 ± 8.01, Time 2: 16.4 ± 6.38, t26 = 1.64, p=0.11), or the XLNTbrain total score (Time 1: 12.85 ± 5.89, Time 2: 14.77 ± 10.30, t26 = -1.02, p=0.31). There was a moderate reliability score for the BESS total score (ICC3,1 = 0.54, p<0.005) and a low reliability score for the XLNTbrain Balance Test (ICC3,1 = 0.17, p=0.17).

**Conclusions:** Although the XLNTbrain Balance Test appears to demonstrate moderate concurrent validity against the BESS, it did not demonstrate improved reliability. Future research should determine if the XLNTbrain Balance Test demonstrates validity against force plates. Additionally, the sensitivity of the BESS and XLNTbrain Balance Test to the effects of concussion should be explored.
Purpose: To examine the association between objective and subjective measures during recovery from concussion injury. The primary hypothesis is to describe changes in cognition, balance, and symptom severity over a one month timeframe following concussion injury. A secondary hypothesis is that symptom severity at time of injury will be associated with objective measures during the recovery period.

Methods: Fifty-one young adults (18.01±5.96 years old) who recently sustained a concussion completed a battery of four cognitive tests, eight balance tests, and a 22 item symptom report using a commercially available concussion assessment tool (Clearview, Quadrant Biosciences Inc; Syracuse, NY). All subjects completed test 1, on average, 5.45 ± 3.53 days after injury, and test 2, 23.06 ± 10.92 days following test 1. Group comparisons (repeated measures ANOVA or T-Test) and effect sizes (Cohen’s d) were used to compare recovery across time. To address the secondary hypothesis, those within the group reporting low symptom severity (symptoms <10; n=18) and high symptom severity (symptoms > 40; n=14) were compared.

Results: Across the sample, symptom severity at initial testing ranged from 0-89. Statistically significant differences between test 1 and 2 were seen for all cognitive tests (p<0.001) and 1 of the 8 balance tests (p<0.028). When comparing symptom severity groups, significant differences (p<0.05) at the first testing session were seen on 3 cognitive tests and 2 balance tests. No differences were seen between groups at test 2. The low symptom severity group had no changes in cognitive or balance scores between test 1 and 2. The high symptom group had large effects sizes towards improvement on Tandem Stance Eyes Closed (d=1.16), and Simple Reaction Time (d=1.36).

Conclusion: Symptom severity is associated with objective measures of balance and cognition during the recovery period. The low symptom group appears to have reached full recovery prior to initial testing. The high symptom group showed signs of initial testing with large changes in cognitive and balance performance at re-test.
Skeletal muscle function (MF), skeletal muscle mass (SMM) and arterial stiffness are independent risk factors for all-cause mortality and cardiovascular events. Decreases in SMM are negatively associated with arterial stiffness, however, the relationship in SMM is largely unknown. PURPOSE: To examine the relationship between arterial stiffness and CRF in apparently healthy adults. METHODS: Two hundred three subjects—97 men (aged 50±21 years) and 106 women (aged 47±20 years)—visited the Human Performance Lab to complete one round of testing. Each performed a maximal cardiopulmonary exercise test to determine CRF (i.e., VO2peak). Aortic stiffness was measured via carotid-femoral pulse wave velocity (cPWV). Data were checked for normality, and Pearson product moment correlations were performed to determine the association between CRF and arterial stiffness. RESULTS: VO2peak for the entire cohort was 3.2±1.0 L/min (range: 1.9–4.5 L/min). The mean BMI of our patients had a VO2peak below the 5th percentile of a matched healthy population of our patients had a VO2peak below the 5th percentile of a matched healthy population of women. MF was assessed through dual-energy X-ray absorptionmetry (DXA), while grip strength was measured with a hand dynamometer. Relationships for the entire cohort were analyzed using Pearson correlations between cPWV, SMM, and MF. RESULTS: Inverse associations for the entire cohort were observed with MF and cPWV (r = −0.343, p < 0.001) while SMM was not associated with cPWV (p > 0.05). All associations remained significant when divided into groups based on sex (p < 0.05). CONCLUSIONS: These data suggest that muscle function, specifically handgrip strength, but not SMM are associated with arterial stiffness irrespective of sex. Interventions to improve arterial health should target muscle function itself rather than skeletal muscle mass.

**REFERENCES**

*Laboratory data, drug therapy and history of infectious events were collected. The results of the study analysis were obtained with multivariate regression models. RESULTS: 157 KTRs (age 51±13 years, 64% men) were included in this study, with a mean BMI of 24.2±3.3 Kg/m2, Glomerular Filtration Rate of 57±19 mL/min/1.73m2, and hemoglobin concentration of 123.5±16.7 g/L. During a mean follow-up period of 33 months after the CPET, at least one infectious event occurred in 72 subjects (46%). The mean VO2peak of the entire population was 25.6±6.9 L/min, corresponding to 81.3±21.6% of the VO2peak predicted for age and gender. 14.7% (n=22) of our patients had a postexercise VO2peak below the 5th percentile of a matched healthy population based on the FRIEND study results. This subgroup demonstrated an increased risk of infectious events with a Hazard Ratio of 2.11 (CI 95%, 1.19-2.73, p=0.01), which was independent of age, hemoglobin and immunosuppressant regimen. CONCLUSION: To our knowledge, this is the first clinical study associating a poor cardiopulmonary fitness with a higher risk of infectious events in KTRs. It can be speculated that an improved cardiopulmonary fitness, obtained by specific aerobic exercise training, may thus reduce infectious events and improve prognosis in this specific population.

**CONCLUSIONS:**

The air displacement plethysmography (CE = 0.1%, TE = 3.2%) and BIA (CE = -0.3%, TE = 8.2%). CONCLUSION: These findings indicated that the air displacement plethysmography and BIA methods provided acceptable estimates of body composition when compared to hydrostatic weighing. The DEXA method, however, displayed large CE and TE values and thus was not an accurate measure of percent body fat.

**REFERENCE**

*Abstracts were prepared by the authors and printed as submitted.
The evaluations were performed in the follicular phase between the 9th and 11th day and in the luteal phase between the 19th and 21st day after the beginning of the menstrual cycle. Statistical analysis employed parametric tests with two-tailed p value set at 5%. **RESULTS:** At rest, HR was [supine: 64.12±8.2 bpm - 64.7±1.9 bpm, (p<0.05)] and [orthostatic: 82.6±3.4 - 82.1±3.4 bpm (p<0.05)] in the follicular and luteal phases, respectively. Chronotropic reserve was not different (p<0.05) during Follicular (86.4±2.2 bpm) and Luteal (86.9±3.8 bpm) phases. Also, absolute HRR, Δ% HRR and HRR Coefficient did not show any difference between both phases of menstrual cycle (p<0.05).

**CONCLUSIONS:** We concluded that HR responses during rest, maximal treadmill exercise and 5 minutes post-exercise were not affected by the menstrual cycles, even with all physiological changes that occur during Follicular and Luteal phases.

### Table: HRR Parameters during Rest and Exercise (bpm)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Follicular</th>
<th>Luteal</th>
<th>p</th>
</tr>
</thead>
<tbody>
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<td>HR&lt;sub&gt;initial&lt;/sub&gt; (bpm)</td>
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</table>

**Glycogen storage disease 3 (GSDIII)** is a rare inherited metabolic disorder caused by glycogen debranching enzyme (GDE) deficiency which primarily affects the liver, skeletal muscle and heart and results in muscle weakness and profound exercise limitation. Despite exercise intolerance being a major complication associated with the disease, the influence of GSDIII on aerobic capacity is largely unstudied. **PURPOSE:** To preliminarily describe the impact of GSDIII on aerobic capacity and investigate potential mechanisms responsible for any impairment. **METHODS:** In this descriptive study 5 patients (3 female) (39 ± 11 years) with GSDIII underwent an incremental cycle exercise test to volitional exhaustion. During exercise, breath-by-breath gas analysis was performed in the first 2-minute treadmill exercise work stage (2 mph, 0% grade). Patients were randomly assigned to combined exercise group (EX; n = 24) trained for 12-week or to a “non-exercise” control (CON; n = 21) group. The variables of vascular inflammatory markers, BP, PWA and PWV were measured in all the subjects before and after the 12-week combined exercise training. The 60 minute combined exercise program (aerobic exercise 1 time, strength exercise 2 times/week) was performed 3 times per week for 12 weeks, and the intensity was progressively increased every four weeks (1-4 weeks: RPE 12 to 13, 5-8 weeks: RPE 13 to 14, 9-12weeks: RPE 14 to 15).

**RESULTS:** The vascular inflammatory markers were as follows; WBC, CRP, fibrinogen (p<0.05) and fibrinogen (p<0.01) levels significantly increased in the CON. SBP showed interaction effect and significant difference in delta-value. CON. SBP showed interaction effect and significant difference in delta-value. CON. SBP showed interaction effect and significant difference in delta-value. CON. SBP showed interaction effect and significant difference in delta-value. The significant predictors of SBP were age (p<0.001), BMI (p<0.001), and the percentage drop in exercise calf muscle StO<sub>2</sub> (p=0.023), high sensitivity C-reactive protein (p=0.032), and glucose (p=0.033). Conclusion: Higher levels in pro-inflammatory vascular biomarkers, impaired calf muscle StO<sub>2</sub>, during exercise, and elevated blood glucose were independently associated with greater exercise pressor response in patients with symptomatic PAD. The clinical implication is that exercise and nutritional interventions designed to improve inflammation, microcirculation, and glucose metabolism may ameliorate the exercise pressor response in patients with symptomatic PAD. **Purpose:** The purpose of this study was to analyze the effects of a combined exercise training regimen on vascular inflammatory markers (WBC, CRP, fibrinogen) and arterial stiffness (blood pressure, pulse wave analysis and velocity) in elderly women. **Methods:** Forty-five healthy elderly female volunteers, aged 75.44 ± 5.30 years, were randomly assigned to combined exercise group (EX; n = 24) trained for 12-week or to a “non-exercise” control (CON; n = 21) group. The variables of vascular inflammatory markers, BP, PWA and PWV were measured in all the subjects before and after the 12-week combined exercise training. The 60 minute combined exercise program (aerobic exercise 1 time, strength exercise 2 times/week) was performed 3 times per week for 12 weeks, and the intensity was progressively increased every four weeks (1-4 weeks: RPE 12 to 13, 5-8 weeks: RPE 13 to 14, 9-12weeks: RPE 14 to 15).

**Results:** The vascular inflammatory markers were as follows; WBC, CRP, fibrinogen (p<0.05) and fibrinogen (p<0.01) levels significantly increased in the CON. SBP showed interaction effect and significant difference in delta-value. CON. SBP showed interaction effect and significant difference in delta-value. CON. SBP showed interaction effect and significant difference in delta-value. CON. SBP showed interaction effect and significant difference in delta-value. The significant predictors of SBP were age (p<0.001), BMI (p<0.001), and the percentage drop in exercise calf muscle StO2 (p=0.023), high sensitivity C-reactive protein (p=0.032), and glucose (p=0.033). Conclusion: Higher levels in pro-inflammatory vascular biomarkers, impaired calf muscle StO2, during exercise, and elevated blood glucose were independently associated with greater exercise pressor response in patients with symptomatic PAD. The clinical implication is that exercise and nutritional interventions designed to improve inflammation, microcirculation, and glucose metabolism may ameliorate the exercise pressor response in patients with symptomatic PAD.
this sport modality, favors athletes presenting morning types profile. There are no data about amateur triathletes chronotype, but probably there are also a high percentage of morning type, mainly because the training sessions occur even earlier, once amateurs need to work after the training. As the training sessions occur early in the morning, it is possible for morning-type athletes are able to develop higher intensity trainings and thus having better physiological adaptations. However, there are no data about chronotypes and physiological profile.

PURPOSE: Characterize the chronotype profile in a group of amateur competitors who participate in the Olympic distance triathlon race. Verify if there are association between chronotype profile and physical fitness in amateur triathletes.

METHODS: Thirty-nine men and six women who had subscribed to compete in the sixth stage of the 26o Troféu Brasil de Triathlon in the Olympic distance participated in this cross-sectional observational study. Participants were evaluated for anthropometric characteristics (body mass, height, and body composition through [DXA]), aerobic physical fitness (maximum oxygen consumption [VO2max], anaerobic threshold and respiratory compensation point, maximum aerobic velocity [MAV] and running economy [RE]). Chronotype profile was evaluated using Horne-Ostberg morning-eveningness questionnaire.

RESULTS: According to the chronotype questionnaire 66.7% of the volunteers (69.2% men and 50.0% women) were classified as morning profiles (22.2% definite morning and 44.4% as moderate morning) and only 6.7% were classified as evening profiles. There were no significant correlations between chronotype profiles and the physical fitness variables. CONCLUSIONS: Amateur triathletes show to comprise high proportions of morning-types, but the physiological profile is similar between the different existing chronotypes.

### 2137 Board #293 May 30 3:30 PM - 5:00 PM The Effect Of Time Of Day On Jump Potentiation In Distance Runners


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(No relevant relationships reported)

The Effect of Time of Day on Jump Potentiation in Distance Runners.

Time of day is a key factor that influences athletic performance. No study has specifically investigated the effect of early morning vs. late afternoon training on jump potentiation in distance runners. This is important because circadian rhythms and alterations in sleep patterns can affect training adaptations and athletic performance.

PURPOSE: To determine whether the time of day influence jump potentiation in distance runners. METHODS: We recruited 18 male runners that were divided into two groups: novice runners (NOV) with ≤3 years of racing experience (n=6; age 34.7±6.4) and experienced runners (EXP) with ≥3 years of experience (n=12; age 34.5±5.1). Chronotypes were identified using the Horne-Ostberg’s Morningness-Eveningness questionnaire and sleep quality was assessed with the Pittsburgh Sleep Quality Index. Counter movement jump (CMJ) was determined with the My Jump App. CMJ height was measured after 5 min warm-up and after 30 min test (70% HRR) on a treadmill at 8:00 am and 8:00 pm. Following the 30 min test, CMJ height was measured at 3, 6 and 9 minutes of recovery. RESULTS: The overall sleep quality of the athletes were poor (5.4±3.8, n=18). The NOV group were poor sleepers (5.6±3.6, n=6) whereas the EXP group were at the limit score to become poor sleepers (4.8±3.9, n=12). The majority (77.3%, n=14) of the runners were morning types and 22.2% (n=4) were intermediate types. CMJ height in the EXP group was increased at 0 min of recovery and was decreased to warm-up levels at 3, 6 and 9 min (p<0.01) during morning test. Interestingly, jump potentiation only occurred in the morning while no significant increases were observed in the evening in the EXP group (p=0.6). The NOV group had no changes in jump potentiation in both morning and evening tests. CONCLUSION: We conclude that jump potentiation could be only observed during morning in experienced distance runners probably because of their chronotypes.

### 2138 Board #294 May 30 3:30 PM - 5:00 PM Effects Of Time Restricted Feeding On Metabolism Depression And Circadian Rhythms


(No relevant relationships reported)

Time restricted feeding (TRF) is a form of intermittent fasting limiting the time to intake calories throughout the day. TRF has been shown to affect substrate concentration and utilization at rest and exercise. Changing patterns in substrate availability and utilization can have effects on metabolism, cognitive functioning and circadian rhythms. PURPOSE: The purpose of this study was to evaluate the effects of TRF on overall physiological functioning, specifically sleep, resting energy expenditure (REE), resting respiratory quotient (RQ), and likelihood of depression.

METHODS: A longitudinal design was used to examine physiological changes associated with four weeks of TRF among 34 healthy adults between the ages of 18-60 years. Sleep was evaluated via self-report and actigraphy, as well as given to participants starting at different times of day. REE and RQ were measured using a metabolic cart while subjects were in a fasted state. The Brief Anxiety and Depression Survey was administered, and each subject was given a score indicating their likelihood of depression at each testing session. Variable differences within subjects were determined using a repeated measures ANOVA or a paired samples T-test. RESULTS: A significant decrease in total sleep (p = 0.034) and BADS scores (p = 0.046) occurred between non-TRF and TRF. Analysis revealed that resting RQ values experienced a significant increase (p = 0.002) between testing periods. CONCLUSION: TRF may influence glucose utilization during rest. Past studies have shown that different forms of intermittent fasting, such as TRF, enable an organism to create more regulated circadian rhythms, allowing less reliance on glucose, resulting in benefits in prevention and treatment of various diseases. The results of the present study are in opposition of previous literature and may provide insight into how glucose utilization affects other physiological processes. Increased glucose utilization may have been a factor in the decrease in sleep and depression that was seen in the study. Future research is needed to verify if increased utilization of carbohydrates at rest influences changes of circadian rhythms and depression occurrence.

### 2139 Board #295 May 30 3:30 PM - 5:00 PM Circadian Phase Is Associated With Self-reported Chronotype In Young, Sedentary Adults

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(No relevant relationships reported)

Chronotype, which is an individual’s preferred timing of sleep and activity across the 24-hour day, is regulated by genetics, environmental exposure, and age. Chronotype is measured by subjective questionnaires that query the timing of daily behaviors. Late chronotype has been previously associated with lower levels of physical activity, higher body mass index (BMI), and increased risk of type 2 diabetes and the metabolic syndrome. A well-established measure of an individual’s circadian timing, or phase, is the onset of melatonin secretion measured in dim light conditions (dim light melatonin onset; DLMO). Despite previous investigations, the associations between DLMO and chronotype, as well as body composition, have not been fully elucidated in young, sedentary adults. PURPOSE: To examine the association between DLMO and chronotype; and the association between DLMO and measures of body mass in sedentary adults. METHODS: Fifty-two adults (19 male, 25.8 ± 6.0 y; BMI 26.1 ± 5.4 kg/m²; %Fat 34.2 ± 8.8%) participated in this study. All subjects were sedentary (~2 hrs weekly structured exercise), non-smokers, and did not use medication. Circadian phase was measured by DLMO (time of day when saliva melatonin ≥ 2 pg/mL) and %Fat was measured by total body DXA scanning. Pearson’s correlation analysis was used to determine if significant (p < 0.05) associations were observed between DLMO and chronotype (MEQ); and between DLMO and body composition measures in young, sedentary adults. RESULTS: Fifty-two adults (19 male, 25.8 ± 6.0 y; BMI 26.1 ± 5.4 kg/m²; %Fat 34.2 ± 8.8%) participated in this study. All subjects were sedentary (~2 hrs weekly structured exercise), non-smokers, and did not use medication. Circadian phase was measured by DLMO (time of day when saliva melatonin ≥ 2 pg/mL) and %Fat was measured by total body DXA scanning. Pearson’s correlation analysis was used to determine if significant (p < 0.05) associations were observed between DLMO and chronotype (MEQ); and between DLMO and body composition measures (BMI, %Fat). CONCLUSION: A significant decrease in total sleep (p = 0.034) and BADS scores (p = 0.046) occurred between non-TRF and TRF periods. No significant changes were observed between non-TRF and TRF periods in BMI (p = 0.887%). %Fat was significantly associated with BMI (r = -0.13) and MEQ (r = 0.66). The association between DLMO and chronotype, as well as with body composition measures, has not been fully elucidated in young, sedentary adults. Supported by the University of Kentucky Pediatric Exercise Physiology Laboratory Endowment, the University of Kentucky, and the NIH TL1TR001997 and UL1TR001998.

### 2140 Board #296 May 30 3:30 PM - 5:00 PM Social Jetlag Is Associated With Higher Evenness

Stephanie Witzel Esteves Alves, Olivia Francisco Antunes, Marcos Múncio-Neto, Hanna Karen Moreira Antunes. Universidade Federal de São Paulo, São Paulo, Brazil.

Email: stephanie.witzel@gmail.com

(No relevant relationships reported)

Currently, the social demands imposed by work, school and academic activities prevent youth and adults from maintaining an ideal sleep routine. This situation causes...
sleep restriction, reducing sleeping hours per night and leading to numerous health damages. This phenomenon has been conceptualized as social jetlag (SJL). **Purpose:** Investigate the association between chronotype and mood profile in presence of SJL of young adults. **Methods:** Participated in this study 68 male subjects (mean age 25.43±6.64 years, and BMI 24.59±4.25) and physically active. In a transversal study approved by our institutional ethics committee (n° 2.263.382), the subjects answered a sleep questionnaires battery composed by Pittsburgh Sleep Quality Index (PSQI), Morningness-Eveningness Questionnaire (MEQ), Munich Chronotype Questionnaire (MCTQ), Epworth sleepiness scale (ESS) and Brunel Mood Scale to determinate a mood profile (subscals: anger, confusion, depression, fatigue, vigor, tension). The SJL was categorized in accord to MCTQ results in 3 groups: a) No SJL (≤ 30 min), b) SJL until 1 h (31-60 min), c) SJL more than 1 h (>61 min). **Results:** The groups were compared, and no differences were found between all subscales of Brunel. Moreover, we didn’t find any differences regard the sleep quality and diurnal excessive sleepiness. On the other hand, the groups were different on sleep duration and chronotype. Longer SJL is associated to higher Evenness index (F(2,65)=7.48; p<0.001). **Conclusions:** Our findings suggest that the presence of SJL didn’t impact the volunteer’s humoral profile and longer SJL is associated to higher eveningness index.

**2141 Board #297**
May 30 3:30 PM - 5:00 PM
**Effects of Aerobic Physical Exercise Performed Under Hypoxic Conditions on Melatonin**

Valdir A. Lemos1, Ronaldo Vagner Thomazieli Dos Santos1, Hanna Karen Moreira Antunes1, Claus Behn2, Gines Viscor3, Fabio Lira1, Aline Caris1, Sergio Tufik1, Marco Julio De Mello1.
1 Federal University of São Paulo, São Paulo, Brazil. 2 Faculty of Medicine, University of Chile, Santiago, Chile. 3 University of Barcelona, Barcelona, Spain.

**Purpose:** The present study assessed whether aerobic physical exercise can influence melatonin in normoxia. However, there is controversy about the effects of exercise on the melatonin level in hypoxia, which is characterized by impaired sleep. **Methods:** This work evaluated the effects of aerobic physical exercise on melatonin under hypoxic conditions. **Results:** Forty healthy men were randomized into 4 groups: Normoxia (N) - 22.1±3.1 y, 69.1±1.1 kg); Hypoxia (H) - 23.2±2.1 y, 72.3±2.7 kg); Exercise under Normoxia (EN) - 26.1±3.2 y, 71.1±3.2 kg); and Exercise under Hypoxia (EH) - 24.1±3.1 y, 72.3±2.4 kg). The observation period for all groups was 36 hrs, beginning with a first night devoid of any intervention. The normobaric hypoxia condition was conducted in a room equipped for altitude simulation that can reach up to 4,500 m (normobaric chamber, CAT – Colorado Altitude Training™ / 12 CAT-Air Unit, USA). Aerobic exercise was performed by the EN and EH groups on a treadmill at 50% of VO2.peak for 60 minutes. Venous blood samples for the melatonin measurement were obtained on the 1st and 2nd days at 7:30 AM as well as on the 1st and 2nd nights at 10:30 PM. Data are reported as mean ± standard deviation. A repeated measures and one-way analysis of variance (ANOVA) followed by the Tukey’s post hoc test were used to detect significant differences between groups. The accepted significance level was p≤0.05. **Results:** On the 2nd night, melatonin was higher in the H group compared to the N group (48.3±2.2 vs. 26.1±1.1, p<0.05); low in the N group compared to the EH group (26.1±1.1 vs. ±59.2±2.1, p>0.05); low in the H group compared to the EH group (48.3±2.2 vs. ±59.2±2.1, p>0.05); and low in the EN group compared to the EH group (37.2±1.0 vs. ±59.2±2.1, p<0.05). On the 2nd day, melatonin was higher in the H group compared to the N group (39.1±3.1 vs. 28.1±2.1, p<0.05); low in the N group compared to the EH group (26.1±1.1 vs. 46.2±2.0, p<0.05); and high in the EH group compared to the H group (46.2±2.0 vs. ±39.1±3.1, p<0.05).

**Conclusions:** Hypoxia acutely increases melatonin. Diurnal remission of the nocturnal increase in melatonin seems to be delayed by hypoxia and to an even greater extent if acting together with exercise.

**2142 Board #298**
May 30 3:30 PM - 5:00 PM
**Investigations of Sleep Quality Disturbances and Its Associations with Respiratory Functions and Depression Level among Young Adults with Down’s Syndrome**

Ertugrul Safran, Hikmet Ucgun, Meltem Ramoglu, Hulya Nilgun Gurses, Bezmialem Vakif University, Istanbul, Turkey.

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Individuals with Down Syndrome (DS) have a broad range of respiratory problems. These problems are important cause of morbidity, mortality and may increase tendency to sleep disturbances. Also depression has been frequently reported in individuals with DS.

**Purpose:** To investigate of sleep quality disturbances and its associations with respiratory parameters and depression levels in young adults with DS.

**Methods:** 50 individuals with DS (28 male, 22 female; 21.5±3.39 year) were included in the study. Sleep quality components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction) evaluated with Pittsburgh Sleep Quality Index (PSQI). According to PSQI guidelines, good sleep quality is indicated by a composite score of <5 (possible total=21), and poor sleep quality by a score of >5. Forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and peak expiratory flow (PEF) values were recorded using with spirometry. Pearson correlation was used to relate variables.

**Results:** Sleep quality parameters, respiratory values and depression scores of participants showed in Table 1. A total of % 52 (n=26) of participants have poor sleep quality. % 10 of participants (n=5) in severely depressed status. We found significant correlations of sleep quality parameters (habitual sleep efficiency; sleep disturbances, total PSQI) to depression level (r=0.68, r>0.75;r=0.72, p<0.05). Significant correlations were found between PEF values and total PSQI scores; habitual sleep efficiency (r=0.86; r>0.69 p<0.05).

**Conclusions:** Our study suggest that sleep quality has a important effects on depression level. Also suggest that sleep quality and respiratory parameters are correlated, especially with PEF. All of this three parameters may affect each other. Further studies with bigger populations and controls needed for better results.

**Table 1. Values of Sleep Quality, Respiratory Functions and Depression Scale**

<table>
<thead>
<tr>
<th>Sleep Quality Parameters</th>
<th>Values(mean±standard deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep duration</td>
<td>0.47±0.28</td>
</tr>
<tr>
<td>Sleep latency</td>
<td>1.22±0.40</td>
</tr>
<tr>
<td>Subjective sleep quality</td>
<td>0.92±0.31</td>
</tr>
<tr>
<td>Habitual sleep efficiency</td>
<td>1.45±0.73</td>
</tr>
<tr>
<td>Sleep disturbances</td>
<td>0.97±(0.6)</td>
</tr>
<tr>
<td>Daytime sleep dysfunction</td>
<td>0.52±0.25</td>
</tr>
<tr>
<td>Use of sleep medications</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.1±0.23</td>
</tr>
<tr>
<td>Respiratory Parameters</td>
<td></td>
</tr>
<tr>
<td>Forced Expiratory Volume</td>
<td>64.83±20.11</td>
</tr>
<tr>
<td>Forced Vital Capacity</td>
<td>69.33±16.93</td>
</tr>
<tr>
<td>Peak Expiratory Flow</td>
<td>42.66±24.67</td>
</tr>
<tr>
<td>Self-Depression Scale</td>
<td>601±28.75</td>
</tr>
</tbody>
</table>
Elastic Band Resistance Training Effects on Strength and Sleep of Shift Workers

Marco T. de Mello, Diego A. Borba, Lucas A. Facundo, Fernanda V. Narciso, Andressa Silva. Universidade Federal de Minas Gerais, Belo Horizonte, Brazil. Email: tmello@demello.net.br

PURPOSE: To determine the effect of elastic band resistance training in strength, muscle mass and sleep of shift workers. METHODS: Twelve sedentary workers with weekly work schedule of 12 hours of work for 36 hours of rest (Age: 42.3±8.8 years, Body Mass Index: 27.6±3.7 Kg), performed 16 elastic band training sessions (2 sets until failed; 3 times by week, for 16 weeks). The initial training load was determined by color and/or number of elastic band test to 10RM (shoulder abduction and biceps curl) and 20RM to seated low row exercise. The push up exercise no used elastic band. In following training sessions, the participants were instructed to perform the four exercises in the maximal number of repetition possible each new session. The estimated arm muscle band, exercises repetition number and sleep (sleep-duration, sleep latency, sleep efficiency and slow wave sleep) were assessed pre and post-training. The sleep variables were determined by actigraphy technique for during seven days. The pre and post-tests comparisons were made using paired t-test. RESULTS: The arm muscle area, was improved after training (701.5±185.9 vs. 751.7±1723.625, p<0.05) as well as exercises repetition number (shoulder abduction: 10.3±0.6 vs. 22.3±4.7; push up: 11.2±3.2 vs. 19.8±6.7; seated low row: 20.2±1.0 vs 37±1.8; biceps curl: 10.2±0.6 vs. 23.7±7.7, p<0.001). There is no change in sleep variables after training (Sleep Duration: 386.3±36.7 vs. 384.6±43.8 min; Sleep Latency: 28.5±32.7 vs. 14.0±15.0 min; Sleep Efficiency: 86.7±7.7% vs. 86.5±7.5%; Weak after sleep onset: 34.4±22.2 vs. 38.3±23.7 min, p<0.05). CONCLUSIONS: Elastic band resistance training improved the strength and muscle mass of shift work without to change their sleep quality of shift workers. Supported by UFMG, FAPEMIG, FAPES-P estand CENPQ.

Impact Of Sleep Deprivation On Flexibility Performance

Fernanda Veruska Narciso, Beatriz M. Pereira, Andressa Silva, Mauro H. Chagas, Matheus M. Reis, Carlos Amaral Costa, Valdenio M. Brant, Lucas A. Facundo, Aline A. Cruz, Marco Tulio de Mello. Universidade Federal de Minas Gerais, Belo Horizonte, Brazil.

Purpose: To determine the effect of elastic band resistance training in strength, muscle mass and sleep of shift workers. METHODS: Twelve sedentary workers with weekly work schedule of 12 hours of work for 36 hours of rest (Age: 42.3±8.8 years, Body Mass Index: 27.6±3.7 Kg), performed 16 elastic band training sessions (2 sets until failed; 3 times by week, for 16 weeks). The initial training load was determined by color and/or number of elastic band test to 10RM (shoulder abduction and biceps curl) and 20RM to seated low row exercise. The push up exercise no used elastic band. In following training sessions, the participants were instructed to perform the four exercises in the maximal number of repetition possible each new session. The estimated arm muscle band, exercises repetition number and sleep (sleep-duration, sleep latency, sleep efficiency and slow wave sleep) were assessed pre and post-training. The sleep variables were determined by actigraphy technique for during seven days. The pre and post-tests comparisons were made using paired t-test. RESULTS: The arm muscle area, was improved after training (701.5±185.9 vs. 751.7±1723.625, p<0.05) as well as exercises repetition number (shoulder abduction: 10.3±0.6 vs. 22.3±4.7; push up: 11.2±3.2 vs. 19.8±6.7; seated low row: 20.2±1.0 vs 37±1.8; biceps curl: 10.2±0.6 vs. 23.7±7.7, p<0.001). There is no change in sleep variables after training (Sleep Duration: 386.3±36.7 vs. 384.6±43.8 min; Sleep Latency: 28.5±32.7 vs. 14.0±15.0 min; Sleep Efficiency: 86.7±7.7% vs. 86.5±7.5%; Weak after sleep onset: 34.4±22.2 vs. 38.3±23.7 min, p<0.05). CONCLUSIONS: Elastic band resistance training improved the strength and muscle mass of shift work without to change their sleep quality of shift workers. Supported by UFMG, FAPEMIG, FAPES-P estand CENPQ.
### MEDICINE & SCIENCE IN SPORTS & EXERCISE®

**Board #303 May 30 3:30 PM - 5:00 PM**

**Landing Mechanics And Muscular Strength Are Not Altered Following Acute Sleep Restriction**

Stuart Best, Reiley Bergin, Cheyenne DeRayment, Nicholas R. Heebner, Amanda C. Glueck, John Aft, FACSMM. *University of Kentucky, Lexington, KY. (Sponsor: John Aft, FACSMM)*

**Email:** stuart.best@uky.edu

(No relevant relationships reported)

**PURPOSE:** Inadequate sleep is associated with an increased risk of injury, however it is unknown what physical risk factors for injury are altered by inadequate sleep. We hypothesized that one night of sleep restriction would affect reaction times and landing mechanics but not leg strength. **METHODS:** Ten healthy subjects (5 males, 5 females, 21.3±3 yrs, 170±11.01m, 59.8±11.8kg) completed cognitive testing, strength testing and a series of jump assessments following 8 hours (well-rested, WR) or 3 hours sleep (sleep-restricted, SR) in a randomized crossover design. Subjects woke at the same time for each assessment and testing was conducted at the same time of day, in the same order, and separated by at least one week. Reaction time was assessed using the computerized Automated Neuropsychological Assessment Metrics (ANAM) assessment. Strength testing (isokinetic dynamometer-60°/s) included maximal knee extension (KE) and flexion (KF) strength for each leg. Subjects completed 5 trials of a double leg drop-landing task, as well as 5 trials on each leg of a single leg drop-jump task. Peak knee flexion angles (PKK) were captured using 3D motion capture. Vertical ground reaction forces (VGRF) for each leg were captured with two force mounted force plates. **RESULTS:** There were no significant differences between conditions for reaction time (p=0.894), or KE (p=0.882, p=0.568) and KF (p=0.295, p=0.156) in the left or right legs respectively. VGRF was not significantly different between the WR and SR conditions during the drop-landing task (Left: p=0.216, Right: p=0.082). Although not significant, a trend of greater PKK was found (Right WR: 68.7±32.7°, SR: 49.5±34.4°, p=0.068) (Left WR: 68.8±32.1°, SR: 51.1±34.2°, p=0.097), when comparing the WR to the SR condition during the drop-landing task. The difference in PKK during the single leg drop-jump task approached significance for the left leg (WR: 2.5±0.41, SR: 2.72±0.40, p=0.052). No other significant differences in PKK or VGRF were observed during the single-leg drop-jump task (all p>0.362).

**CONCLUSIONS:** No significant differences in strength and landing mechanics were observed following one night of sleep restriction. Knee flexion angle data trends suggest additional nights or chronic sleep restriction may be required to significantly alter movement mechanics.

**D-71b Free Communication/Poster - Sports Medicine Fellow Research Abstracts**

**Board #304 May 30 3:30 PM - 5:00 PM**

**Parameters Associated with Abnormal Cardiac Conditions in Adolescent Athletes: Analysis using Simon’s Heart Heartbytes Registry**

Jacob Jones1, Dai Sugimoto2, Gregory Kobelski1, Prashant Rao2, Stanton Miller2, Chris Kooi2, Gian Corrado1, David Shippon1. *Boston Children’s Hospital, Boston, MA. 1Jefferson University, Philadelphia, PA.*

Email: jacob.jones@childrens.harvard.edu

(No relationships reported)

**PURPOSE:** To determine clinical parameters that are related to abnormal cardiac conditions in the physically active youth. **METHODS:** We used the Simon’s Heart Heartbytes National Youth Cardiac Registry to collect cardiac related data from middle and high school athletes in southeastern Pennsylvania. We collected age, race/ethnicity, symptoms suggestive of abnormal cardiac conditions in the physically active youth.

**RESULTS:** There were a total of 887 athletes (543 males and 344 females, age=16.9±2.1, height=166.9±11.4, weight=62.0±16.0). There was an independent association between abnormal cardiac symptoms and presence of significant past medical history (OR: 4.75, 95%CI: 1.95, 9.5% CI: 2.11, 95%CI: 0.87, 5.07, p=0.097) were not significant, there was a trend to reach the p prior significance level.

**CONCLUSIONS:** The current study identified several clinical parameters that are associated with symptoms suggestive of abnormal cardiac conditions. Further research needs to be done on a larger scale to better sort out the clinical history that may contribute to false positives in an effort to reduce false positives at heart screenings.

**Board #305 May 30 3:30 PM - 5:00 PM**

**Evaluation of Shoulder Health of Collegiate Wheelchair Basketball Athletes**

Matthew T. Santa Barbara, Jacqueline M. Spangenberg, Monica E. Rho, Shirley Ryan AbilityLab, Chicago, IL.

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(No relationships reported)

Shoulder pain is the most commonly reported musculoskeletal complaint among manual wheelchair users. Wheelchair basketball athletes may be at a higher risk of shoulder injury given the additional demands of their sport, but there is little research on the prevalence of shoulder injuries in this population. Shoulder injuries affect both sport participation and ability to perform activities of daily living for manual wheelchair users. Identifying shoulder injuries in wheelchair basketball athletes is important to provide better context in injury treatment and prevention. **PURPOSE:** Determine the prevalence of shoulder injuries using questionnaires, physical exams, and ultrasound evaluations in collegiate wheelchair basketball athletes. **METHODS:** Observational cross-sectional study of collegiate wheelchair basketball athletes at a single institution. Inclusion criteria were participation on a collegiate wheelchair basketball team and use of a manual wheelchair for ≥50% of mobility. Each athlete completed a baseline questionnaire that included a Visual Analogue Scale (VAS) for shoulder pain in the last month, the American Shoulder and Elbow Surgeons Score (ASES), the Wheelchair User’s Shoulder Pain Index (WUSPI) and then underwent a physical exam and musculoskeletal ultrasound evaluation of both shoulders. The Ultrasound Shoulder Pathology Rating Scale (USPRAS) was used to grade pathologic ultrasound findings. 2-tailed t-tests were used to compare shooting arms to non-shooting arms. **RESULTS:** Seven males and eight females completed the study. Ten of the fifteen athletes had experienced shoulder pain or an injury during the time they had used a wheelchair. Mean VAS in the shooting arm was 2.78 (±2.24) and non-shooting arm was 1.50 (±1.89) (p = .11). Mean ASES score was 89.92 (±11.28). Mean WUSPI was 7.12 (±9.46). There were nineteen positive physical exam findings in the shooting arms, compared to eight in the non-shooting arms (p = .05). Mean USPRAS for the shooting arm was 2.13 (±1.73) and non-shooting arm was also 2.13 (±1.25) (p = .99).

**CONCLUSIONS:** Shoulder injury and pain are prevalent in wheelchair basketball athletes based on questionnaires, physical exams and ultrasound findings. Supported by the Craig Neilsen Foundation.

**Board #306 May 30 3:30 PM - 5:00 PM**

**Descriptive Analysis of Youth American Football Quarterback Injuries: A 15-years of Retrospective Data Study**


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(No relationships reported)

**PURPOSE:** To describe the common injuries of youth American football (FB) quarterbacks (QB) within the last 15 years. **METHODS:** A retrospective chart review of all patients cared for in a sports medicine clinic of an academic pediatric medical center between 01/01/2003 - 10/01/2018. Patients were identified using the search engine HoundDog to search the term “quarterback.” Records were then reviewed to identify all QBs ≤ 18 years of age. Injuries that were not associated with FB participation were excluded. Main outcome variables were injured anatomic locations, injury types, surgical status, and settings in which the injury was sustained. Descriptive statistics were used to analyze the outcome variables. **RESULTS:** A total of 374 male QBs (mean age: 14.6±2.1) sustained a total of 423 injuries. The top 5 injured anatomic locations (Figure 1) were shoulder (22.2%), knee (15.5%) head/neck (14.5%), elbow (13.6%), and wrist/hand/lower arm (11.3%). The injuries consisted of 64.3% in acute mechanism and 35.7% chronic in nature. The acute injuries occurred during game competition (55.5%), practice (14.3%), and off-season (6.7%); for the remaining 23.5% there was not sufficient documentation in the medical record to determine the setting. Of the chronic injuries, 47.0% occurred during off-season and 34.4% occurred in-season; for 15.2% of the chronic injuries there was not sufficient documentation in the medical record to determine the setting. Among all injuries, 22.9% were surgical cases, and of the top 3 anatomic locations of surgery were knee (35.9%), shoulder (20.7%), and elbow (18.7%). **CONCLUSIONS:** The shoulder is the most commonly injured body part among young QBs seeking care in a specialty sports medicine clinic.
although the knee is the most commonly injured body part that requires surgery. Quarterback injuries are primarily acute in mechanism, and the majority of these acute injuries occur during game competition.

2151 Board #307
May 30 3:30 PM - 5:00 PM
Spine Injuries and Concussions among Figure Skaters
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(No relationships reported)

PURPOSE: To determine the prevalence and mechanism of spine injuries and concussions among a sample population of figure skaters. To assess for potential risk factors for these injuries.

METHODS: This is a cross-sectional analysis of spine injuries and concussions reported by figure skaters. Data was obtained through an anonymous, confidential online questionnaire distributed to members of participating figure skating clubs. The main outcomes included diagnoses, mechanism and source of medical care. Simple descriptive statistics were used; Fisher’s exact test was used to assess for statistical differences in categorical variables between groups. SPSS was used for all analyses.

RESULTS: Thus far, 88 participants have completed questionnaires (recruitment ongoing). The mean age of participants is 25.2 years (SD 17.1). Most (79%) respondents are female. Most (85%) practice figure skating year-round; 85% participate in competitions. Some skaters participate in more than one discipline, including singles (n=68), pairs (n=3), ice dance (n=21), synchronized skating (n=29), theatre on ice (n=17). More than a quarter (27%; n=24) of participants reported spine injuries/back pain. The most common diagnosis was muscular back pain. Treatment was primarily guided by primary care (n=10), sports medicine (n=13), physical therapists (n=14) and athletic trainers (n=10). Almost half of those who reported back pain did not present to a health care provider (HCP) (45%; n=11/24). All injuries occurred in practice. More than a quarter of participants (27%; n=24) sustained at least one concussion; 7 sustained two concussions. Several (42%; n=10/24) skaters did not present to a HCP for evaluation of their first concussion. All concussions occurred during practice and most (92%; n=22/24) were during on-ice activities. The most common mechanism of injury was a fall (62%; n=15/24). The sex of the skater was not associated with either mechanism of spine injury or history of concussion.

CONCLUSIONS: Nearly a third of skaters sustained a concussion or spine injury, yet nearly half did not report their injuries to a HCP. Our findings warrant further investigation into the reasons for such a low reporting rate among figure skaters and the potential effect on injury outcomes.

2152 Board #308
May 30 3:30 PM - 5:00 PM
Development and Evaluation of an Electronic Preparticipation Physical Examination System: A Pilot Feasibility Study
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The preparticipation physical examination (PPE) is important for athlete health and safety, and is required for participation in collegiate sports and the majority of US high schools. The vast majority of PPEs are completed using a paper PPE form. Previous work had developed an ePPE system and found it was efficient and yielded good athlete compliance and high physician satisfaction. Another study showed ePPE’s value for collecting and analyzing college athlete injury and illness data, suggesting strong potential for the ePPE to improve injury analysis as well as efficiency of the PPE. Despite these reports, use of electronic PPE forms has not become widespread.

PURPOSE: 1) to develop and implement an ePPE system for collegiate athletes that simultaneously serves as a relational database for research purposes, 2) to assess perceptions of providers on the ePPE system compared to paper PPE forms, and 3) to demonstrate the research potential of an ePPE system by conducting a sample epidemiologic analysis using electronically collected data.

METHODS: In this pilot feasibility study, researchers developed an ePPE system using REDCap, a HIPAA-compliant web application designed for academic research purposes. The ePPE form included identical contents and questions as the paper PPE form already in use at the NCAA Division I institution. Athletes on three teams at were randomized to use the ePPE (n = 22) or the paper PPE (n = 21) form. Providers and athletes were later surveyed regarding their perceptions of the two systems. A sample epidemiologic analysis using ePPE data was conducted.

RESULTS: The ePPE was successfully developed and implemented. All athletic trainers and physicians preferred the ePPE over the paper PPE, and felt that the ePPE was more efficient. Data were easily extracted for analysis from the ePPE system. A sample epidemiologic analysis established concerns about concussions sustained by athletes (27.3% of athletes) and some behavioral and psychological symptoms reported by athletes (trouble sleeping, depression, and anxiety; 13.6-22.7% of athletes).

CONCLUSIONS: While this was only a pilot feasibility study involving relatively small teams, we show that development and implementation of an ePPE system is technically feasible, is preferred by users, and facilitates sports research.

2153 Board #309
May 30 3:30 PM - 5:00 PM
Psychological Factors Related to Return to Sport After ACL Reconstruction in Adolescents
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(No relationships reported)

PURPOSE: The present study aimed to assess the relationship between psychological factors, including perceived social support and pre-operative expectations, and return to sport after ACL reconstruction in adolescents.

METHODS: 56 participants completed the Hospital for Special Surgery Pediatric Functional Activity Brief Scale (HSS Pedi-FABS), the Psychovigilance (PV) questionnaire, and the Multidimensional Scale of Perceived Social Support (MSPSS) prior to undergoing ACL reconstruction. We performed a multiple linear regression to assess if MSPSS score was associated with confidence in returning to sport (total PV score). Adolescents were divided into competitive and non-competitive groups based on their response to the HSS Pedi-FABS. Outcome variables obtained from the PV questionnaire addressing pre-operative expectations of returning to sport following surgery were compared between the competitive and non-competitive groups using a series of Chi-square analyses.

RESULTS: Among all participants, 54 (n=48) reported that they expected to return to sport within less than six months of surgery. A significantly higher proportion of competitive athletes (81%) expected to return to sport within six months post-operatively compared to the non-competitive athletes (63%; p<0.18). In addition, a significantly lower proportion of competitive athletes (14%) compared to non-competitive athletes (39%) reported that they would be content returning to a activity level that was less than their pre-injury activity level (p=0.037) and would be willing to settle for a less strenuous sport than their pre-injury sport (16% vs 42%; p=0.034). There was no significant association between MSPSS total score (mean = 6.22±0.375, range = 4-7) and PV total score (mean = 13.83±3.0, range = 8-18; β coefficient = -0.63, 95% CI = -1.17, 0.52, p = 0.23).

CONCLUSIONS: The majority of all participants reported the expectation of returning to sport within six months of surgery. A significantly lower proportion of competitive athletes compared to non-competitive athletes reported that they would be content returning to a less strenuous sport at a level that was less than their pre-injury activity level. These findings suggest that psychological factors related to return to sport are important to consider in the management of adolescents undergoing ACL reconstruction.

2154 Board #310
May 30 3:30 PM - 5:00 PM
A Review of the Injury Pattern of the 2018 Chicago Marathon
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(No relationships reported)

Marathon racing is increasingly popular and it is estimated that 25 out of every 1000 finishers will seek medical help during their race. Some studies have shown that the most common injuries are musculoskeletal and the volume of runners seeking medical care increases as the race progresses. However, there is a lack of information that illustrates a specific injury pattern along a race course.

PURPOSE: To measure the volume and types of injuries sustained by 2018 Chicago Marathon runners at the various medical stations to determine the impact that distance has on injury pattern.

METHODS: In this retrospective chart review of records collected at the 2018 Chicago Marathon (N=1016), the diagnoses of runners seeking medical care was assessed if MSPSS score was associated with confidence in returning to sport. The present study aimed to assess if MSPSS score was associated with confidence in returning to sport (total PV score). Adolescents were divided into competitive and non-competitive groups based on their response to the HSS Pedi-FABS. Outcome variables obtained from the PV questionnaire addressing pre-operative expectations of returning to sport following surgery were compared between the competitive and non-competitive groups using a series of Chi-square analyses.

RESULTS: Among all participants, 54 (n=48) reported that they expected to return to sport within less than six months of surgery. A significantly higher proportion of competitive (81%) expected to return to sport within six months post-operatively compared to the non-competitive athletes (63%; p<0.18). In addition, a significantly lower proportion of competitive athletes (14%) compared to non-competitive athletes (39%) reported that they would be content returning to a activity level that was less than their pre-injury activity level (p=0.037) and would be willing to settle for a less strenuous sport than their pre-injury sport (16% vs 42%; p=0.034). There was no significant association between MSPSS total score (mean = 6.22±0.375, range = 4-7) and PV total score (mean = 13.83±3.0, range = 8-18; β coefficient = -0.63, 95% CI = -1.17, 0.52, p = 0.23).

CONCLUSIONS: The majority of all participants reported the expectation of returning to sport within six months of surgery. A significantly lower proportion of competitive athletes compared to non-competitive athletes reported that they would be content returning to a less strenuous sport at a level that was less than their pre-injury activity level. These findings suggest that psychological factors related to return to sport are important to consider in the management of adolescents undergoing ACL reconstruction.

THURSDAY, MAY 30, 2019

Abstracts were prepared by the authors and printed as submitted.
respectively. When comparing the diagnosis of musculoskeletal, medical, wound care, and other complaints, there was a statistically significant difference in incidence with p<0.001.

CONCLUSIONS: The most common presenting complaints were musculoskeletal, followed by medical, other, and then wound care. The largest number of runners seeking medical care were at the finish line and halfway point of the race and so the majority of resources should be focused at these locations. While there was a larger proportion of musculoskeletal complaints near the halfway point of the course, the higher percentage of medical complaints was at the finish line.

2155 Board #311 May, 30 3:30 PM - 5:00 PM Iron and Vitamin D Deficiency in D1 Female Track & Field Athletes

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(No relationships reported)

PURPOSE: To identify the prevalence of Iron and Vitamin D deficiency in D1 female track and field (T&F) athletes

METHODS: In a retrospective review of medical records at a single institution, laboratory data were reviewed for female T&F athletes [BT1] from 2013 to 2019. Labs were acquired as part of the entrance pre-participation physical (PPE) including ferritin, hemoglobin, and Vitamin D. Iron deficiency was defined as serum ferritin below 30 ng/mL-1 with severe deficiency below 13 ng mL-1. Vitamin D was classified as; below 15 ng/mL - deficient, 16-29 ng/mL insufficient, and above 30 ng/mL sufficient. Anemia was defined as hemoglobin (Hgb) <11.1 g dl-1.

RESULTS: Seventy-seven student-athletes were screened, 48% were iron deficient, and a further 13% had severe iron deficiency. Of those with iron deficiency (ferritin <30, n=37), four had anemia (n=3). For Vitamin D, 7% were deficient, 24% were insufficient, and 69% were sufficient. Anemia was defined as hemoglobin (Hgb) <11.1 g dl-1.

CONCLUSIONS: When compared to the prevalence of iron deficiency in the general US female population ages 16-49 (11%), there was an increased prevalence in our sample (48%). Interestingly, we noted a similar prevalence of iron deficiency anemia (3-5% general population vs. 4.3% in our sample). Furthermore, our results showed a 24% prevalence for Vitamin D Insufficiency consistent with the general US female population of similar age at 24-26%. The prevalence of Vitamin D deficiency was higher in the US population at 10-11% when compared to our study at 7%. The effects and benefits of screening, intervention, and performance outcomes are a topic of ongoing investigation.

2156 Board #312 May, 30 3:30 PM - 5:00 PM The Impact of Clinical Factors in Physician and ATC Decision Making for Concussion Return to Play: Insight from Policy Capturing Study

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(No relationships reported)

PURPOSE: To scrutinize the role of several clinical factors in physician and clinical athlete trainer (ATC) return-to-play (RTP) decision making in high school athletes who sustained a concussion.

METHODS: Sports Medicine physicians and ATCs completed a policy capturing survey of 50 clinical scenarios and rated how likely they were to clear the athlete for RTP. Nine factors were randomly varied within the scenarios: age, gender, sport, prior concussion, initial symptom score, symptom duration, and ImpACT performance. Participants then ranked how important each variable was in their decision making process.

RESULTS: 16 physicians (87.5% CAQSM, 12.5% Fellows, mean 9.2 concussions managed per month) and 29 ATCs (mean 4.8 concussions managed per month) participated. ImPACT testing was the most significant contributor to RTP decisions. Physicians and ATCs weighed ImPACT charged from baseline (β, 0.42±0.23 and 1.28±1.18 respectively) and ImPACT compared to normative values (0.39±0.24 and 1.38±0.90 respectively) most heavily. Respondents self-ranked prior concussion and age as most influential in their RTP decision making. There was no correlation between participants self-ranking of importance and the observed contribution of a variable to decision making.

CONCLUSIONS: Respondents displayed poor insight to the role of various clinical factors in their management of concussion RTP. ImPACT testing has a greater influence on RTP decisions than physicians and ATCs realize. Despite having low self-ranked importance, variables related to ImPACT results were among the most influential. Self-ranking importance of clinical variables is similar between physicians and ATCs; however, correlation is less important to ATCs compared to physicians. Although age was considered important in self-ranking it was not a significant contributor to RTP decision making.

2157 Board #313 May, 30 3:30 PM - 5:00 PM Evaluating Patient Reported Outcomes in a Pediatric Sports Medicine Practice: A Look at the FAAM

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(No relationships reported)

PURPOSE: Foot and ankle injuries account for up to 30% of all pediatric sports medicine visits. Self-reported outcome measures can be utilized to capture the patient’s perspectives on their injury and monitor recovery, however, this has not been well studied in youth athletics. The objective of this study is to examine the relationship between patient injury characteristics and FAAM scores. Methods: A retrospective cross-sectional pilot study was conducted on patients that completed the Foot and Ankle Ability Measure (FAAM) survey as standard of care for either their first clinic or physical therapy visit. Factors of interest include age, sex, diagnosis and type of rehabilitation program. Descriptive statistics and multiple linear regression models were performed. Results: In this pilot study, 457 individuals were identified as having completed the FAAM over the 3 year review period. A sample of 36 patients with 42 distinctive injuries were reviewed. The average age of the sample was 16.38 years, 53% were female. Only 8 athletes (22%) identified as participating in multiple sports. Soft tissue injury was the most common diagnosis (65% of encounters) and more than half of the patients were referred to physical therapy. The average time from injury to presentation was 63 days (RNG: 1-694 days). The average initial FAAM score was 0.52 (SD ± 0.28, RNRG: 0.03-0.96). Multiple linear regression models showed no significant predictors. Only time from injury to initial FAAM score approached a p-value of <0.10. Conclusions: The use of the FAAM may provide insight into patient perception of function and recovery from a musculoskeletal injury. Our study unveils characteristics of one cohort of adolescents from a pediatric sports medicine clinic with foot and ankle injuries. Time to presentation was significantly longer than expected but perceived level of dysfunction was higher. The multiple linear regression models showed no strong predictors of FAAM scores, however, this pilot study was underpowered. Future efforts will focus on further evaluation of this entire cohort and the interaction between injury characteristics, management recommendations, and FAAM scores.

2158 Board #314 May, 30 3:30 PM - 5:00 PM Application of Quantitative Balance Testing to Office Based Concussion Care: A Feasibility Study

Brady Bowen, Ian D. Hutchinson, Kelly Russio, Hamish A. Kerr, FACSM. Albany Medical Center, Cohoes, NY. (Sponsor: Hamish Allister Kerr, FACSM)

(No relationships reported)

PURPOSE: Assessment of concussion in the office should be multimodal, including a clinical interview, neurocognitive and balance assessment. Access to baseline, pre-injury measures have been identified as having greater clinical utility than single assessments. Our institution offers baseline ImpACT neurocognitive assessment to pediatric contact sport athletes. The goal of this study was to determine the feasibility of quantitative balance testing of individuals to improve quality of our concussion care.

METHODS: Following Institutional Review Board (IRB) approval, patients were offered objective balance assessment using a modified Balance Error Scoring System (mBESS) conducted using a combination motion analysis video/force plate of postural stability (Equilibrate; Balance Engineering LLC, Henrietta, NY). Baseline balance testing obtained was compared to published normative data (Howell & Meehan, J Pediatr Orthop, 2016); results were segmented by age and gender using unpaired Student-t test with significance set at p<0.05.

RESULTS: 80 patients (December 2014-present) conducted a balance assessment: (43 Female/37 Male); age (14.5±4.1 yrs), Body Mass Index (21.7±5.6 Kgm-2), previous concussion 7/80 (9%) and history of lower extremity musculoskeletal injury 15/80 (19%). 18 patients over the age of 18 years were excluded from comparative analysis to published pediatric normative data, leaving 62 patients. Two stances were directly compared and analyzed: double leg stance and tandem stance (non-dominant behind) with eyes closed. There were significantly better performances in our study groups in tandem stance for 16-18 yrs females, 8-12 yrs males and females compared to the normative data (Table 1).

CONCLUSION: Quantitative baseline balance testing was deliverable in our office and our results indicate better performance for some populations than previously published normative data.
2159
Board #315
May 30 3:30 PM - 5:00 PM
Specific Dietary Practices In Female Athletes And Their Association With Disordered Eating
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(No relationships reported)

PURPOSE: Health and weight management benefits may influence athletes’ decisions regarding specific dietary practices. Eating disorders/disordered eating (ED/DE) are highly prevalent in the athletic population. The purpose of this study was to determine if following specific diets correlated with a greater likelihood of responding positively to ED/DE screening tools compared to not adhering to a diet. METHODS: 1000 female athletes (15-30 yrs) were asked to complete a comprehensive health and wellness survey. Athletes were asked to specify their diet and completed 3 ED/DE screening tools: the Brief Eating Disorder in Athletes Questionnaire, the Eating Disorder Screen for Primary Care, and self-reported current or past history of ED/DE. We hypothesized that athletes adhering to specific diets were more likely to score positively on ED/DE screening tools than those not following a diet. The most common diets were included in the analyses: vegan, vegetarian, pescatarian, gluten free, low carbohydrate, low dairy, and ≥2 diets. Athletes following diets for health issues (e.g. Celiac disease) were excluded. Descriptive statistics were calculated for all study measures and Chi-square testing was performed to assess relationships between athletes’ dietary practices and their responses to ED/DE screening tools.
RESULTS: 234 of 1000 female athletes reported adherence to specific diets; 766 reported no diet adherence. 69 of the 234 athletes were excluded due to medically-related dietary practices or vague dietary descriptions. 133 athletes reported following 1 of the diets and 32 athletes reported following ≥2 diets. Of the diet-adherent athletes, 67.9% responded positively to ≥1 of the 3 ED/DE screening tools. Athletes practicing vegetarian, vegan, low carbohydrate, low dairy, or ≥2 diets were more likely to respond positively to ≥1 ED/DE screening tool vs. athletes without dietary restrictions (70.0%, 77.8%, 79.5%, 60.0%, and 65.6%, respectively vs. 41.8%; p<0.048). CONCLUSION: Specific diet adherence in female athletes is associated with greater likelihood of positive screening for ED/DE using survey self-report. Health practitioners should consider further ED/DE questioning of athletes reporting specific diet adherence in order to enhance nutritional knowledge and help treat and prevent ED/DE.

2160
Board #316
May 30 3:30 PM - 5:00 PM
Concussion Symptom Reporting Across Age Levels
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(No relationships reported)

Purpose: To evaluate differences in concussion symptom reporting across age levels
Methods: Between 2008-2018 post-concussion symptoms were reported by Middle School (MS), High School (HS) and Collegiate athletes (CA) utilizing the post-concussion symptom scale after a concussive injury. Repeat evaluations and initial evaluations with a symptom score of zero were excluded. ANOVA was performed assessing total symptom scores and number of symptoms reported by age group and gender.
Results: 1,748 athletes (65.2% male, 22 sports) were included: Middle School (6.3%, n=110), High School (86.4%, n=1511) and Collegiate (7.3%, n=127). Significant differences were found in total symptom scores (p=0.006) and number of symptoms reported (p=0.00003). Symptom scores were highest in High School athletes (23.37, SD 20.2) compared to MS (mean 17.78, SD 18.5) and CA (20.13, SD 21.3). Total number of symptoms reported was also highest in High School athletes (9.73, SD 6.1) compared to MS (7.55, SD 5.4) and CA (8.02, SD 5.9). High School females report significantly higher symptom scores (27.5+/22.5 vs 21.6+/18.9, p<0.0001) and number of symptoms (10.7+/6.1 vs 9.4+/6.1, p<0.0002) relative to male peers.
Conclusion: In student athletes who have suffered a concussion, the post injury symptom scores and total number of symptoms and individual symptoms reported varied significantly across age levels, with significantly less symptoms being reported in the middle school athletes.

2161
Board #317
May 30 3:30 PM - 5:00 PM
The Role of Resistance Training Dosing on Pain and Quality of Life in Individuals with Knee Osteoarthritis: A Systematic Review
Meredith N. Turner, Daniel O. Hernandez, Christopher P. Emerson, William Cade, John Reynolds, Thomas M. Best. FACS, University of Miami, Coral Gables, FL.
(No relationships reported)

Purpose: To determine whether resistance training effects pain and quality of life in individuals with knee osteoarthritis (OA), and whether or not a dose-response relationship exists. Secondly, we will investigate if the effects of resistance training are influenced by KL grade or location of OA (tibiofemoral and/or patellofemoral).
Methods: A systematic literature search of three electronic databases (PubMed, CINAHL, and EMBase) was performed for English studies to identify RCTs comparing resistance interventions with no intervention or education in knee OA and reporting changes in pain and physical function. Articles meeting inclusion criteria were assessed independently by two reviewers for methodological quality using the CONSORT 2010 scale and bias assessed by the Cochrane Collaboration’s tool for assessing risk of bias.
Results: Four hundred and sixty-nine studies were found in the initial search. Fourteen were included for analysis after screening. Thirteen trials were rated with high methodological quality based on the CONSORT scoring system. One study was excluded due to poor CONSORT score (9). Thirteen eligible trials with 1,521 participants were therefore included in the subsequent analysis. The average CONSORT quality score was 20.3 (range 17 to 24.5). Evidence from eleven studies revealed resistance training significantly improved pain and/or quality of life. No trends were identified with maximum strength, and frequency of exercise sets or repetitions, and thus trends between strength training outcomes and location or KL grade of knee OA were unable to be evaluated.
Conclusion: This systematic review suggests that resistance training improves pain and quality of life for patients with knee OA, but specific optimal dosing strategies remain unknown. Further high quality prospective studies with homogenous populations and interventions aimed to investigate precise dosing parameters are needed.

2162
Board #318
May 30 3:30 PM - 5:00 PM
Distribution of Sonographically Guided Injections of the Subgluteus Minimus and Medius Bursae in Cadaveric Model
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(No relationships reported)

PURPOSE: The primary purpose of this investigation was to describe and validate sonographically guided techniques for injecting the subgluteus minimus bursa (SGMinB) and subgluteus medius bursa (SGMedB) in a cadaveric model.
METHODS: A single experienced operator completed all injections under ultrasound guidance in 12 unembalmed cadaveric specimens. SGMinB injections (N=12) placed 3mL of diluted yellow latex into the bursa using an in-plane, anterior-to-posterior approach in short axis (SAX) to the gluteus minimus (GMin) tendon. SGMedB injections (N=12) placed 3 mL of diluted yellow latex into the bursa using an in-plane, anterior to posterior approach in SAX to the gluteus medius (GMed) tendon. For comparison with more commonly performed injections, the same operator completed sonographically guided injections into the subgluteus maximus bursa (SGMaxB, N=12) and sonographically guided intrarticular hip injections (N=2) in the same 12 specimens. 10 specimens were subsequently dissected and 2 specimens were frozen and cut into cross sections.
RESULTS: All 12 SGMinB injections accurately placed latex deep to the GMin tendon without intraarticular communication. All 12 SGMedB injections accurately placed latex deep to the GMed tendon. In 3/12 specimens some latex communicated between SGMinB and SGMedB, 2 of which occurred in the setting of pre-injection documented tendosynovitis. No injections communicated with the SGMaxB or intraarticular space.
CONCLUSIONS: Sonographically guided SGMinB and SGMedB injections can accurately target specific locations of tendon-bursa pathology in patients with greater trochanteric pain syndrome. In the presence of tendon pathology, communication between SGMinB and SGMedB may occur.
**2163** Board #319  
**May. 30 3:30 PM - 5:00 PM**  
**Field Of View: A Football Player With Acute Visual Changes**  
Samantha Smith, James J. Kinderknecht. Hospital for Special Surgery, New York, NY.  
(No relationships reported)

**HPI:**  
A 23 year old professional football player self-reported abnormal vision during a game. He had two episodes of blurriness in the superior visual field of the right eye lasting 15-20 minutes each and separated by 15 minutes. He had no eye pain or headache. He identified head trauma preceding symptoms. He was not removed from play.

**Exam:**  
Post-game: Normal visual acuity and remainder of exam normal.

**Differential Diagnosis:**  
1. Retinal detachment  
2. Retinal vessel occlusion  
3. Acephalgic migraine  
4. Concussion  
5. Optic nerve lesion

**Tests and Results:**  
Athlete referred to ophthalmology for full eye exam the day following the game.  
Ophthalmology Findings:  
- normal intraocular pressure  
- bilateral AV nicking consistent with hypertensive retinopathy  
- right retinal venous engorgement with few dot blot hemorrhages consistent with central retinal vein occlusion  
- no retinal detachment

**Final/Working Diagnosis:**  
Central retinal vein occlusion and hypertensive retinopathy, likely associated with obstructive sleep apnea, an associated description in the literature, with no other identified etiology.

**Treatment and Outcomes:**  
- Athlete did not miss any football practices or games  
- Vision remained normal and follow up retina exam was unchanged  
- Blood pressure monitored frequently without any documented daytime hypertension  
- Began to use CPAP at night  
- Reported improved sleep quality and reduced daytime fatigue

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**2165** Board #321  
**May. 30 3:30 PM - 5:00 PM**  
**When Leg Pain In A Runner Does Not Mean Stress Fracture Or Shin Splints**  
Sayedmajid Reza Alavi Dehkordi, Carlos R. Rodriguez. Bayfront Health System, St. Petersburg, FL.  
Email: alavidehkordi@hotmail.com  
(No relationships reported)

**HISTORY:**  
A 17-year-old male participating in high school middle-distance running presented with a 6-week history of lower left leg pain and limp. The pain was getting worse with increased training. He was running an average of 12-15 miles per day five days a week. This was evenly split on streets and cross-country roads. Although he had taken analgesics, the pain did not improve. He had no pain at rest but had noted some occasional pain at night. There was no history of antecedent trauma and the remaining history did not reveal any significant abnormalities.

**PHYSICAL EXAMINATION:** Local examination revealed diffuse tenderness over the anterior aspect of the lower left leg. There was no bruising or palpable swelling noted. The musculature and strength was normal. The range of motion of the left knee and ankle joints was normal and there was no neurovascular deficit noted. General physical examination did not reveal any significant abnormalities.

**DIFFERENTIAL DIAGNOSIS:**  
1. Shin Splint  
2. Stress Fracture  
3. Brodie Abscess  
4. Osteoid Osteoma

**TEST AND RESULTS:** Plain radiographs revealed cortical thickening in the middle 3rd of medial cortex of Tibia(Figure-1). The central nidus and the surrounding sclerosis of the bony lesion was apparent on the CT scan (Figure-2).

**TREATMENT AND OUTCOMES:** The patient underwent surgical excision as an outpatient procedure. A shark bite excision of cortical lesions along with the surrounding sclerotic bone was performed under image guidance. The specimens were sent for histopathological examination which was consistent with Osteoid Osteoma. He was kept partial weight bearing for 6 weeks, followed by gradual progression to full weight bearing. Three months post-surgery, the patient was completely asymptomatic. Follow-up radiographs revealed a well-healed excision site and no evidence of recurrence. He returned to his running without problems.

2166  
**Doc, My Leg Is Numb.**

Justin R. Thompson1, P. Patrick Mularoni2, Sayedmajidreza Alavidehkordi1.  
*Bayfront Health, Saint Petersburg, FL.* Johns Hopkins All Children's Hospital, Saint Petersburg, FL.  
(No relationships reported)

**HISTORY:** An 18 year old, high school, football kicker suffers a leg injury during his last regular season game. He kicked his last PAT of the game when he reported tightness in his anterior leg. During the following kick off, he felt a pop in his right upper thigh as he kicked the ball. He reported immediate pain and difficulty walking. He was able to independently limp off the field. That night he elevated and iced his leg. He reported that he fell asleep with his leg elevated with ice on the area. Upon waking the next morning he felt numbness in the outside of his right thigh. He continued experiencing the soreness in the anterior portion of his thigh, but reported it was no worse than the day before. He denied any back pain, prior back injury, or history of trauma to his back.  

**PHYSICAL EXAMINATION:** General: NAD, crutch assisted ambulation, athletic build CV: 2+ dorsalis pedis pulses bilaterally, warm extremities Palm: no dyspepsia GI: abdomen soft, non-tender Skin: no bruising Neuro: decreased sensation subjectively along the outer right thigh from hip to knee to MSK: Pain to palpation along proximal hip flexors and AHI, no defect in muscle palpated, full AROM, PROM of hips: 4/5 strength of right hip flexion secondary to pain, 5/5 on left. 5/5 strength bilaterally with hip extension, adduction, abduction, as well as knee flexion and extension. No spinous process or SIJ tenderness to palpation, no step offs appreciated.  

**DIFFERENTIAL DIAGNOSIS:** 1. Avulsion fracture of AHI with associated nerve injury 2. Hip flexor strain with malragnia parahytetica 3. hip flexor strain with direct nerve injury from ice 4. FAI with acute hip labral tear 5. Lumbar disc herniation  

**TESTS AND RESULTS:** CT: Pelvis XR: Normal radiographic examination of the hips and the remainder of the pelvis  

**FINAL/DIAGNOSIS:** Hip flexor strain with associated malragnia parahytetica  

**TREATMENT AND OUTCOMES:** 1. Ortho Foot and Ankle referral to address operative management in process. 2. Referral to Rheumatology after case discussion given concern for inflammatory arthritis. 3. Final Outcome pending; patient has yet to consult with either of the above.

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2167  
**“Not Just Another Ankle Sprain”-an Interesting Case Of Chronic Ankle Pain**

Cole C. Budyński. Nationwide Children’s Hospital, Columbus, OH.  
(No relationships reported)

**HISTORY:** A 22 year-old female presented with progressively worsening ankle pain, swelling, catching, and locking over a five year period. She denied recent or prior trauma. Her limitation was inability to stand throughout a full work day. Past medical history was significant for morbid obesity s/p sleeve gastrectomy 4 years ago. She was seen in the past and told it was “just another ankle sprain” or “from her weight”. The pain has worsened despite claims it would improve “once she lost weight”.  

**PHYSICAL EXAMINATION:** Mild circumferential swelling with moderate pes planus noted. Tenderness: talar dome, post-tib, tendon, posterior talar processes. Full ROM, with 4/5 strength appreciated in all planes. Able to walk on heels and toes, with a limp. Unable to hop. Anterior Drawer: positive w/excessive laxity and crepitus. Talar Tilt: positive. Anterior impingement and impaired proprioception noted. Sensation and pulses intact.  

**DIFFERENTIAL DIAGNOSIS:** 1. Talar Stress Fracture 2. Tarsal Coalition 3. Ac Trigonom  

**TEST AND RESULTS:** Radiographs: 3-view Left Ankle  

- Degenerative changes of the tibiotalar joint.  
- Osteochondral lesions of the medial talar dome and medial shoulder of the tibial plafond.  
- Hypertrophic changes concerning for enthesitis about the tendinous insertions. MRI: Left Ankle:  
- Chronic OCD lesion to medial talar dome with large subchondral cysts, measuring 16mm x 8mm.  
- Talar Dome collapse with Outerbridge Grade 3/4 articular cartilage loss of the overlying tibial plafond and talar dome.  
- Enthesopathy of the dorsal and plantar calcaneus.  

**FINAL/DIAGNOSIS:** Large medial talar dome OCD lesion with subchondral cysts (Grade 5 Hepple MRI Seiging) and evidence of enthesitis and degenerative talarovascular changes concerning for longstanding inflammatory arthritis condition.  

**TREATMENT AND OUTCOMES:** 1. Talar walking boot and ice therapy, with work modifications to limit weight bearing status. 2. Ortho Foot and Ankle referral to address operative management in process. 3. Referral to Rheumatology after case discussion given concern for inflammatory arthritis. 4. Final Outcome pending; patient has yet to consult with either of the above.
X-ray Knee 4 views Left: avulsion fracture of lateral femoral condyle – minimally displaced
MRI: Left knee without contrast: popliteus tendon rupture with retraction. Edema surrounding ACL

Final / Working Diagnosis
Left popliteus tendon femoral avulsion

Discussion
Isolated popliteus tendon rupture is a rarely reported finding in the literature. The vast majority of popliteus tendon ruptures occur in combination with other ligamentous injuries specifically in the postero lateral structures of the knee. Generally, reported cases are treated non-operatively with a high rate of return to play at previous level.

Outcome
Patient was evaluated by an orthopedic surgeon at Andrews Sports Medicine and Orthopaedic Center in Birmingham, AL and underwent arthroscopic left popliteus tendon repair

Return to Activity and Follow Up
After surgery the patient followed an ACL rehabilitation protocol, weight bearing as tolerated in a controlled motion brace, locked in extension for two weeks and began physical therapy after his initial post-operative appointment two weeks after surgery. At his 2-week post-operative appointment he could wean off crutches and weight bear as tolerated with his knee brace locked in extension. Physical therapy following ACL rehab protocol was initiated for the next 4 weeks, allowing for range of motion exercises out of the brace. After six weeks total he was released to return to full activities.

2170
Board #326
May. 30 3:30 PM - 5:00 PM
Surgical Diagnosis of Cervical Disc Herniation
Jacob Jones, William Meehan, III. Boston Children's Hospital, Boston, MA.
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HISTORY: Patient is a 13-year-old right-hand-dominant male fencing athlete who presented with one year of intermittent right upper arm pain without a specific injury. The pain was diffuse throughout the entire upper arm. The delt, acr pain rated 5/10 and last weeks at a time. The pain was worse at night, causing him to cry. Advil and BenGay helped with the pain. PT did not seem to help. He had seen by two other physicians previously and had a working diagnosis of referred pain from the shoulder. He had shoulder x-rays that were reportedly normal. After initial evaluation and imaging, the patient underwent another extremity evaluation. PT: At 2 month follow-up, he endorsed similar symptoms on his left upper extremity, despite not using the arm for any strenuous activities apart from PT PHYSICAL EXAMINATION: Normal cervical ROM. Normal posture. Bilateral upper extremities: No scapular dyskinesia. No pain with palpation over clavicle, SC joint, AC joint, biceps tendon, humerus, elbow. Full ROM of both shoulders and elbows. Negative rotator cuff, AC, labrum provocative tests. Nerves intact. DIFFERENTIAL DIAGNOSIS: Biceps/ Triceps strain, Humeral stress injury, Cervical spine radiculopathy, Thoracic Outlet Syndrome, Leukemia

TEST AND RESULTS: Right humerus x-ray: Cortical thickening of the right mid humeral shaft, no evidence of periosteal reaction. Matted cortical thickening which could represent an atypical stress reaction location. Left humerus x-ray: Unremarkable. Right humerus MRI: Diffuse, primarily diaphyseal marrow and periosteal edema of the right humerus. Findings could be consistent with chronic stress injury. Left humerus MRI: Diffuse bone marrow edema of the left humerus, with adjacent periosteal and mild muscular edema, consistent with left humeral stress reaction with no fracture line. Labs: BMP, Mg, TSH, Free T4, PTH, Vit D, Celiac panel are normal. Phos mildly elevated.

2171
Board #327
May. 30 3:30 PM - 5:00 PM
Different Strokes for Different Folks
Shannon Carroll. Edward Via College of Osteopathic Medicine at Auburn University, Auburn, AL.

HISTORY: A 21-year-old right-hand-dominant Division I women’s golfer presented with gradual onset right wrist pain starting July 2018 without change in equipment, technique, grip or shaft, but did increase tournament play over the summer. She was initially diagnosed with radiocarpal impingement and treated with posterior interosseous nerve injection at the fourth dorsal compartment. Shortly after she began to have right medial elbow pain with associated fourth and fifth digit numbness and tingling. She had an injection of the cubital tunnel as well with immediate pain relief, though the pain returned shortly after injection and continued to worsen. Particularly noted pain was worsened with full extension mid-swing. She had minimal playing time through the fall season (unable to chip and putt secondary to pain) and has been unable to participate in spring practice for more than 10 minutes at a time without pain. At this time she is also having resting pain.

PHYSICAL EXAMINATION: Right Wrist/Hand: No muscular atrophy, full range of motion active and passively, non-tender to palpation, ligamentously stable Right Elbow: No soft tissue swelling, bruising, or muscle atrophy, tender to palpation over the flexor pronator mass, medial epicondyle, and sublime tubercle with resisted digital and wrist flexion as well as pronation, stable in varus and valgus at 0 and 30 degrees, positive Tinel’s test and elbow flexion test, negative subluxable ulnar nerve, negative moving valgus test, negative Milking maneuver, decreased sensation in the distribution of the ulnar nerve, negative Froment sign, negative Scott Earl test, negative Wartenberg syndrome. DIFFERENTIAL DIAGNOSIS: 1. Medial Epicondylitis 2. Cubital Tunnel Syndrome 3. Flexor Pronator Synrome TEST AND RESULTS: 1/2/19 MRI Right Elbow - minimal tendinopathy of the common flexor tendon without tear, small spurring at the sublime tubercle with subtle marrow edema, possibly reflecting low-grade stress reaction, intact UCL, anconeus epitrochlearis identified T2-weighted axial images 11-12 1/10/19 Right Upper Extremity EMG/NCV - no evidence of right cervical radiculopathy or ulnar neuropathy 2/19 Right Upper Extremity Dynamic EMG/NCV - no significant change in activity, recruitment or motor unit seen pre- or post-exertion of right upper extremity; parenthetically despite normal studies, significant tenderness palpated in the area of the anconeus/flexor carpi ulnaris origin on the median elbow regionFINAL/WORKING DIAGNOSIS: Dynamic Compression of Ulnar Nerve secondary to Anconeus Epitrochlearis with Medial Epicondylitis TREATMENT AND OUTCOMES: Surgical release of anconeus, release with anterior subcutaneous nerve transposition with a nerve protection wrap, neurolysis of the posterior medial antebrachial cutaneous nerve and excision of the Flexor Carpi Ulnaris. Post-operatively she will be in a long arm splint for two weeks followed by a removable long arm splint with 30 degrees extension at the wrist and 90 degrees flexion at the elbow. Continue progression at 4 weeks post-operatively to full active range of motion, then 6 weeks full passive range of motion if indicated. At 8 weeks patient can begin sport-specific activity with full return to play after 12 weeks of post-operative recovery.

2172
Board #328
May. 30 3:30 PM - 5:00 PM
An Unusual Presentation of an Increasingly Common Infection
Erica Martin. The University of Michigan, Ann Arbor, MI.
(Sponsor: Keri Denay, FACSM)
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HISTORY: 20-year-old female collegiate basketball player with no medical history presented to training room for 1 day history of epigastric abdominal pain. Pain initially generalized but then localized to epigastric region with nausea and non-bloody diarrhea but no emesis or urinary symptoms. Patient’s last menstrual period ended 2 days prior to presentation, was normal. She is sexually active but uses condoms inconsistently. No vaginal complaints. She tried ibuprofen for pain which helped somewhat. No history of GERD, but given location of her symptoms and benign examination, treated with Tums with follow up in 1-2 days. She presented to the emergency department that evening as pain acutely increased.

PHYSICAL EXAMINATION: (in emergency department) General: fatigued, moderate distress HEENT: dry mucous membranes Gastrointestinal: tender in the bilateral upper quadrants, normal bowel sounds, no rebound or guarding. Psychiatric: appropriate affect

DIFFERENTIAL DIAGNOSIS: 1. Gastroesophageal reflux 2. Viral gastroenteritis 3. Anxiety

TESTS AND RESULTS: 1. Negative labs: comprehensive metabolic panel, lactate, blood cultures (eventually) 2. Abnormal labs: complete blood count (CBC) (high white blood cell count) 3. Imaging studies: abdominal ultrasound unremarkable, CT of abdomen and pelvis negative

FINAL WORKING DIAGNOSIS: Gonorrea

TREATMENT AND OUTCOMES: Two days after initial emergency room (ER) visit, patient returned and was feeling a bit better, but was still having abdominal pain in the right upper and bilateral lower quadrants. Examination reassuring, but repeat CBC obtained given leukocytosis in ER and sexually transmitted infection (STI) testing ordered. White blood cell count decreased. Prior to STI testing resulting, patient’s abdominal pain increased and she was directed again to the ER. There, she had pelvic examination which revealed yellow vaginal discharge. STI testing done, in addition to urine pregnancy testing.

Abdominal ultrasound was negative. At the time of discharge from the ER, STI test results pending. Treated empirically in ER for STI with azithromycin and ceftriaxone.
Both STI tests (from training room and ER) positive for gonorrhea after discharge from ER. In follow up with patient, she is feeling better and has returned to normal activities.

2173 Board #329 May 30 3:30 PM - 5:00 PM
A Narrow Wrestling Decision
Tyler K. Drewry1, Richard Okragly1, Jaideep Chunduri2.
1TriHealth, Cincinnati, OH; 2Beacon Orthopaedics, Cincinnati, OH. (Sponsor: Henry Stiene, MD, FACSM)
Email: krdrewry88@gmail.com
(No relationships reported)

HISTORY: A 25-year-old male college wrestler presented to the training room the day after a wrestling match complaining of neck soreness. He had unintentionally fallen backwards on the mat and sustained a hyperextension injury of his neck. Immediately after the trauma, he felt an “electrical sensation” traveling down both of his arms into his hands, which resolved within 24–48 hours. At the time of evaluation, he denied any weakness, bowel or bladder retention or incontinence, or numbness or tingling. His only complaint was residual neck pain which was previously treated with oral prednisone and NSAIDS.

PHYSICAL EXAMINATION: A young healthy male in no distress. Normal ambulation. Neck range of motion demonstrated full flexion, but 50% in extension, right and left rotation and lateral tilting. Pain reproduced with neck extension. There was left and right cervical paraspinal tenderness to palpation with no step-off or crepitus noted. Bilateral upper and lower extremity sensation, strength, and reflex testing were normal. No clonus and negative Babinski, Spurling’s, and Hoffman’s signs.

DIFFERENTIAL DIAGNOSIS:
1. Cervical paraspinal muscle strain
2. Cervical Cord Neurapraxia
3. Fracture of cervical vertebrae
4. Congenital Cervical Stenosis

TEST AND RESULTS:
Cervical Spine AP and Lateral Radiographs: Seven cervical vertebrae seen in AP view. Pedicle shadows intact. Lateral view shows loss of cervical lordosis. Intervertebral disc spaces are well maintained.
MRI Cervical Spine WO Contrast: No evidence of acute injury. Multilevel cervical spondylosis with congenital stenosis with the diameter of the spinal canal measuring 6-7 mm. No significant CSF surrounding the spinal cord.
Torg ratio measured on all imaging had values of 0.7 or less.

FINAL/WORKING DIAGNOSIS:
Congenital Cervical Stenosis

TREATMENT AND OUTCOMES:
Based off of imaging and Torg ratio of 0.7 or less, the athlete was not cleared to return to participation. Although he had wrestled for 20 years without issues, he did sustain a strain of his neck. He was referred for a second opinion to a neurosurgeon regarding clearance for return to play.

2174 Board #330 May 30 3:30 PM - 5:00 PM
A Jaw Crushing Line Drive in a Baseball Pitcher
Joshua I. Wilner, Michael Fong, Kaiser Permanente, Los Angeles, CA. (Sponsor: Aaron Rubin, FACSM)
(No relationships reported)

Title: A Jaw Crushing Line Drive in a Baseball Pitcher
Authors: Joshua Wilner, MD, Michael Fong, MD (Sponsor: Aaron Rubin, FACSM)
Institutions: Kaiser Permanente Los Angeles

History: A 23-year-old collegiate baseball pitcher sustained a line drive off the right body of his mandible. The patient had a few seconds in which he reported loss of consciousness. After regaining consciousness, he found the baseball at his feet and threw to first in time for the out. At initial medical evaluation, patient complained of pain and bleeding at the right body of his mandible where the baseball made struck him. However, the site of maximal pain was the left superior mandible, where there was no direct trauma. The patient also had concussion symptoms, including headache, confusion, and photophobia.

Physical Examination: Examination on the field indicated a superficial laceration over the right body of the mandible. There was tenderness and swelling at the right body and left subcondylar aspect of the mandible. He had trismus, but no dysphagia or malocclusion. Patient had a positive concussion evaluation. There was no dental or oral trauma. There was no airway compromise or cervical spine abnormalities. There were no neurologic deficits. The patient was sent to the emergency room for further evaluation and imaging.

Differential Diagnosis:
1. Mandible fracture
2. Mandible contusion
3. Mandible dislocation

Test and Results:
CT Scan Head and Mandible:
1. Non-displaced left subcondylar mandible fracture
2. No fracture of right body of mandible
3. No acute intracranial hemorrhage or pathology

Final Diagnoses:
1. Non-displaced, closed left subcondylar mandible fracture
2. Cervical Cord Neurapraxia
3. Mandible fracture

Treatment and Outcomes:
1. Mandible fracture was treated with observation and soft diet for 4 weeks.
2. All concussion symptoms resolved within 4 days, and the patient graduated return to play protocol.
3. The laceration was treated with simple interrupted suture repair for 7 days. There were no wound complications.
4. The patient returned to full baseball activities 4 weeks after date of initial injury.

2175 Board #331 May 30 3:30 PM - 5:00 PM
A Real Pain in the Neck: A Football Player with Atypical Post-Traumatic Neck Pain
James Suchy, Doug McKeeag, FACSM. OHSU, Portland, CA.
Email: jsuchy@gmail.com
(No relationships reported)

HISTORY:
18 yo M football player presented to college training room clinic with painful right-sided neck swelling after blunt neck trauma from another player’s shoulder pad 2 weeks prior. He had presented to ER 2 days after the incident with acute neck pain and limited ROM, headaches, and difficulty concentrating. CT head & cervical spine were unremarkable. Diagnosed with concussion and SCm strain. He started concussion and muscle strain rehab. Concussion symptoms improved over the next two weeks, but his cervical pain and ROM didn’t, and his neck became more swollen. He denied recent illness, cough, rash, fever, chills, dyspnea, dysphagia. POCUS was performed before referral to ER.

PHYSICAL EXAMINATION: VS: Normal; Gen: No acute distress; Htnt: 5 x 3.5 cm subcutaneous mass on the antero-lateral neck, no bruits appreciable; MSK (Neck): tenderness to palpation along the entire right SCM, no spinal process tenderness, decreased lateral flexion and rotation towards the contralateral side; Card: Regular rate and rhythm, no murmurs; Resp: Clear bilaterally.

DIFFERENTIAL DIAGNOSIS: Occult cervical spine fracture, Intramuscular infection, Ruptured sternocleidomastoid, Internal jugular thrombosis, Arterial pseudoaneurysm.

TEST AND RESULTS: POCUS: diffuse heterogeneous regions throughout the SCM musculature, increased vascularity; ED Labs: WBC: 15.40; ED CT Neck with Contrast: diffuse inflammation of the right SCM muscle with multiple intramuscular abscesses collections in the deep aspect, largest measuring 2.1 x 2.4 x 6.0 cm with associated narrowing of the right internal jugular vein.

FINAL/WORKING DIAGNOSIS: Traumatic SCM myositis with intra-muscular abscesses

TREATMENT AND OUTCOMES:
Hospitalized and started on IV Unasyn and Decadron. Ultrasound guided needle aspiration collected 2 cc purulent fluid that grew 2+ strep pyogenes. Symptoms didn’t improve, so sent to OR for I&D where purulent fluid was drained from cavities superficial to and within the SCM. Neck swelling, pain, and range of motion improved. Repeat neck CT confirmed resolution of infection. Discharged on oral Augmentin. Over several weeks rehabbed to full strength and range of motion in the neck. Given the duration of time away from sport, patient decided to red-shirt the rest of his football season.

2176 Board #332 May 30 3:30 PM - 5:00 PM
Atypical Shortness of Breath in Division 1 Athlete
David M. Baxter, Crozer-Keystone Health System, Springfield, PA. (Sponsor: Thomas Kaminski, FACSM)
Email: david.baxter@crozer.org
(No relationships reported)

HISTORY: This patient a 20-year-old NCAA Division 1 Field Hockey player who presented with shortness of breath, early fatigue, weakness, and achiness with aerobic training for the past several years. She had symptoms almost immediately with aerobic conditioning that would progress as she continued to exercise. Our athlete reported a trial of pre-exercise aminophylline which did not improve her symptoms or exercise tolerance.

PHYSICAL EXAMINATION: Lungs were clear to auscultation bilaterally, with appropriate inspiratory and expiratory effort and normal lung sounds. The patient was able to speak in full sentences without hoarseness. Pulse oximetry 99% and resting...

Abstracts were prepared by the authors and printed as submitted.
heart rate was 64. There was no cyanosis or clubbing of the nails, with normal capillary refill. Cardiac exam revealed regular rate and rhythm without murmurs, rubs, gallops. PMI was not displaced.

DIFFERENTIAL DIAGNOSIS:
1. Reactive Airway Disease
2. Exercise Induced Bronchospasm
3. Valvular Heart Disease
4. Vocal Cord Dysfunction

TEST AND RESULTS:
- Chest X-rays — no focal consolidation, trachea is midline, no masses, no pneumothorax, full inspiratory effort.
- EKG — within normal limits.
- Echocardiogram — within normal limits, preserved ejection fraction and without significant stenosis or regurgitation.
- Spirometry — Pre albuterol administration - FVC 3.33L, FEV1 3.01L, FEV1% 90.5% — Post albuterol administration - FVC 3.4L, FEV1 3.00L, FEV1% 88.9% — Normal lung volumes
- Flexible laryngoscopy — appropriate vocal cord movement with respiration and phonation.

FINAL WORKING DIAGNOSIS:
- Exercise-Induced Laryngeal Obstruction, Vocal Cord Dysfunction

TREATMENT AND OUTCOMES:
1. Referred to Otolaryngologist for diagnosis and treatment; diagnosed with Exercise-Induced Laryngeal Obstruction as diagnosis of exclusion. 2. Treated with boxtox to the bilateral thyro-arytenoid muscles on 3 separate occasions separated by 4 months with positive clinical response.
3. Regular behavioral voice/speech therapy with Speech Language Pathologist tolerated well.
4. Sport psychology counseling was utilized and subjectively helpful to address the underlying anxiety associated with her dyspnea.
5. Patient with improved exercise tolerance, although continues to have symptoms and was unable to return to NCAA Division 1 competition level.

2177 Board #333
May 30 3:30 PM - 5:00 PM
Eosinophilic Fasciitis Presenting as Benign Subcutaneous Emphysema
Karim Elghawy, Aditya Mehta, Karen Bovid, Robert Baker, FACSM. Western Michigan University, Homer Stryker MD School of Medicine, Kalamazoo, MI. (Sponsor: Robert J. Baker, FACSM)

HISTORY: A previously healthy 12 year old female presented with left forearm pain and subcutaneous crepitus of one week duration. She sustained a minor fall 6 weeks ago where she scratched her forearm against a wooden deck. No bruising, cut wounds or penetrating injury. Few days later she developed dull aching pain and subcutaneous crepitus at the front of her left forearm. No redness, warmth, swelling or limitation of movement. X-rays showed air under the skin. She was started on oral antibiotics without improvement. Ten days later, she was admitted to the hospital and started on IV antibiotics with partial improvement. After 2 days she was discharged on oral antibiotics. Symptoms resolved within 10 days of discharge. A week from finishing antibiotics, she presented with similar symptoms without new injuries. No fever, malaise, weight loss or joint pains. She has family history of JIA in a 19 year old brother and Psoriasis in a 15 year old sister.

PHYSICAL EXAM: She looked non-ill and non-toxic with normal vitals signs. There was a mildly tender palpable crepitus over the antero-lateral aspect of her left forearm. No localized swelling, erythema or fluctuation. Normal active range of motion at shoulder, elbow, forearm and wrist. Intact sensation to light touch. Intact radial pulse and brisk cap refill.

DIFFERENTIAL DIAGNOSIS:
1. Necrotizing fasciitis
2. Benign subcutaneous emphysema
3. Autoimmune disease

TESTS AND RESULTS:
- Forearm AP and lateral radiographs:
  - Moderate subcutaneous gas in the left volar forearm
- MRI left forearm:
  - Subcutaneous, muscle as well as superficial and deep fascial edema suggestive of cellulitis, myositis and fasciitis. Multiple foci of gas within the subcutaneous tissues and deep fascia
  - No osteomyelitis or abscess

CBC, CRP and ESR:
- Normal
- Tissue biopsy and cultures:
  - Severe eosinophilic inflammation, no bacterial growth

FINAL WORKING DIAGNOSIS:
- Eosinophilic fasciitis

TREATMENT AND OUTCOMES:
1. Surgical I&D. No fluid or gross tissue abnormality was noted
2. No antibiotics post-operatively, only one prophylactic dose intra-operatively after cultures were collected
3. Her symptoms resolved and she remained symptom free for 2 months
4. Symptoms recurred without new injury
5. She was referred to pediatric rheumatology for further management
6. Symptoms resolved spontaneously within 2-3 weeks

ACSM May 28 – June 1, 2019
Orlando, Florida

TITLE: Tunneling Away Lateral Ankle Pain
AUTHORS: Geoffrey M. Drehner, DO; David Webner, MD; Kevin DuPree, DO
ACSM Sponsor (if you accept): Thomas Kaminski, PhD, ATC (kaminski@udel.edu)

HISTORY:
60-year-old boilermaker presented with 2-month insidious onset left lateral ankle pain, localized to the lateral malleolus, described as achy and throbbing, 7/10, worse with walking, stairs and climbing ladders. No relief with Acetaminophen or NSAIDs.

PHYSICAL EXAMINATION:
Left ankle: no edema or ecchymosis, full range of motion with pain in active dorsiflexion and plantarflexion. Strength 5/5, gross sensation intact and 2+ dorsalis pedis and posterior tibial pulses. Tenderness to palpation along the lateral malleolus extending distally approximately 5 cm along lateral ankle.

DIFFERENTIAL DIAGNOSIS:
1. Chronic lateral ankle instability
2. Peroneal tendinosis with subluxation
3. Lateral malleolar stress fracture
4. Ankle osteoarthritis
5. Talar osteochondral lesion

TEST AND RESULTS:
- Left ankle 3 view x-ray: Normal.
- Left ankle MRI: Anatomic variant involving conjoined peroneus brevis and longus tendons, located along the anterolateral aspect of distal fibula. Deficient/absent peroneal groove along posterior fibula, which also suggests congenital abnormality.
  - Mild conjoined tendinosis, without surrounding edema.
  - Left lateral ankle ultrasound: Intact peroneal tendon overlying the lateral malleolus with trace fluid in sheath. The peroneal tendons split just before brevis insertion onto base of 5th metatarsal.

FINAL WORKING DIAGNOSIS:
- Conjoined left peroneal tendon subluxation with tenosynovitis and absence of fibular groove.

TREATMENT AND OUTCOMES:
1. Physical therapy for 6 weeks led to improved balance and walking mechanics, but no change in pain.
2. Immobilization in CAM boot for 6 weeks caused no improvement in pain or swelling out of boot.
3. Corticosteroid injection to peroneal tendons at level of lateral malleolus lead to no improvement.
4. Podiatric referral and surgery including tunnelization of peroneal tendons, creation of 6mm fibular groove and repair of peroneal retinaculum. 3 months post-operatively, the patient was full weight bearing pain free with daily activities in lace-up ankle brace.

2179 Board #335
May 30 3:30 PM - 5:00 PM
Shoulder Pain in a Weightlifter
Kelly Joy Valignotta, Terry Nicola, FACSM, Melody Hruby, UIC Sports Medicine, Chicago, IL. (Sponsor: Dr. Terry Nicola, FACSM)

HISTORY: A 20-year-old male weightlifter presented as a new patient to a sports medicine clinic with left shoulder pain. Pain began five months prior while the patient was performing overhead presses with a 205 lb barbell. While pushing up into his 5th repetition, he felt a “shift” in his left shoulder. He did not have a significant amount of pain at the time. In the following weeks, he began to have more pain in the left shoulder and decreased his weight during overhead presses and chest presses due to pain and weakness. He tried taking two weeks off from lifting, but when he resumed

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2178 Board #334
May 30 3:30 PM - 5:00 PM
Tunneling Away Lateral Ankle Pain

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(No relationships reported)
he was unable to complete any overhead or chest work due to pain. The pain is focal over the anterior-lateral shoulder with no radiation. No numbness or tingling. He is unsure if his weakness is due to pain or a separate issue.

PHYSICAL EXAMINATION: There was no bony abnormality or muscle atrophy. Patient had full active range of motion of the left shoulder in forward flexion and abduction, with mild pain at end range. Passively, he had 85 degrees of external rotation and 85 degrees of internal rotation with arm abducted to 90 degrees. There was tenderness to palpation along the distal clavicle and acromion, as well as over the supraspinatus, infraspinatus, teres minor/major, biceps, and anterior deltoid. Jobe’s test positive for pain and weakness. Positive cross-arm test. Negative Hawkwin’s, Neer’s, O’brien’s, Speed’s, and Yergason’s. Pain with resisted external rotation and shoulder abduction. Strength was 5/5 at bilateral deltoid, biceps, triceps, wrist extendors, finger flexors, and finger abductors, but 4/5 during resisted left glenohumeral external rotation due to pain.

DIFFERENTIAL DIAGNOSIS: 1) Glenohumeral subluxation 2) Rotator cuff tear 3) Labral tear 4) AJ joint sprain/separation 5) Clavicle fracture

TESTS AND RESULTS: 1) XR Chest from ER visit for unrelated incident: Visualized left clavicle normal, shoulder not visualized. 2) MRI left shoulder without contrast: Nondisplaced fracture of the distal clavicle with associated bony edema of the clavicle and acromion at the AC joint with mild surrounding soft tissue edema. Low grade tendinosis of the infraspinatus and supraspinatus with suspicion for a tiny undersurface tear without retraction. 3) XR Clavicle: Clavicle is intact and negative for fracture.

FINAL WORKING DIAGNOSIS: Nondisplaced fracture of distal clavicle

TREATMENT AND OUTCOMES: 1. Given no signs of fracture healing after 5 months, ordered laboratory work which revealed Vitamin D deficiency. Patient started on Vitamin D 1200mg and Calcium 800mg daily. 2. Activity modified to abstain from weight bearing exercises through the left upper extremity until next follow up visit.

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2180 Board #336 May. 30 3:30 PM - 5:00 PM Is it Friction? A Rare cause of Medial Knee Pain

Wade Johnson, Jeffrey Payne. Mayo Clinic, Minneapolis, MN. (Sponsor: Jonathan Finnoff, FACSM)

(No relationships reported)

HISTORY: A 22-year-old male with no significant past medical history presents with reports of two weeks of progressive medial knee pain, after beginning training for a sprint triathlon. Prior to starting his training, he primarily lifted weights and ran only sporadically. He increased his running significantly up to 3 to 4 miles 4 to 5 times per week. Pain was initially only present while running, but became present with any activity including swimming, especially with a frog-leg kick, after cycling, and finally with day-to-day walking. He notes mild swelling in the medial knee. He denies any catching, locking, buckling, or give-way of the knee. He denies any paresthesias in the right lower extremity.

PHYSICAL EXAMINATION: Pain in the right medial knee with single leg squat on the right. No knee effusion, however, there is mild swelling located just below the medial joint line over the proximal medial tibia on the right. Knee range of motion is full bilaterally. Ligamentous exam stable. Pain with valgus stress testing at 30 degrees on the right without laxity. No tenderness over the medial or lateral joint lines. Tenderness to palpation over the proximal medial tibia a few centimeters distal to the joint line and over the MCL in this region. No tenderness to palpation over the proximal MCL or pes anserine bursa.


TEST AND RESULTS: Plain radiographs: — No acute osseous abnormality. MRI right knee: — focal subcortical narrow edema within the medial aspect of the tibia 2.5cm below the joint line at the site of a bony protruberance compatible with prominent medial tibial crest — No fracture line, or soft tissue mass

FINAL WORKING DIAGNOSIS: Medial tibial crest friction syndrome

TREATMENT AND OUTCOMES: 1. Voltaren gel and activity modification with cessation of cycling, and reduction in training volume, with reported improvement. 2. Patient wanted to return to training for a triathlon and ultrasound-guided corticosteroid injection, deep to the MCL over the tibial protruberance, was performed. 3. Patient reported complete resolution of pain immediately after injection that was maintained at 2 weeks. 4. Patient completed his sprint triathlon without development of pain and he was instructed to follow-up should his symptoms recur.

PHYSICAL EXAMINATION: LEFT KNEE Symmetric, no quadriceps atrophy No effusion No TH O p quadriceps tendon, patella, patellar tendon, medial joint line, MCL or LCL Left: Active ROM: 5-135, PROM 0-135 Right: Active ROM: -3-135 Clark Inhibition: neg Bounce test: neg Patella grind: neg Varus stress 0 and 30: neg Valgus stress 0 and 30: neg Lachman: neg Anterior drawer: neg Posterior drawer: neg Mc Murray: + palpable knee joint click without pain Thessaly/Apley: neg Ober: very flexible at level of hip Short and hypertonic hamstrings on left, w/o tenderness to palpation No tenderness along IT band Thomas: positive Strength 5/5: hip and knee extension and knee flexion intact to light touch

DIFFERENTIAL DIAGNOSIS: Hamstring hypertonicity, Mass/tumor, Reactive arthropathy, Enteropathic arthropathy, Meniscus tear

TEST AND RESULTS: X-ray left knee, standing: flattening of the lateral tibial plateau and tibial spines, no acute fracture, no joint disease, open physi

TREATMENT AND OUTCOMES: Left discoid meniscus suture and Physical therapy for rehabilitation. Patient doing well after surgery, with return to full activity without pain or other symptoms.

D-75 Clinical Poster/Reception - Clinicians’ Reception with Poster Presentations

Thursday, May 30, 2019, 6:00 PM - 7:00 PM
Room: Hotel-Signature 1 Meeting Room

2197 Board #1 May 30 6:00 PM - 7:00 PM The Relationship between Bone Mineral Accrual and Changes of Body Composition in Competitive Girl Runners Norimitsu Kinoshita1, Eriko Uchiyama1, Kenta Okuyama1. 1Hosei University, Tokyo, Japan. Shimane University, Shimane, Japan. (No relevant relationships reported)

Low bone density is a complication of a long-term strict weight control during adolescence in women.

PURPOSE: To assess whether decrease in percent body fat (%BF) is associated with an impaired bone mineral accrual in girl runners.

METHODS: Consecutive 22 freshman girl runners (15yo, 156cm, 45kg) during 7 years in competitive high school teams were evaluated over 2 years of training. DXA was performed at the preparatory phase (baseline) and repeated after 23 ± 2 months (follow-up). The runners were divided into 2 groups; negative (DEC, n=11) or positive (GAIN, n=11) changes of %BF (Δ%BF) during the period. The effect of the period and the group on the changes in bone mineral content (BMC) and density (BMD) of total body less head and z-score were analyzed by 2-way repeated measures ANOVA. As for lean soft tissue mass (LSM) and fat mass (FM), paired t-test was used to compare between baseline and follow-up. Bivariate correlation analysis was used to examine the relationship between bone mineral accrual (ΔBMC and ΔBMD) and Δ%BF as well as the changes of FM (ΔFM) and LSM (ΔLSM). Written informed consent was obtained from the runners and their parents. P<0.05 was considered as statistically significant.

RESULTS: %BF changed from 17.4 to 14.3 (DEC) and 15.0 to 18.4 % (GAIN). The period had significant effects on BMC, BMD, and z-score without interactions. Contrast showed significant increases in those variables, while the group of Δ%BF had no significant effect, indicating the values of DEC and GAIN were similarly increased; 1.57 to 1.64 and 1.66 to 1.77 kg, 0.98 to 1.00 and 1.00 to 1.03 g/cm², and -0.25 to -0.20 and 0.04 to 0.22, respectively. The DEC runners gained LSM (34.2 to 36.1 kg) and reduced FM (7.7 to 6.4 kg) significantly, while the GAIN runners significantly increased FM (6.9 to 9.0 kg) without LSM change (36.6 to 37.0 kg). Neither Δ%BF nor ΔFM, but ΔLSM was significantly correlated with ΔBMC (r=0.45) and ΔBMD (r=0.55).

CONCLUSIONS: Bone mineral was equally accrued among the runners of which %BF increased or decreased, where the accretion was associated with LSM gain. Competitive distance runners would develop leanness by not only losing FM but also gaining LSM (i.e., skeletal muscle) along with long-term exercise training. This would ameliorate an impairment of bone mineral acquisition by strict weight control.
Sport specialization has become increasingly common and has been related to sports injury and menstrual dysfunction among female high school distance runners. The association between sport specialization and low bone mineral density (BMD) is poorly described in this population. PURPOSE: To determine the association between sports specialization and low BMD in female high school distance runners.

METHODS: Participants consisted of 64 female runners (age 15.6 ± 1.4y), not currently on birth control medication, who competed in interscholastic cross-country and distance track events in southern California. Each runner completed a survey on sport participation and menstrual function, and had her height and weight measured. Each runner’s spine and hip BMD were assessed using DXA, standardized to BMD Z-score by age and sex normative values. Sport specialization classifications were: low specialization (distance running sport(s) for ≤8 months/year and participation in ≥2 other non-running high school sports); moderate specialization (only distance running sport(s) for ≤8 months/year, or participation in distance running sport(s) ≥9 months/year and ≥2 other non-running sports); and high specialization (participation in distance running sport(s) for ≥9 months/year and no other sports). Multivariable logistic regression was performed to determine the adjusted odds ratio (OR) and 95% confidence interval (CI), adjusting for BMI and gynecological age. RESULTS: Both groups showed a significantly reduced 2,000-m rowing time (KME: p<0.001, CON: p=0.01), and the total number of strokes were significantly fewer in the KME group than in the CON group (p=0.05). After supplementation the levels of IL-6 and TNF-α were lower in the KME group than in the CON group in all periods of the rest (p<0.001), immediately after exercise (IL-6; p=0.01, TNF-α; p=0.001), and after 30 min of recovery (p=0.01). Conclusion: Therefore, mistletoe extract intake can reduce the serum inflammatory cytokine levels (which are otherwise increased due to high-strength exercise) among active individuals, indicating improved anti-inflammatory activity.

CONCLUSIONS: Our findings indicated that high sport specialization was associated with low BMD among female high school distance runners. Further investigation of this association is warranted as low BMD has been related to increased risk of stress fracture.

Excessive long-term training and extensive exertion during exercise can inflammatory cytokine expression. Various measures have been explored to minimize this, and dietary supplements having anti-inflammatory and antioxidant functions can help athletes recover from repetitive intensive exercises, thereby preventing reduced vitality. Purpose: This study aimed to identify the effect of mistletoe extract consumption on inflammatory markers of university male rowing athletes for 8 weeks during the winter training period. Methods: This study included 20 male rowing athletes divided into two intervention groups: KME and CON. The KME group took 110 mL of mistletoe extract every morning and evening after meals (total of 220 mL) for eight weeks. Before and after taking mistletoe for eight weeks, 2,000 m rowing performance capabilities were measured, and KME group took 110 mL of mistletoe extract after recovery from the rowing exercise. Blood samples were collected during the rest, immediately after exercise, and after 30 min of recovery. Among inflammatory markers, IL-6 and TNF-α were analyzed. Results: Both groups showed a significantly reduced 2,000-m rowing time (KME: p<0.001, CON: p=0.01), and the total number of strokes were significantly fewer in the KME group than in the CON group (p=0.05). After supplementation the levels of IL-6 and TNF-α were lower in the KME group than in the CON group in all periods of the rest (p<0.001), immediately after exercise (IL-6; p=0.01, TNF-α; p=0.001), and after 30 min of recovery (p=0.01). Conclusion: Therefore, mistletoe extract intake can reduce the serum inflammatory cytokine levels (which are otherwise increased due to high-strength exercise) among active individuals, indicating improved anti-inflammatory activity.
The Impact of Clinical Factors in Physician and ATC Decision Making for Concussion Return to Play: Insight from a Policy Capturing Study

Darwin McKnight, Vicki Nelson, Franklin Sease, FACSM, Rg Gilliland. Greenville Health System, Greenville, SC. (No relevant relationships reported)

PURPOSE: To scrutinize the role of several clinical factors in physician and clinical athletic trainer (ATC) return-to-play (RTP) decision making in high school athletes who sustained a concussion.

METHODS: Sports Medicine physicians and ATCs completed a policy capturing survey of 50 clinical scenarios and rated how likely they were to clear the athlete for RTP. Nine factors were randomly varied within the scenarios: age, gender, sport, prior concussion, initial symptom score, symptom duration, and ImPACT performance. Participants then ranked how important each variable was in their decision making process.

RESULTS: 16 physicians (87.5%) and 29 ATCs (mean 4.8 concussions managed per month) participated. ImPACT testing was the most significant contributor in RTP decisions. Physicians and ATCs weighed ImPACT changed from baseline (β=0.42, p=0.23 and 1.28, p=0.18 respectively) and ImPACT compared to normative values (0.39, p=0.24 and 1.38, p=0.90 respectively) most heavily. Respondents self-ranked prior concussion and age as most influential in their RTP decision making. There was no correlation between participants self-ranking of importance and the observed contribution of a variable to decision making.

CONCLUSIONS: Respondents displayed poor insight to the role of various clinical factors in their management of concussion RTP. ImPACT testing has a greater influence on RTP decisions than physicians and ATCs realize. Despite having low self-ranked importance, variables related to ImPACT results were among the most influential. Self-ranking importance of clinical variables is similar between physicians and ATCs; however, symptom duration is less important to ATCs compared to physicians. Although age was considered important in self-ranking it was not a significant contributor to RTP decision making.

Spine Injuries and Concussions among Figure Skaters

Kristen M. Lambrinakos-Raymond, Greggory Kobelski, Ellen Geminiani, Dai Sugimoto, William P. Meehan, III. Boston Children’s Hospital, Boston, MA. (No relevant relationships reported)

PURPOSE: To determine the prevalence and mechanism of spine injuries and concussions among a sample population of figure skaters. To assess for potential risk factors for these injuries.

METHODS: This is a cross-sectional analysis of spine injuries and concussions reported by figure skaters. Data was obtained through an anonymous, confidential online questionnaire distributed to members of participating figure skating clubs. The main outcomes included diagnosis, mechanism and source of medical care. Simple descriptive statistics were used; Fisher’s exact test was used to assess for statistical differences in categorical variables between groups. SPSS was used for all analyses.

RESULTS: Thus far, 88 participants have completed questionnaires (recruitment ongoing). The mean age of participants is 25.2 years (SD 17.1). Most (79%) practice figure skating year-round; 85% are female. Most (85%) report injuries requiring medical attention; 96% report at least one medical visit. The most common diagnosis was muscle or ligament strain (23%). Two-thirds (65%) of respondents had at least one injury this past season. Participants reported 208 injuries; 64% self-reported multiple injuries per season. Self-reported injuries varied across disciplines, with 51% being sustained in practice and 49% in competition. The most common injuries were muscle strains (39%), followed by joint sprains (27%). The most common locations were the spine (18%), followed by the upper arm (11%). There was no significant difference in injury prevalence across disciplines. Injury prevalence was not associated with age, sex, or discipline participation. Injury prevalence was associated with degree of engagement in the sport (r=0.41, p=0.001). The most common factors for these injuries were musculoskeletal (77%), followed by misjudgment (54%).

CONCLUSIONS: Nearly a third of skaters sustained a concussion or spine injury, yet nearly half did not report their injuries to a HCP. Our findings warrant further investigation into the reasons for such a low reporting rate among figure skaters and the potential effect on injury outcomes.