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 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; -13% in females) and catalase (+18% in males; -11% in females) was different between genders after a vigorous bout of aerobic exercise (p=0.0136, 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

**References**

1. Ahmad A, Morris Z, Kim LMK, Chinn R, Fang R, Saligan L, Chan L, Keyser R. 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.

2. Males performed vigorous-intensity exercise at a higher WR than 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; -13% in females) and catalase (+18% in males; -11% in females) was different between genders after a vigorous bout of aerobic exercise (p=0.0136, p=0.0344, respectively). This difference became insignificant when WR was accounted for.

3. 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
Our results showed that swimming does not appear to improve bone microarchitecture or strength. Future research should investigate whether site-specific bone adaptations exist following swimming exercise. Our findings provide reassurance that swimming is not a bone-thinning modality and may offer a unique alternative to conventional weight-bearing exercises to achieve bone health.

**CONCLUSION:**

Our study provides preliminary evidence that swimming does not appear to improve bone microarchitecture or strength. Further research is needed to determine if swimming is a beneficial activity for bone health in general and for females in particular.

**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>886.5±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>

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**S344 Vol. 51 No. 5 Supplement**

**Medicine & Science in Sports & Exercise®**

**THURSDAY, MAY 30, 2019**

**S011 Board #6 May 30 1:30 PM - 3:30 PM**

**Skeletal Responses To An All-female Unsupported Antarctic Expedition**

Thomas J. O’Leary1, Robert M. Grifford2, Rebecca L. Double1, Rebecca M. Reynolds2, David R. Woods3, Sophie L. Wardle1, Julie P. Greczes3, 1Army Headquarters, Andover, United Kingdom; 2University of Edinburgh, Edinburgh, United Kingdom; 1Defence Medical Services, Lichfield, United Kingdom.

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(No relevant relationships reported)

**Medicine & Science in Sports & Exercise®**

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**Medicine & Science in Sports & Exercise®**

**THURSDAY, MAY 30, 2019**

**S012 Board #7 May 30 1:30 PM - 3:30 PM**

**BMI as a Predictor of Bone Mineral Density Among Premenopausal Women**

Stephanie M. Otto. Gustavus Adolphus College, St. Peter, MN.

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(No relevant relationships reported)

**Medicine & Science in Sports & Exercise®**

**S346 Vol. 51 No. 5 Supplement**

**Medicine & Science in Sports & Exercise®**

**THURSDAY, MAY 30, 2019**

**S013 Board #8 May 30 1:30 PM - 3:30 PM**

**Bone Mineral Density is an Important Women’s Health Topic**

Melissa Y. Vassmer, Meghan C. Boyd, Tiffany A. Zvarric, Stephanie M. Otto. Gustavus Adolphus College, St. Peter, MN.

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(No relevant relationships reported)

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**Medicine & Science in Sports & Exercise®**

**THURSDAY, MAY 30, 2019**

**S014 Board #9 May 30 1:30 PM - 3:30 PM**

**Low Intensity Exercise Promotes Bone Health in Adolescent Girls**

Jordan L. Sirois, Jocelyn A. Peloquin, Christopher J. McDonald, Shane M. Hammer, Andrew M. Alexander. Kansas State University, Manhattan, KS.

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(No relevant relationships reported)

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**THURSDAY, MAY 30, 2019**

**S015 Board #10 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.

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(No relevant relationships reported)

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**THURSDAY, MAY 30, 2019**

**S016 Board #11 May 30 1:30 PM - 3:30 PM**

**A comparison of bone mineral density and bone strength of premenopausal and postmenopausal women**

Julie L. Popp, Rachel D. Slocumb, Melissa C. Meek, Andrew M. Alexander, Shane M. Hammer. Kansas State University, Manhattan, KS.

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(No relevant relationships reported)

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**THURSDAY, MAY 30, 2019**

**S017 Board #12 May 30 1:30 PM - 3:30 PM**

**Bone mineral density is an important women’s health topic**

Melissa Y. Vassmer, Meghan C. Boyd, Tiffany A. Zvarric, Stephanie M. Otto. Gustavus Adolphus College, St. Peter, MN.

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(No relevant relationships reported)

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**Medicine & Science in Sports & Exercise®**

**THURSDAY, MAY 30, 2019**

**S018 Board #13 May 30 1:30 PM - 3:30 PM**

**Bone mineral density and bone mineral content of the lower extremities in postmenopausal women**

Melissa M. Jorgensen, Stephen J. Iriarte, Andrew M. Alexander, Shane M. Hammer. Kansas State University, Manhattan, KS.

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(No relevant relationships reported)

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**THURSDAY, MAY 30, 2019**

**S019 Board #14 May 30 1:30 PM - 3:30 PM**

**Effect of Intermittent Moderate Intensity Exercise on Bone Density in Men and Women**

Daniel A. Voss, Mark W. Lawrence, Christopher J. McDonald, Thomas J. Barstow, FACSM. Kansas State University, Manhattan, KS.

Email: devoss@k-state.edu

(No relevant relationships reported)
D-09 Thematic Poster · Physical Activity & Behavioral Science during Pregnancy and Motherhood

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
Room: CC-102B

Chair: Sofiya Ahassan, FACSM. University of Massachusetts, Amherst, MA.
(No relevant relationships reported)

Despite the benefits of physical activity and the potential risks of sedentary behavior (SB), few studies have examined sensor-measured SB in pregnant women.

**PURPOSE:** To evaluate sensor-measured PA in overweight and obese pregnant women and its sociodemographic and psychological correlates.

**METHODS:** We analyzed baseline data from an ongoing behavioral lifestyle intervention trial in Columbia, SC (n=202). PA was measured with the SenseWear Armband; compliance was set at wearing for 20+ hrs/d, 5+ days (including 1+ weekend day). SB was defined as MET values < 1.5. Total time in non-sleep SB, # of SB bouts ≥ 30 min, and total time in SB bouts ≥ 30 min were calculated. Differences in SB by parity, race, education, marital status, and employment (t-tests), as well as BMI, age, depressive symptoms, perceived stress, and satisfaction with body function and appearance (Pearson rs) were tested.

**RESULTS:** Participants (n=202) randomized with usable armband data are 18 to 44 yrs old, and without exercise contraindications. Participants wore a SenseWear Armband ≥ 20 hrs/d for ≥ 5 days (including ≥ 1 weekend day). SB was defined as MET values < 1.5. Total time in non-sleep SB, # of SB bouts ≥ 30 min, and total time in SB bouts ≥ 30 min were calculated. Differences in SB by parity, race, education, marital status, and employment (t-tests), as well as BMI, age, depressive symptoms, perceived stress, and satisfaction with body function and appearance (Pearson rs) were tested.

**CONCLUSIONS:** Total SB time, SB time ≥ 30 min bouts, and # of SB bouts ≥ 30 min appear to be high in early pregnancy, with these behaviors of particular concern in several demographic subgroups. SB was also related to more negative psychological experiences. Interventions to target SB could benefit pregnant women.

Funded by NIH/NICHD.

1595 Board #1 May 30 1:30 PM - 3:30 PM

Baseline Correlates Of Sedentary Behavior In The Health In Pregnancy And Postpartum (HIPP) Study

Sara Wilcox, FACSM1, Jihong Liu1, Brent Hutto1, Ellen Wingard1, Gabrielle Turner-McGrievy1, Judith Burgess2, Alycia Boutte1, Lara Schneider1. 1University of South Carolina, Columbia, SC. 2University of South Carolina School of Medicine, Columbia, SC.
Email: wilcoxs@mailbox.sc.edu
(No relevant relationships reported)
vigorou 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 quantile regression models. 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 (154, 258) min/d LPA, 34 (20, 49) min/d MVPA, and 4,707 (3,768, 6,590) steps/d. LPA, MVPA, and steps were lower in African American and obese women (p<.05). LAP was lower in nulliparous women (p<.05). Participants with less than college education had lower MVPA and steps (p<.05). Further, LPA, MVPA, and steps were positively associated with PA self-efficacy (r’s ranging from 0.13 to 0.16, p<.05) and PA goal setting (r’s ranging from 0.16 to 0.21, p<.05). MVPA was positively associated with PA planning (r=0.16, p<.05). Only 10.4% of met MVPA guidelines, which was more prevalent in white (17.1%) vs African American (2.2%) women and in overweight (17.9%) vs obese women (3.7%) (p<.05). After adjusting for age, parity, and marital status, white women and overweight women had higher odds of meeting MVPA recommendation than their counterparts: white: 5.8 (1.2-26.8); overweight: 5.2 (1.6, 16.9).

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.

1598 Board #3 May 30 1:30 PM - 3:30 PM
The Association Between Type and Intensity of Physical Activity on Cortisol Levels Among Low-Income, Ethnic-Minority Mothers

Wendy Miranda, Guido Urizar. California State University, Long Beach, Long Beach, CA. Email: wndymiranda@gmail.com

(No relevant relationships reported)

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 varies (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 majority of our sample were sedentary with only 3% meeting the national recommendations of daily aerobic activity (>30 minutes or more of moderate to vigorous aerobic activity). Mothers completed an activity log of their physical activity over three days. During this three-day period, mothers also collected their saliva at four times on one collection day (upon waking time, 30 minutes after waking, 4pm, and 8pm) to assess for cortisol levels. 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).

RESULTS: Multiple regression analyses found that mothers who engaged in greater minutes of vigorous recreational activity 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 moderate or vigorous miscellaneous (e.g., heavy lifting) activity had higher cortisol levels, but only among mothers with more children (β = 0.93, t(21) = 3.12, p = 0.01). No significant association was found with other types of activity.

CONCLUSION: Despite the benefits of physical activity, results suggest that low-income, ethnic minority mothers with more children are not receiving these benefits and that number of children may be a stressor. Further research should consider family size when designing and implementing physical activity interventions in this population.

1599 Board #4 May 30 1:30 PM - 3:30 PM
Self-regulation Capacity Of Low-income Mothers In Community-based Nutrition Program

Alyssa Abreu, 1 Eric J. Jones, 1 Dustin Joubert, 1 Mark D. Faries. 2 Stephen F. Austin State University, Nacogdoches, TX. 2Texas A&M AgriLife Extension, College Station, TX. (Sponsor: Thomas J. Pujol, FACSM)

(No relevant relationships reported)

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-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 using 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 on 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 reach 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.

1600 Board #5 May 30 1:30 PM - 3:30 PM
Physical Activity Does Not Moderate the Relationship Between Postpartum Body Satisfaction and Depressive Symptoms

Faith C. Laframboise, Rebecca A. Schlaff, Samantha J. Deere, Meghan Baruth. Saginaw Valley State University, University Center, MI.

(No relevant relationships reported)

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 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); six subscales: attractiveness, feeling fat, disparagement, strength and fitness, salience of weight/shape, and lower body fat), 4) PDS via the 10-item Center for Epidemiologic Depression Scale (CES-D), and 5) postpartum MVPA. Relationships 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<0.001, salience of weight/shape, and lower body fat): p=0.005; two were inversely related (attractiveness: p=0.0007 and strength and fitness: p=0.003). 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 of weight/shape, and lower body fat: 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.

1601 Board #6 May 30 1:30 PM - 3:30 PM
Impact of Weight Related Variables on Postpartum Depressive Symptoms

Samantha J. Deere, Meghan Baruth, Rebecca A. Schlaff. Saginaw Valley State University, University Center, MI.

(No relevant relationships reported)

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 and ≥18 years of age 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 postpartum, and 4) postpartum weight retention (PPWR).
Postpartum (to calculate weight retention at 6 months), and current weight (to calculate PPWR). The 10-item Centers for Epidemiological Studies Depression Scale (CES-D 10) measured postpartum depressive symptoms. Regression models examined the relationship between postpartum depressive symptoms and 1) pre-pregnancy BMI, 2) weight gain during pregnancy (controlling for pre-pregnancy BMI), 3) weight loss at 6 months postpartum (controlling for weight gain), and 4) PPWR (controlling for months postpartum). RESULTS: On average, women were 30.1±3.9 years of age and 5.8±7.3 months postpartum. Mean pre-pregnancy BMI was 27.5±6.8 kg/m², and weight gain was 29.8±14.1 pounds. A majority were Caucasian (97%), married (88%), and college graduates (77%). Results showed a significant, positive relationship between postpartum depressive symptoms and 1) pre-pregnancy BMI (p=0.04) and 2) PPWR (p=0.04). A significant negative relationship was identified between postpartum depressive symptoms and weight loss at 6 months (p=0.01). There was no significant relationship between postpartum depressive symptoms and weight gain during pregnancy (p=0.93). CONCLUSION: Women with a higher pre-pregnancy BMI, higher PPWR, and lower weight lost at 6 months postpartum, may be at a greater risk for postpartum depressive symptoms; weight gain during pregnancy was not associated with postpartum depressive symptoms. Understanding factors associated with postpartum depressive symptoms can help develop and implement appropriate screenings/follow-ups and interventions among those at greatest risk.

Sleep On Pregnancy - Related Anxiety

Emma K. Wilscie, Christopher P. Connolly, Zoe Wright Osborn, Maria Garstein, Sara Waters. Washington State University, Pullman, WA. Washington State University, Vancouver, WA. (No relevant relationships reported)

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 regarding their moderate and vigorous physical activity (min/wk) for prepregnancy, in the first and second trimesters, and concurrently. Participants also wore a validated physical activity monitor (Modus StepWatch) for one week, and average steps/day were calculated. QS was evaluated with the Pittsburgh Sleep Quality Index (PSQI), calculating a global score. The Pregnancy Related Anxiety Questionnaire (PRA-Q-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). Mann-Whitney U-tests were used to compare the distribution of MVPA for all timepoints, step/day, and also QS between high and low PRA participants. Hierarchical logistic regression determined the joint influence of MVPA and quality of sleep on PRA. RESULTS: Mann-Whitney U-tests showed lower PRA participants had significantly superior third trimester global QS scores (p=0.048). Likewise, global QS scores were related to increased odds of high PRA (p=1.34, 95% CI: 0.99-1.80). Average steps/day and self-reported MVPA prior to pregnancy and at all pregnancy timepoints were not related to PRA. Hierarchical analyses did not reveal an interactive effect of steps/day and QS or MVPA and QS on PRA as hypothesized. 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.
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. Balbim,1 Susan Aguillaga,2 Priscilla Vazquez,3 Isabelia G. Marques,3 Jaqueline Guzman,4 Deborah Salvo1, David X. Marquez, FACSM.1 University 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. 1Washington University in St. Louis, St. Louis, MO. (Sponsor: David X. Marquez, FACSM)
Email: gbalbi2@wustl.edu

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

METHODS: Older Latino adults (n= 333; M± SD: 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 for two sessions per month 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 days. Wrist cut-points utilized were proposed by Kamada (2016) (moderate-to-vigorous PA (MPV) ≥7500 counts per minute). We performed a fixed-intercept mixed model (p & t½), adjusting for baseline covariates of age, sex, education, income, and health status. Cohen’s effect size were computed.

RESULTS: Self-reported MVPA (minutes) increased significantly (t(1) = 3.2, p<0.001) from baseline to four months of dance (M=140.81±111.35; HE=115.48±111.35). Significant group*time interaction was demonstrated (t(1), 121)=1.33, p=0.19, d=0.22. Total leisure-time PA (LTPA) (minutes) increased significantly from baseline (Dance: M=29.11±20.45; HE: M=23.21±18.27) with significant group*time interaction (t(1), 121)=2.16, p=0.03, d=0.33. Accelerometer-assessed MVPA did not increase significantly from baseline (Dance: 24.43±22.67, HE: 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 (t(1), 112)=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. Dooley2, Ashleigh M. Johnson1, Abiodun Oluymomi2, Kelley P. Gabriel, FACSM3, Alexandra E. van den Berg2, Adriana Perez2, Harold W. Kohl III1, FACSM1. 1Washington University in St. Louis, Saint Louis, MO. 2The University of Texas Health Science Center at Houston, Houston, TX. 3The University of Texas Health Science Center at Houston, Austin, TX. 4Baylor College of Medicine, Houston, TX. Email: dsalvo@wustl.edu

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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 exposure: high access & high work, high access at home & low access at work, 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 RO1DK101593.

1608 Board #5
May 30 1:30 PM - 3:30 PM
Developing a National Network of Physical Activity Promotion: The Case of Germany
Stefan Peters,1 Hagen Wäschte,1 Alexander Woll2, Gerhard Huber2. 1DVGS e.V., Hürth-Efferen, Germany. 2Karlsruher Institute of Technology, Karlsruhe, Germany. 1Heidelberg University, Heidelberg, Germany.
Email: stefan.peters@dvg.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 multiplicators as well as their structural connection.

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, professionals groups and multiplicators as well as their structural connection. In Germany, an exploratory study addressed 2 goals accordingly: (1) the identification of relevant actors, professional groups and multiplicators 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.

CONCLUSIONS: Several important 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 Van Ness1, Mercedes K. Steidley1, Ryan C. Bain2, Courtney D. Jensen1. 1University of the Pacific, Stockton, CA. 2Tree House Rehabilitation, Orange County, CA.

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
The effects of different modalities of aerobic training on cardiorespiratory 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 meta-analysis suggest that high-intensity interval training (HIIT) (i.e., a quadratic relationship). CONCLUSIONS: The SMART design was feasible and suitable for defining the best sequence of interventions, but so far it has been utilized in a smartphone/gamified intervention for physical activity. PURPOSE: To investigate the effects of a SMART design on the behavior of the average number of steps/day in a smartphone app intervention for physical activity in insufficiently active adults. METHODS: We conducted a feasibility 24-week/2-stage SMART in which 18 insufficiently active participants (=10000 steps/day) were first randomized to Group 1 (smartphone app only), Group 2 (smartphone app + tailored messages) and a control group. Participants were asked to increase at least 2000 steps/day on average each week. Based on the 12-week intermediate outcome, responders kept their interventions and non-responders were rerandomized to a subsequent treatment. In group 3 (Smartphone app + gamification), participants were instructed to form groups to use several game elements available in the chosen application (Pacer®). We fit linear regressions for each participant with the relationship between weeks and steps/day. We considered responders those with any positive slope at the end of the 1st stage treatment. We compared the accelerometer-based steps/day before and after the intervention as well as the slopes of the app-based steps/day between the 1st and second stages of treatment. RESULTS: Twelve participants, five controls, finished the intervention. We identified two responders in group 1. We did not observe significant changes in the steps/day neither throughout the intervention nor compared to the control group. However, the rerandomization of the five non-responders was able to change the slope of the steps/day of a median, +198 steps/day (interquartile range, -279 to +103) to 20 steps/day (-294 to +145), P = 0.079. Finally, we observed in three participants in group 2 an increase in the number of steps/day up to the sixth week and then an inflection to the baseline values or even lower (i.e., a quadratic relationship). CONCLUSIONS: The SMART design was feasible and changed the behavior of the steps/day after rerandomization. Our results suggest that the rerandomization should be implemented earlier to take advantage of the tailored messages.
Effects Of Running Biomechanics On The Occurrence Of Iliotibial Band Syndrome- A Prospective Study
Qipeng Song, Peixin Shen. Shandong Sport University, Jinan, China.

PURPOSE: This prospective study aimed to determine the gait characteristics that easily induce ITBS and explore the posture changes after the occurrence of ITBS. METHODS: 15 ITBS-stricken runners (I group) and matched 15 healthy runners (C group). All participants underwent two gait trials, namely, before the first day of running (trial1) and after 8-week running (trial2). An eight-camera motion capture system was used to collect kinematic data. Sub-group comparisons were assessed via paired-sample t-test. RESULTS: In trial2, the ITBS group exhibited greater peak anterior pelvic tilt and hip flexion angle than the control group(Fig1a). The ITBS group showed increased peak trunk inclination angle, whereas the control group demonstrated lower peak hip flexion (Fig1b) and peak hip abduction than those at trial1(Fig1c). Fig1. Comparison of joint activity between the two groups. ■ Represent significant differences between the two groups in trial 2. ▲▲ Significant differences in the control group compared with trial 1. Abbreviation: t1: trial1; t2: trial2; LDT=left foot touch down; LTO=left foot take off; RTD=right foot touch down; RTO=right foot take off; 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 truncal 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 (2017GSF06044).

Achilles tendonopathy is an overuse injury that commonly sidelines runners. During rehabilitation, return-to-sport (RTS) decisions are made with minimal guiding evidence. With reinjury rates as high as 44%, evidence is needed to improve clinical decisions. Abrupt loading patterns while running may partially explain reinjury rates. PURPOSE: To determine if Achilles tendon loading patterns change during a 30-minute steady-state run in patients with Achilles tendonopathy and explore relationships between loading patterns and kinesiophobia.

METHODS: 12 runners (7M) with Achilles tendonopathy were included (age:44±11y; height:171±10cm; mass:70±12kg; VISA-A score:71±10; current mileage:40±29km/wk). Participants ran for 30 minutes at their endurance pace (2.9±0.3 ms) on an instrumented treadmill with retroreflective markers affixed to their lower limbs and feet. After a 6-minute familiarization period, marker trajectories and ground reaction forces were sampled during the 7th and 29th minute. Data was reduced to 10 gait cycles bilaterally. Sagittal plane ankle joint angles, moments and powers were calculated and a previously described musculoskeletal model was used to estimate Achilles tendon loads. Tampa Scale for Kinesiophobia (TSK) quantified the degree of kinesiophobia. RESULTS: On the injured side, there was a significant decrease in peak concentric ankle power (7min=4.9±1.0W/kg·m; 29min=4.7±1.1W/kg·m; p=0.02) and peak dorsiflexion (7min=23.4±3.9º; 29min=22.7±3.7º; p=0.02), but no changes in peak plantarflexion moment, peak eccentric power, Achilles tendon peak load, loading rate or, impulse (p=0.12-0.65). No changes occurred on the uninjured side (p=0.17-0.90). There were significant relationships between the TSK scores (32±7) and changes in Achilles tendon impulse, peak concentric ankle power, and peak plantarflexion moment (r=-0.66-0.60; p=0.02-0.04), indicating increased unloading of the injured side during the run in patients with higher degree of kinesiophobia. CONCLUSIONS: Achilles tendon impulse and motion change during a 30-minute steady-state run in patients with Achilles tendonopathy. Additionally, changes in loading patterns are associated with kinesiophobia.

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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 without pain is essential to their return to sport. In this study we investigated whether patients with medial tibial stress syndrome (MTSS) are able to return to running, and if so, whether they could generate the same running power as healthy individuals.

METHODS: 15 patients with MTSS (9M, 6F, age 27 ± 6.3 years) and 15 matched controls (CON; sex: 7M/8F; age: 31.9 ± 11.2 years) 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 trunk. 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 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 joint moment 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 uninvolved limb.

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 been 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 power and mechanical energy efficiency during stance phase of running, and even then only accounted for 12% of the variance (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 results comparing Y balance test to get variables previously linked to running injuries, *BW* = bodyweight (kg), *p* < 0.05 |
|-------------|-----------------|-----------------|---------------------|-----------------|-----------------|---------------------|
| Variable    | p-value         | R²              | Lower 95% CI       | Upper 95% CI     | Coeficient      |
| Hip adduction (°) | 0.08            | 0.04            | -14.81             | 9.79             | -2.50           |
| Hip Internal Rotation (°) | 0.21            | 0.03            | -33.94             | 7.97             | -12.99          |
| Knee Flexion (°) | 0.01*           | 0.12            | 3.15               | 34.44            | 18.80           |
| Knee Adduction (°) | 0.46            | 0.01            | -24.7              | 13.17            | -6.67           |
| Peak Eversion (°) | 0.93            | 0.00            | -11.18             | 14.31            | 0.57            |
| Eversion ROM (°) | 0.21            | 0.03            | -20.73             | 8.11             | -7.96           |
| Peak Eversion Velocity (m/s) | 0.21            | 0.06            | -100.47            | 476.70           | 183.66          |
| Vertical loading rate (nN/m²) | 0.52            | 0.02            | -51.76             | 101.61           | 24.92           |
| Hip Adductor Moment (Nm/kg) | 0.52            | 0.02            | -0.94              | 1.81             | -0.43           |
| Hip Adductor Impulse (Nms/kg*) | 0.96            | 0.00            | -0.23              | 0.22             | -0.01           |
| Knee Adductor Moment (Nm/kg) | 0.13            | 0.05            | -0.35              | 2.54             | 1.09            |
| Knee Adductor Impulse (Nms/kg*) | 0.58            | 0.07            | -0.29              | 0.52             | 0.11            |

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

Sleep Quality Effects Mood, Anxiety And Disablement In Division I National Collegiate Athletic Association Men’s Soccer Players

Courteney L. Benjamin¹, Ryan M. Curtis², Robert A. Huggins¹, Yasuki Sekiguchi¹, William M. Adams², Shawn M. Arent³, Rajat K. Jain⁴, John S. Miller⁵, Bruin C. Armwald⁶, Jason M. Pullara⁷, Douglas J. Casa, FACSM¹. ‘Korey Stringer Institute’ at the University of Connecticut, Storrs, CT. *University of North Carolina at Greensboro, Greensboro, NC. †Rutgers University, New Brunswick, NJ. ‡Northwestern University, Evanston, IL. †Penn State University, University Park, PA. (Sponsor: Douglas Casa, FACSM)

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(No relevant relationships reported)

**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±16.4kg; height, 179±6.4cm; VO₂max, 54±4.7ml•kg⁻¹•min⁻¹) participated in this study. During the 2016 and 2017 NCAA soccer seasons, the Pittsburgh Sleep Quality Index (PSQI), Profile of Mood States (POMS), Sports Anxiety Scale (SAS), and Disablement 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 and within sleep quality factor. Individual and time point were added as random intercepts to account for variance associated with these factors. Statistical significance was set at 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=-1.35, ES=-0.33; p<0.001), anger (MD=-1.95, ES=-0.56; p<0.001), confusion (MD=-2.09, ES=-0.33; p<0.001), fatigue (MD=-2.09, ES=-0.33; p<0.001), anger (MD=-1.95, ES=-0.56; p<0.001), confusion (MD=-1.62, 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 poor 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 disablement scale. Establishing student-athlete wellness monitoring programs may provide a tailored approach to improve the collegiate athlete experience.

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

The Influence of Match Congestion, Load and Wellness on Injury Risk in Collegiate Men’s Soccer

Robert A. Huggins¹, Ryan M. Curtis², Courteney L. Benjamin¹, Yasuki Sekiguchi¹, Erin B. Wasserman², David A. Klossner³, William M. Adams², Shawn M. Arent³, Rajat K. Jain⁴, S. John Miller⁵, Matthew J. Armistead⁶, Stephen M. Borchik⁷, Christopher D’Andrea⁸, Andrew P. Landry⁹, Tyler Sylvester⁸, Alan J. Walker¹⁰, Douglas J. Casa, FACSM¹. ‘Korey Stringer Institute, University of Connecticut, Storrs, CT. †Datays Center for Sports Injury Research and Prevention, Indianapolis, IN. ‡University of Maryland, College Park, MD. †University of North Carolina at Greensboro, Greensboro, NC. †Rutgers University, New Brunswick, NJ. ‡Northwestern University, Evanston, IL. †Penn State University, University Park, PA. ‡University of North Carolina at Greensboro, Greensboro, NC. †University of Connecticut, Storrs, CT. (Sponsor: Douglas J. Casa, FACSM)

**Email:** robert.huggins@uconn.edu

(No relevant relationships reported)

**PURPOSE:** To examine the impact of match congestion, training load (TL), perceived stress, fatigue and soreness on the odds of injury reports unclear. **METHODS:** 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. **RESULTS:** 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 AE (per 1000 AE, 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. **CONCLUSION:** 312 players experienced 116 injuries in 125 matches and 75 injuries in 301 practices. Overall match and practice IRs (per 1000 AE) were 47.9 [39.1,
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 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 (IR=57.9 [30.0, 76.3]). Participants were at increased odds of being injured in a match with 1 to 5 years since the last match vs. 6+ days (OR [95%CI] = 1.85 [1.10, 3.12]), respectively. Practice IRs were highest in the preseason (IR = 26.8 [13.2, 40.3]). The aim of this study was to evaluate the optimal duration of neuromuscular training to prevent injuries of the lower extremities in young soccer players. RESULTS: During the entire season 123 young soccer players sustained a total of 145 lower extremity injuries (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 insufficient to reduce injuries of the lower extremities in young male football players.

The importance of sport-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 highly talented 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 subdivided 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 answers (OPG: 216.1 ± 32.0; DPG: 231.3 ± 26.0) in selective attention test (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 intervention. Results: During the entire season 123 young soccer players sustained a total of 145 lower extremity injuries (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 insufficient to reduce injuries of the lower extremities in young male football players.

The importance of sport-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 highly talented 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 subdivided 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 answers (OPG: 216.1 ± 32.0; DPG: 231.3 ± 26.0) in selective attention test (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.
REG was reduced vs. PRE (MD = –0.14 ± 0.06 SD; p = 0.05). CONCLUSION: This study indicates higher HRV, greater physical and physiological loading, decreased self-reported sleep and decreased sleep efficiency during PRE compared to REG. In this men’s soccer team, PRE training was associated with significantly increased physical stress, adverse sleep characteristics and increased HRV. These responses should be considered when designing and implementing optimal training and recovery strategies.

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/min/kg) during a maximal incremental treadmill test. Results: The maximal FATox rate was 0.47±0.16 g/min-1, reached at 62.5±6.5% of the VO2peak. A significant inverse correlation was found between the average values of Tsk and FATox rates (p<0.005). A significant correlation was found between average FATox rates and average blood [La]− (r=−0.47). Values of maximal FATox and CHOox rates were 0.80±0.16 and 4.80±0.80 g/min-1 respectively. 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 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. 

Table 1. Subjects’ characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>n=20</th>
<th>24.5±3.4</th>
<th>180.6±6.5</th>
<th>76.7±6.2</th>
<th>23.5±1.54</th>
<th>10.29±1.85</th>
<th>46.58±2.14</th>
<th>16±1</th>
</tr>
</thead>
</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 (ºC)</th>
<th>[La]− (mmol·L−1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>53.5±3.98</td>
<td>180.3±7.9</td>
<td>1.06±0.05</td>
<td>145.53±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>

D-13 Free Communication/Slide - Physical Activity Epidemiology: New Insights

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
Room: CC-202C

1630 Chair: I-Min Lee, FACSM. Harvard Medical School, Boston, MA.
(No relevant relationships reported)

Physical activity, sedentary behavior, and sleep are three movement behaviors that are mutually exclusive parts of a whole (i.e., a 24-hour day) and therefore may be related to weight in a co-dependent manner. Compositional data analyses (CoDA) provide the opportunity to analyze associations between constrained behaviors and health outcomes without violating statistical assumptions involving collinearity.

Purpose: To use CoDA to investigate the relationships between the composition of four movement behaviors (objectively-measured sedentary time [SED], light intensity physical activity [LPA], moderate-vigorous intensity physical activity [MVPA] and self-reported sleep duration) and one-year changes in body mass index (BMI) and waist circumference (WC).

Methods: Participants were 716 adults from the Cancer Prevention Study-3 (mean age 52.2 [SD 9.9] years, 59% female, 66% white, 40% normal BMI). Self-reported weight, height, and self-measured WC were captured one year apart. Participants wore an accelerometer (Actigraph GT3X) for a minimum of 14 hours/day for three days and self-reported sleep duration via 24-hour diaries. CoDA was used to examine associations between all movement behaviors and change in BMI or change in WC. CoDA isotemporal substitution models estimated associations for the replacement of 30 minutes of SED for other behaviors in the composition. Models were stratified by sex and adjusted for age, race/ethnicity, smoking status, and average daily caloric intake.

Results: Participants spent most of their time SED (mean proportion of time SED = 0.414), followed by sleeping (0.344), in LPA (0.195), and in MVPA (0.047). The overall composition of movement behaviors was associated with a one-year change in BMI (p = 0.003) and WC (p = 0.048) among men, but not among women (p = 0.19 and p = 0.43). Among men, compositional isotemporal substitution models suggested that replacing 30 minutes of SED with 30 minutes of MVPA while holding LPA and
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: Cardiovascular Lifetime Risk Pooling Project

Amanda E. Paluch¹, Hongyan Ning², Mercedes R. Carnethon³, Kelley Petee Gabriel, FACSM², Norrina B. Allen¹, Donald M. Lloyd-Jones¹, John T. Wilkins¹. 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)

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(No relevant relationships 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.

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 = 1,602, current smokers = 1,377) 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 who were more fit exhibited reduced 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: Engaging in more LTPA and less TV viewing was associated with longer overall and nonfatal CVD-free life expectancy. Increasing LTPA levels and limiting TV viewing could potentially increase longevity and years lived CVD-free.

1634 May 30 2:15 PM - 2:30 PM
Cardiorespiratory Fitness Incidence and Mortality from Lung Cancer in Male Smokers

Baruch Vainshelboim¹, Ricardo M. Lima², Peter Kokkinos, FACSM², Jonathan Myers, FACSM³. ¹Saint Francis University, Loretto, PA. ²University of Brasilia, Brasilia, Brazil. ³Washington DC Veterans Affairs Medical Center, Washington, DC. (Sponsor: Kelley Pettee Gabriel, FACSM)

Email: baruch.v1981@gmail.com

(No relevant relationships reported)

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CONCLUSIONS: Engaging in more LTPA and less TV viewing was associated with longer overall and nonfatal CVD-free life expectancy. Increasing LTPA levels and limiting TV viewing could potentially increase longevity and years lived CVD-free.

1633 May 30 2:00 PM - 2:15 PM
Leisure-time Physical Activity And TV Viewing Associations With Life Expectancy With And Without Cardiovascular Disease

Carmen C. Cuthbertson, Xiaoming Tan, Gerardo Heiss, Anna Kucharska-Newton, Hazel B. Nichols, Chirayath M. Suchindran, Kelly R. Evenson, FACSM. University of North Carolina at Chapel Hill, Chapel Hill, NC.

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(No relevant relationships reported)

PURPOSE: Although high levels of physical activity are associated with longer overall and cardiovascular disease (CVD) free life expectancy years lived without CVD research has been limited and sedentary behavior has not been considered. Therefore, we examined associations between leisure-time moderate-to-vigorous physical activity (LTPA) and television (TV) viewing with life expectancy overall and with and without three types of CVD.

METHODS: We included 13,534 participants from the Atherosclerosis Risk in Communities Study prospective cohort. LTPA in the past year (no LTPA, < median (13.2 MET hours/week), > median) and TV viewing (often/very often, sometimes, seldom/rarely) were self-reported. Outcomes included all-cause mortality, and incident nonfatal coronary heart disease (CHD), stroke, and heart failure (HF). We used a multivariate survival model to estimate associations of LTPA and TV viewing with life expectancy (95% confidence interval (CI)) with and without nonfatal CHD, stroke, and HF at age 50 separately for men and women. Models were adjusted for time-varying covariates (age, gender, race by study center, education, smoking, ethanol intake).

RESULTS: Over a median of 27 years of follow-up, the average life expectancy at age 50 was 26 years. Compared to participants who engaged in no LTPA, participants who engaged in LTPA above the median had greater overall life expectancy (1.8 years each for men and women), greater nonfatal CHD-free life expectancy (men 1.5 years (95% CI 1.0, 2.0), women 1.6 years (95% CI 1.1, 2.2)), greater nonfatal stroke-free life expectancy (men 1.8 years (95% CI 1.2, 2.3), women 1.8 years (95% CI 1.3, 2.3)), and greater nonfatal HF-free life expectancy (men 1.6 years (95% CI 1.1, 2.1), women 1.7 years (95% CI 1.2, 2.2)). For each type of CVD, life expectancy with disease was similar across three levels of LTPA. Watching less TV compared to more viewing was associated with longer overall and disease-free life expectancy of 0.8 years each. These findings were similar for CHD, stroke, and HF.

CONCLUSIONS: Engaging in more LTPA and less TV viewing was associated with longer overall and nonfatal CVD-free life expectancy. Increasing LTPA levels and limiting TV viewing could potentially increase longevity and years lived CVD-free.
Hyperemesis 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, 0.95 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·m⁻² reporting no LTPA preparation (aOR 4.89; 2.13 to 11.22, test for trend, P=0.45).

**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.

**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 HKR.

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**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 HKR.

**NETWORK:** The Tromsø study is a population-based longitudinal study of adults in Tromsø, Norway. The study participants were originally recruited in 1972 and followed up in 1977, 1982, 1992, 1997, and 2008. This report is based on data collected in the seventh wave (2010–2014), in which participants attended a cardiovascular and physical activity examination. A total of 17,276 (74.8%) participants attended this examination, and 88% of these participants attended a second examination, which included the measurement of quadriceps strength. The participants in this study were a representative sample of the adult population in Tromsø.

**PURPOSE:** The purpose of this study was to examine the relationship between midlife quadriceps muscular strength and the risk of developing OA, which is a common and disabling disease. The presence of OA can lead to significant disability, reduced quality of life, and increased healthcare costs. Understanding the factors that influence the development of OA is crucial for identifying prevention strategies and improving outcomes for patients.

**METHODS:** Participants were a representative sample of US adults (n=4,840 adults; ≥40 years) assessed for physical activity in 2003-06 using an accelerometer and followed through 2015 for mortality status and cause of death using ICD-10 codes. Accelerometer-derived steps/day were modelled against all-cause, cardiovascular disease (CVD), and cancer mortality using Cox proportional hazard models ([Hazard Ratios (HR) and 95% CI]). Hazard ratios were adjusted for age, sex, race-ethnicity, education, alcohol consumption, diet quality, smoking, BMI, and hypertension using Cox proportional hazard models ([Hazard Ratios (HR) and 95% CI]). Hazard ratios were adjusted for age, sex, race-ethnicity, education, alcohol consumption, diet quality, smoking, BMI, and hypertension using Cox proportional hazard models. 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. The purpose of this study was to examine the relationship between midlife quadriceps muscular strength and the risk of developing OA, which is a common and disabling disease. The presence of OA can lead to significant disability, reduced quality of life, and increased healthcare costs. Understanding the factors that influence the development of OA is crucial for identifying prevention strategies and improving outcomes for patients.
with reduced mobility, poor/very poor health condition, and excluding the first two years of follow-up. NHANES 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), 60% 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/day-mortality associations described here can help setting public health/clinical goals.

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

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

1639 Chair: Cemal Ozemek, FACSMD, University of Illinois Chicago, Chicago, IL.
(No relevant relationships reported)

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 Triakies1, J. Thomas Becton2, Dalane Kitzman2. 1Wake Forest University, Winston-Salem, NC; 2Wake Forest Baptist Medical Center, Winston-Salem, NC. (Sponsor: Peter Brubaker, FACSM)
Email: cbrhill17@wfu.edu
(No relevant relationships reported)

PURPOSE: 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 (HFpEF). Methods: All participants performed a cardiopulmonary exercise test to maximal effort to quantify ventilatory responses (tidal volume (TV), breathing frequency (BF), and minute ventilation (VE)) at submaximal (25 watts) and peak exercise. Ventilation efficiency was determined by assessing VE/TV at submax and the VE/VECO2 slope. Obese vs. non-obese HFpEF 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 HFpEF group had higher VE during peak exercise than the non-obese group (p<0.05), which was mainly due to greater BF (p<0.05) versus TV (p>0.24). The VE/TV at submaximal workload and VE/VECO2 slope were significantly higher in the non-obese HFpEF group. Conclusion: As hypothesized, obese HFpEF participants exhibited worse ventilatory function than the non-obese HFpEF patient at similar levels of exercise. However, obese HFpEF participants demonstrate a similar degree of ventilatory inefficiency compared to normal weight HFpEF participants. Since ventilatory efficiency was not abnormal in obese HFpEF it appears that their prognosis is no worse than normal weight HFpEF participants.

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 Teken, Arlette Perry, FACSM. University of Miami, Coral Gables, FL. (Sponsor: Arlette Perry, FACSM)
Email: o.alan@umiami.edu
(No relevant relationships reported)

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 ± 1%HRmax and 81.9 ± 1%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 (Mdiff = 23.9 m, p<0.029) and R-HIIT (Mdiff = 23.8 m, p=0.029) had higher aerobic fitness than CON (Mdiff = 190.9 m sEMR / 6.3) using the 2-minute walk test following training. Only R-HIIT (Mdiff = −45.5 W, p=0.002) showed increases in upper body power over CON (Mdiff = 949 W sEMR / 8.2) while displaying lower fasting insulin (Mdiff = 5.6 uM/ l p=0.036) compared to CON (Mdiff = 17.4 uM/ ml sEMR / 1.4). R-HIIT also showed greater reductions in HOMA2-IR (Mdiff = 0.7, p=0.046) than CON (Mdiff = 2.2, SEmR / 0.2). Furthermore, HOMA2-IR was lower in R-HIIT compared to both CON (Mdiff = −0.193, SEmR / 3.5%), Mdiff = −8.8, p=0.017), and A-HIIT (Mdiff = 172.2%, SEmR / 9.4%, p=0.01), and 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 (Mdiff = −51.4%, SEmR / 0.05). 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 UM Citizens Board Grant

1642 May 30 2:00 PM - 2:15 PM
Short and Long Term Effects of Exercise Intensity on Conduit Artery Function in Cardiac Rehabilitation Patients
Jenna Taylor1, Jeff S. Coombes, FACSM1, David J. Holland1, Shelley E. Keating1, Daniel J. Green2, Tom G. Bailey1. 1The University of Queensland, Brisbane, Australia. 2The University of Western Australia, Perth, Australia. (Sponsor: Professor Jeff Coombes, FACSM)
Email: j.kirchner@uq.edu.au
(No relevant relationships reported)

PURPOSE: Patients with coronary artery disease (CAD) commonly present with conduit artery dysfunction characterized by decreased brachial arterial flow-mediated dilation (FMD). Reduced FMD of 1% is associated with an 8-13% increased risk of future cardiovascular events1, and thus interventions designed to improve FMD in patients with CAD are warranted. Short-term supervised exercise training may improve FMD, however whether improvements are maintained longer term following cessation of supervised cardiac rehabilitation (CR), is unclear. We compared the short- and long-term effect of High Intensity Interval Training (HIIT) and Moderate Intensity Continuous Training (MICT) on FMD in patients with CAD commencing a 4-week CR program in a real world hospital-based setting. METHODS: Patients with angiographically-proven CAD (Age: 64±7; 35 males, 3 females) completed 3 sessions per week (2 supervised, 1 home-based) for 4-weeks, randomized to either 1) HIIT (n=21): 4 x 4 minute high intensity intervals at a rating of perceived exertion (RPE) 15-18 interspersed with 3 minute active recovery periods or 2) MICT usual care (n=17): 40 minutes moderate intensity continuous exercise at an RPE 11-13. Patients then continued 3 unsupervised home-based sessions per week of their randomized training for a further 11 months. FMD was measured at baseline, 4 weeks, 3 months, 6 months, and 12 months. Data was analyzed using a linear mixed model with baseline diameter and shear rate as covariates. Data is presented as mean (95% CI).

RESULTS: Baseline FMD was not different between groups [HIIT: 3.1% (2.2 to 4.0); MICT: 2.9% (1.9 to 3.9), p=0.657]. FMD increased from baseline at 4 weeks, 6 months and 12 months in the HIIT group [4 weeks: +1.8% (0.8 to 2.7), p<0.001; 6-months: +1.6% (0.7 to 2.6), p<0.001; 12-months: +1.4% (0.4 to 2.3), p<0.007], with negligible changes in the MICT group [4 weeks: +0.4% (-1.1 to 0.0); p=0.94; 6 months: +1.0% (-0.1 to 2.1), p=0.063; 12 months: +0.3% (-0.7 to 1.3), p=0.52).

CONCLUSIONS: A 4-week CR program of HIIT, but not MICT (usual care), improved conduit artery function in patients with CAD. Improved FMD with HIIT was maintained long-term at 6- and 12 months with home-based training. 1Ras, R et al. (2013). Int. J. Cardiology 168:344-351 Supported by Wesley Medical Research Grant 2015-17 and NHMRC Scholarship APP1133622
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-II 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 ± 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), lower NYHA class (β = -10.57 ± 3.26), lower BMI (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 = -0.09 ± 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.
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, CMP, CK, haptoglobin, LDH, and hemoglobin electrophoresis, and notable for a mild anemia (hemoglobin 12.2), thrombocytopenia (platelets 52), mild transaminisim (AST 42, ALT 37), and evidence of hemolysis (haptoglobin <10, LDH 486, CK 384). 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. Trended labs for 2 weeks.
2. Avoid strenuous activity until pain resolved.
3. Provide counseling regarding hydration, heat illness, and training especially at altitude.
4. Follow up with hematology.
5. Consider screening NCAA coaches/athletes training given NCAA athletes are screened for sickle cell.

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)
Email: c.hickstwo@gmail.com
(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. PME: HTN, ADD Meds: Amlodipine, Adderall SH: No tobacco, social ETOH, no illicit drugs FH: Non contributory

PHYSICAL EXAMINATION: Well gentlemen in mild distress due to pain

Blood pressure 140/90, pulse 72, RR 14.
Neck- No JVD
CV: RRR, normal heart sounds. No gallop or rub. No murmur.
Pulmonary: No respiratory distress. Breath sounds normal. Good air movement. No wheezes or rales.

Chest: Tenderness to palpation along the flank areas greatest over ribs 5-7 bilaterally. No true focal pain noted.
Ext: DP and PT +2. No edema.
No true focal pain noted.
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.

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Christopher Hicks. University of Virginia, CHARLOTTESVILLE, VA. (Sponsor: John M. MacKnight, M.D., FACSM)
Email: c.hickstwo@gmail.com
(No relevant relationships reported)
**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 a 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 - Diminished right lung pleural opacity, probably effusion, compatible with osteoarthritis.
9/2017: CXR - persistence of bilateral pleural effusion.
1/2018: Myocardial perfusion scan - no evidence of stress induced ischemia
9/2018: D-dimer 564
3/2018: 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.

**TREATMENT AND OUTCOMES:**
Further rheumatological workup for inflammatory markers
Effective anti-inflammatory therapy, patient is asymptomatic

**TREATMENT AND OUTCOMES:**
The patient was sent to ER after being seen in clinic to expedite getting a CT scan done after the X-rays. After the CT scan was obtained it was decided by the ED to admit the patient for observation. He obtained a subsequent x-ray that evening 12 hours after is intial which showed a slightly smaller left apical pneumothorax. He was discharged the next day. Repeat chest x-ray done three days after discharge showed improving pneumothorax. Patient was seen in clinic 2 weeks after his discharge from the hospital and was started on a graded exercise program with repeat x-ray at 1 week after clinic visit showed resolution of pneumothorax. He returned to full game play at 4 weeks after his initial injury.

**HISTORY:**
A 21-year old rugby-playing male presented with a one year history of worsening anterior chest wall pain. Pain was associated with a popping sensation in the anterior chest. Additionally, symptoms were aggravated by overhead movements and chest exercises. Pain was focal, without discomfort in the ribs or thoracic back. He denied shortness of breath, pain while coughing, and all other systemic symptoms.

**PHYSICAL EXAMINATION:**
Local examination revealed a tender swelling at the manubriotosternal joint (MSJ). Chest expansion was full and deep breaths did not elicit pain. Full painless range of motion at the shoulder, with strength intact to manual muscle testing throughout

**DIFFERENTIAL DIAGNOSIS:**
1. Strain of pectorals 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.

**FINAL WORKING DIAGNOSIS:**
Manubriosternal osteoarthritis

**TREATMENT AND OUTCOMES:**
1. Refrained from rugby for several months
2. Started on regular daily meloxicam 7.5mg for 1 month
3. Significant improvement in symptoms
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.

Examination:
- 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 plantarflexion, dorsiflexion, inversion, eversion) full.

Special tests: Fracture test (tap, percussion, bony) negative, squeeze test negative, anterior drawer test negative, Talar tilt test negative, Stress test negative, Thompson test negative.

Differential Diagnosis:
- 

Treatment and outcomes:
- Decreased activity level
- Non-weight bearing on crutches for 2 weeks
- Walking boot for 3 weeks with partial weight bearing on crutches
- PT 1-2x/ week for 2-3 weeks
- Vitamin D 2000 IU everyday
- Partial weight bearing to full weight bearing as tolerated
- Gradual return to sports after another 2 weeks of injury, when she did not have pain with ambulation, and repeat MRI showed no evidence of residual bone marrow edema.

Abstracts were prepared by the authors and printed as submitted.
**HISTORY:** Active 10-year-old non-athlete with acute onset of severe ankle pain and swelling for two days. Occurred while at school but can’t recall injury during PE or recess. Taken to Children’s hospital ER and treated with ice. Presented to Acute Injury Clinic for further evaluation.

**PHYSICAL EXAMINATION:** Significant TTP diffusely about R ankle. Moderate-to-severe R ankle joint effusion. Unable to weight-bear. Limited ROM secondary to pain. No rash. No fever. L ankle exam normal.

**DIFFERENTIAL DIAGNOSIS:** Occult injury. Lyme disease. Joint infection. Post-infectious septic joint. Tumor.

**TEST AND RESULTS:** - Aspirate normal CBC, elevated uric acid, normal CRP, negative culture, negative crystals, substantial RBC and some WBC, lyne negative. - MRI with large Tibiotarsal joint effusion. No evidence of stress fracture or fracture/dislocation.

**OUTCOME:** On-going pain with weight bearing but no TTP at follow up. Her treatment plan includes non-weight bearing with boot for 5 weeks, then gradual return to weight bearing.

**TREATMENT:** - Evaluated by orthopedic oncology. Take for surgical intervention. - Patient has atypical joint and atypical age-group. - Splinted for comfort. Narcotic pain medicines prn.

**FINAL WORKING DIAGNOSIS:** PVNS R ankle


**DIFFERENTIAL DIAGNOSIS:** Polyvillous nodular sclerosis or other synovial metaplasia.

**TEST AND RESULTS:** - Negative culture, negative crystals, substantial RBC and some WBC, Lyme negative.

**PHYSICAL EXAMINATION:** - Knee x-rays showed severely hypoplastic patellae, Patellar subluxation/dislocation, Painful bipartite patella, Congenital deformity/displasia.

**DIFFERENTIAL DIAGNOSIS:** Patellofemoral pain syndrome, Patellar subluxation/dislocation, Painful bipartite patella, Congenital deformity/displasia. Knee x-rays showed severe hypoplastic patellae, trochlear dysplasia with prominent lateral femoral trochlea. Elbow x-rays revealed hypoplastic convex radial heads and capitellum with chronic posterior radial head dislocation. Due to these findings a pelvic x-ray was recommended which displayed iliac bone exostoses, confirming the diagnosis.

**FINAL WORKING DIAGNOSIS:** Hereditary Osteo-Onychodysplasia, the “Nail-Patella Syndrome.”

**TREATMENT AND OUTCOMES:** Patient had been treated for individual manifestations of disease without recognition of the syndrome. Education was provided on diagnosis; as Nail-Patella is a syndrome of multiple abnormalities, including renal anomalies, a Nephrology referral was given to screen for renal dysplasia. Understanding of these congenital abnormalities is key to management of associated sequelae, and genetic counseling was further recommended as this is an autosomal dominant disorder.

**OUTCOME:** Radial head resection, which may not improve elbow extension, and internal derotation with closed reduction through x-ray examination. Patient declined. Focused leg strengthening and activity modification to accommodate knee abnormalities resulted in pain reduction, and in 2 months was able to return to light jogging (without hills) and modified yoga.

**TREATMENT:** - Barefoot Rehabilitation Of Arch Pain In A Veteran Foot

**HISTORY:** Patient was a 39-year-old male veteran who complained of dull pain along the plantar portion of the left, medial longitudinal arch. This pain persisted for 3 months and was most noticeable during weight bearing activities. Most notably, the patient was unable to participate in recreational running of any duration secondary to pain. The patient was evaluated by his primary care physician who referred him to outpatient physical therapy after ruling out a fracture through x-ray examination.

**PHYSICAL EXAMINATION:** The patient presented with increased pain along the left medial longitudinal arch during heel elevation, mild swelling along the medial arch.
malicious, 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 gastrocsoleus 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
   - LEFS score improved from 49/80 to 71/80
   - Single leg heel rise test increased from 0 to 10 reps
   - 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
   - Patient reported 3 consecutive days of running 2 miles without pain

1668 May 30 2:10 PM - 2:30 PM

Ankle Injury -- Running

Jaire N. Saunders MPH, MD, Kevin Mullins MD, Brandee Waite MD. UC Davis, Sacramento, CA. (Sponsor: Brian Davis MD, FACSM)

No relevant relationships reported

HISTORY:
57yr old female with pmhx HTN, T2DM, HLD, previously seen in clinic for right knee OA secondary to remote injury. Presenting with 3-week history of acute onset right ankle pain. Occurred while running on treadmill after prolonged decrease in activity level due to BUE injuries. Receiving viscosupplementation in right knee with good improvements. Pt 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 plantarflexors 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)

OUTCOME:
Increased hip ADD, IR and pelvic drop BIL
L inverted and toed-in at foot strike
Increased L arch drop during mid support
Patient was 3/10 on the L. When cued to toe out on the L, symptoms reduced and shifted to the calf.

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

TREATMENT:
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. Promote foot/ankle function and control with balance and plyometrics
5. Iner. 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/o 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.

1670 May 30 2:50 PM - 3:10 PM

Knee Pain -- Running

Adam K. Willson, Joshua Berkowitz. UNC Chapel Hill, Chapel Hill, NC.

No relevant relationships reported

HISTORY:
19 year old female who developed right knee pain over two years ago during mile 23 of a marathon without specific, fiscal injury. She then consistently developed severe right posterior lateral knee pain after running around 2 miles, significant enough that she cannot continue running. Pain is improved with rest. She was a college athlete (running) but had to quit due to this pain. She had completed 3 courses of physical therapy without improvement. She did not report any other symptoms. She has no pain with activities other than running, or with running distances up to 1.5-2 miles. Prior MRI is normal with the exception of some slight signal in the distal biceps femoris tendon.

PHYSICAL EXAM:
1. Right knee – no erythema, swelling or ecchymosis.
2. Mild to moderate tenderness to palpation at the posterior lateral fibular head and just proximally.
3. No other abnormalities.

DIFFERENTIAL DIAGNOSIS:
1. Biceps femoris tendinopathy
2. Poliptile tendinitis
3. Poliptile entrapment syndrome
4. Common peroneal nerve entrapment

**TEST AND RESULTS:**
- PVL arterial duplex: No change in PT and AT artery waveforms with plantar and dorsiflexion. Not suspicious for poliptile arterial entrapment
- MRI right knee: Suggestive of mild trochlear dysplasia. Visualized posterolateral corner right knee structures were normal. Intact right knee ligaments and menisci
- US-guided diagnostic (anesthetic) injection to the biceps femoris tendon sheath yielded no improvement in symptoms
- US-guided corticosteroid injection to the posterolateral corner (deep to the biceps femoris tendon) provided 3 weeks of complete symptomatic relief and she was able to run 5 miles without symptoms

**FINAL WORKING DIAGNOSIS:**
- Low-grade posterolateral corner injury only symptomatic with prolonged exertion

**TREATMENT AND OUTCOMES:**
- Clinically has characteristics localizing to the posterolateral corner, deep to the biceps femoris tendon, possibly related to scar tissue formation or dynamic entrapment
- Ultrasound-guided corticosteroid injection deep to the distal biceps femoris tendon provided relief but only for 3 weeks
- Plan for PRP injection to the posterolateral corner for further treatment and evaluation
- Possible consideration of exploratory arthroscopy if even transient response to posterior lateral corner treatment can be re-demonstrated

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**D-18 Rapid Fire Platform - Acute Hypoxia and Aerobic Performance**

**Thursday, May 30, 2019, 1:30 PM - 2:40 PM**

**Room: CC-Hall WA2**

1671 **Chair: Nisha Charkoudian, FACSM. USARIEM, Natick, MA. (No relevant relationships reported)**

The ability to increase exercise ventilation to defend arterial oxyhemoglobin saturation during hypoxic exercise is commonly viewed as an important factor contributing to large individual variations in the degree of performance impairment in hypoxia. While the hypoxic ventilatory response (HVR) could provide insight into the underpinnings of such impairments, it is almost exclusively measured at rest, under isocapnic conditions.

**Purpose:** 1) to determine in a cohort of highly trained athletes whether the integrated ventilatory response to progressive hypoxia at rest (HVR$_{\text{norm}}$) and during exercise (HVR$_{\text{ex}}$) are comparable, and 2) to determine whether HVR$_{\text{ex}}$ is related to the degree of performance impairment in acute hypoxia.

**Methods:** Sixteen endurance-trained men (VO$_2$ peak: 62.6 ± 6.2 ml kg$^{-1}$ min$^{-1}$) performed two poikilocapnic HVR tests: 1) during seated rest (HVR$_{\text{norm}}$) where inspired O$_2$ fraction (FiO$_2$) was progressively reduced; and 2) while cycling at 40% of power at normoxic VO$_2$peak (HVR$_{\text{ex}}$) where FiO$_2$ was reduced in a square-wave fashion every 5 min (FiO$_2$: 0.21, 0.18, 0.15 and 0.12). On two separate visits, subjects (n = 12) performed a 10km cycling time trial (TT) while breathing either room air or a hypoxic gas mixture (FiO$_2$: 0.16), in a randomized order. Performance impairment was calculated as the percentage change in time to complete the TT between normoxia and hypoxia (ΔTT).

**Results:** HVR$_{\text{norm}}$ was significantly (p < 0.05) greater than HVR$_{\text{ex}}$ (1.51 ± 0.45 and 0.67-1.67 m s$^{-1}$). Each walking speed lasted for four minutes. EE was calculated using pulmonary oxygen uptake and carbon dioxide output. RESULTS: During walking, reductions in SpO$_2$ trended slightly greater in women under hypoxia (71.5 ± 4.5%) for men and 67.7 ± 4.1% for women at the fastest gait speed, P > 0.05. Hypoxia-induced elevation in EE, HR, and VE were calculated by the difference between values in hypoxia and normoxia. Using a multivariate model that combined EE, VE, and HR to predict ΔSpO$_2$ (hypoxia-induced reduction), we obtained a very strong fit model both for men (r$^2$ = 0.90, P < 0.001) and for women (r$^2$ = 0.95, P < 0.001). We also tried to estimate the relative contributions of AEE, ΔVE, and ΔHR to predict ΔSpO$_2$, by using standard partial regression coefficients. The contribution rate to predict ΔSpO$_2$ was markedly different between men and women. In women, the effect of AEE and ΔVE were greater (EE: 28.1% in women vs. 15.8% in men; VE: 4.1% in women vs. 1.7% in men). Conversely, in the men the contribution of ΔHR was greater (82.5% in men and 67.9% in women). Moreover, significant sex differences in breathing frequency and tidal volume were observed (P < 0.05, respectively).

**CONCLUSIONS:** These findings suggested that high-altitude adaptation in response to hypoxemia has different underlying mechanisms between men and women. Our results can help to explain how men and women adapt high-altitude environments.
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 (SpO2) 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 ± 2 y; V̇O2peak = 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 V̇O2max and an 8km 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 SO2 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 SO2 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 O2 in 85% [OxyHb+Mb] (%) during the 65% constant load with a difference between HYP+P and HYP+C (28 ± 45% vs. 14 ± 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, when co-varied by VO2max, 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. VO2max 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 VO2max. The cetirizine intervention resulted in greater skeletal muscle oxygenation at 65% VO2max with hypoxia. These results would suggest that cetirizine does not improve SO2 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  
Tithya Wren1, Daniel Feifer1, Natalya Sarkisova1, Mia Katsel1, Curtis Vandenberg1, James L. Pace1, Nicole Mueske1.  
1Children’s Hospital Los Angeles, Los Angeles, CA. 2Connecticut Children’s Medical Center, Hartford, CT.  
Email: twren@chla.usc.edu  
(No relevant relationships reported)

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<0.02) and ankle eversion (r=0.85, p<0.0001) along with larger 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<0.004). 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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(No relevant relationships reported)

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 6 mph 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 study. 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 Orthopaedics.

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 was performed (p<0.05).  
Results: Participants (height: 1.7±0 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) or nonexistent and would not likely be noticeable sport deficits. Performance concerns should be minimal in ACL patients looking to RTS when wearing a knee brace.  
Acknowledgements: This work was supported by a DonJoy Orthopaedics 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 (vGRF) 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 25.9 ± 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 kinematics were recorded. VGRF 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 the CMJ. Limb symmetry indices (LSI) 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 vGRF 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-op.

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.
Athletes demonstrate neuroplastic changes and altered neuromuscular control after anterior cruciate ligament reconstruction (ACLR). Conflicting reports of impaired balance and cognitive performance exist for dual-task balance following ACLR. Thus, significant gaps remain in understanding altered postural control strategies in this population.

PURPOSE: To understand altered postural control strategies in ACLR individuals in the presence of sensory, motor, and cognitive challenges.

METHODS: Fourteen ACLR (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 excursion (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), unassisted) was also calculated for increment resultant CoP data after downsampling to 30 Hz. During the four interventions, the subjects performed 3 lower-body exercises (C3), 5-min WBV at a high amplitude (C4), 5-min WBV at a high amplitude with BFR (C5). For the BFR sessions, cuffs were placed on the uppermost portion of the thigh = 166.94± 8.82 cm) completed the study, which involved performing a warm-up protocol under 5 conditions. The conditions were: 5-min treadmill walking (C1), 5-min WBV at a low amplitude (C2), 5-min WBV at a low amplitude with BFR (C3), 5-min WBV at a high amplitude (C4), 5-min WBV at a high amplitude with BFR (C5). For the BFR sessions, cuffs were placed on the uppermost portion of the thighs. Cuffs were then inflated to 120 mmHg, and then increased in increments of 20 mmHg until the final pressure was achieved. Final pressure was found via thigh circumference and capillary refill time. The vibration plate was set at a frequency of 30 Hz. During the four interventions, the subjects performed 3 lower-body exercises (squats, squats squat, calf raises) for 60 seconds each, with 30 seconds of rest between exercises. Thigh temperature was measured between exercises. Total training time with rest was 12 minutes. Following the warm-ups, vertical jumping height, flexibility, and estimated VO2 max. PURPOSE: The purpose of this study was to observe the combined effect of a whole body vibration (WBV) warm up and Blood Flow Restriction (BFR) on muscle temperature, flexibility, vertical jump height, and estimated VO2 max.

RESULTS: 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 79.1±3 to 95.1±3 kg vs. RT 82.1±3 to 100.1±3 kg, p<0.002) and VL MT (BFR: 2.69±0.8 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.
PURPOSE: Hyperoxia (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 microcirculatory 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±6.9 kg, height 179.8± 7.9 m, and VO2max 4.5±0.7 L min-1 performed 6 weeks endurance training on a cycle ergometer consisting of supervised HIIT sessions 3 days/week (3 × 8 min) and additional long slow distance training 2 days/week. Cyclists were randomly assigned to either HYPER (FiO2 0.30; n=12) or NORM (FiO2 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±46.0%, NORM 16.5±49.1%; p = 0.21, ES= -0.05), 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 hyperoxic-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 hyperoxic-supplemented HIIT, it is questionable whether this strategy is worthwhile in maximizing endurance performance in already trained cyclists.

PurPOURSE: This investigation measured local microcirculation, neuromuscular activation and metabolic responses in trained 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 trained women (17.6±3.0kg/m2) performed four sets of knee extension to failure 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 three conditions (P<0.05). Flow was highest in BFR80 with the other conditions were similar (e.g., set3: 213.1 AU for BFR80 vs 196.3 AU for other conditions). After exercise, velo in BFR80, (58.6±1.2AU) was higher than the other conditions [-51.8±1.5AU, (P<0.05)]. Hb did not change in all conditions. LL 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 higher metabolic activation.

PURPOSE: The aim 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 = 24.5±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 progressively increased to a target pressure, 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 on hemodynamics, quad and hamstring temperature, flexibility, and explosive power index were recorded. Explosive power was measured using a jump mat, where 60 maximal 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 effect for all three variables (p<0.01). There were significant condition and time main effects and condition×time interaction for heart 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 quadriceps (p<0.01) and hamstring muscle temperature (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/ampitude setting of WBV on the variables tested in the study.
compared to the non-BFR conditions (70% = +3.4 ± 0.2 vs. 80% = +11.8 ± 5.5, 90% = +7.25). No differences in TOI between ASO (36.93 ± 1.8) 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 ± 0.6) 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.

**PURPOSE**

Pacing strategies are necessary during endurance events in which the goal is to finish in as little time as possible. Both anaerobic and aerobic attributable sources of ATP are used during such efforts. Rating of Perceived Exertion (RPE) increases linearly as heart rate (HR) and power output (PO) increases, however, these markers of intensity are not instantaneous. Near infrared spectroscopy (NIRS) allows for the measurement of local muscle oxygen saturation (SmO2) which may respond to short-term fluctuations in PO. Previously, SmO2 has shown a moderate correlation with oxygen consumption (VO2) and HR during an incremental exercise. The purpose of this study was to determine how SmO2 changes with increases in PO during a non-incremental cycling time trial (20-km) with various interspersed sprints and if decrements in PO due to shorter rest times were associated with lower SmO2.

**METHODS**

Well-trained cyclists (n = 9) (VO2max = 305 ± 45 W), habituated to 20-km trial, performed a self-paced 20-km time trial and two time trials with 1-km sprints imposed, separated by 2- or 4-km of self-paced cycling. SmO2, saturation, PO, and HR were measured. RPE was recorded each kilometer. Pearson’s partial correlations were used to analyze relationship between SmO2 and PO. A one-way analysis of variance was used to determine if there were differences in finishing times between trials.

**RESULTS**

There was a significant inverse relationship between SmO2 and PO during all time trials (r = -0.263, P < 0.0001). There was no significant difference (p = .572) between the finishing times amongst 20-km protocols.

**CONCLUSIONS**

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 time trial. In other words, as the subjects were instructed to significantly increase their PO to simulate a break-away, the SmO2 decreased in a reciprocal manner.

**Erythropoietin Response to Endurance Exercise under Heat and Hypoxic Conditions**

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No relevant relationships reported

**PURPOSE**

The purpose of the present study was to determine EPO response to endurance exercise under heat and hypoxic conditions.

**METHODS**

Twelve healthy males (21.5 ± 0.3 yrs, 168.1 ± 1.2 cm, 63.6 ± 2.0 kg) participated. They conducted a 60 min pedaling exercise at 60% of VO2max under either “heat and hypoxic condition” (H+H) or “hypoxic condition” (HYPO). The exercise was performed in a 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**

The 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 condition. However, heat stress during endurance exercise in hypoxia (heat and hypoxic condition) did not augment the EPO response.

**Neuromuscular Responses to Combined Heat Stress and Hypoxia During 20-km Cycling Time Trials**

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No relevant relationships reported

The effect of combined heat stress and hypoxia on exercise performance may be dependent on the modality of exercise. In response to constant-work exercise, combined environmental stressors demonstrate an interaction effect on time to exhaustion; however, similar combined stressors have an independent effect on performance during time-trial (TT) performance. Investigation of the neuromuscular responses to combined environmental stressors may clarify the underlying mechanism(s) that...
contribute to apparent task-specific responses. **PURPOSE:** To examine the isolated and combined effects of ambient temperature [cool (18°C), 20% rh] vs heat (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 athletes (23 ± 6 yr) performed four 20-km cycling TTs in different environmental conditions [cool/normoxia (COOL); hot/normoxia (HOT); cool/hypoxia (HYP0); hot/hypoxia (H-H)]. Neuromuscular responses of the soleus, as indicated by changes in soleus muscle volume (SMV), M-wave peak force (OPL.), 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 (221±65s; 192±182W), HYP0 (221±122s; 192±27W), and HOT (221±114s; 192±27W) compared to COOL (209±54s; 221±141W, p<0.02). Similar reductions in SMV (p<0.01), and VA (p<0.005) were observed across all conditions (p<0.05); however, no significant differences were observed in M-wave (p=0.09) or OPL. (p=0.43). **CONCLUSION:** Neuromuscular impairments following 20-km cycling TT are attributed to central mechanisms(s) (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.

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During sprint exercise in hypoxia, anaerobic 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 above 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 pedal exercise) under four different conditions: [1] control condition (CON, 20°C, FIO2: 20.9 %), [2] hypoxic condition (HYP, 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, HYP: 1.9 ± 0.1 L/min, HOT: 2.4 ± 0.1 L/min, HH: 2.0 ± 0.1 L/min) and average S02 (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 S02. 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.

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**Conclusions**

During sprint exercise in hypoxia, anaerobic 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 above 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 pedal exercise) under four different conditions: [1] control condition (CON, 20°C, FIO2: 20.9 %), [2] hypoxic condition (HYP, 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, HYP: 1.9 ± 0.1 L/min, HOT: 2.4 ± 0.1 L/min, HH: 2.0 ± 0.1 L/min) and average S02 (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 S02. 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.

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**Background.** Heat acclimation enhances animal and human tolerance during subsequent novel hypoxic stress exposure. This heat-acclimation-mediated crosstolerance (HACT) is attributed to shared cellular stress response pathways. Although skeletal muscle is the largest organ (by mass) in the mammalian body, to our knowledge no research has been conducted examining HACT in skeletal muscle cells. **Purpose.** The timeframe of HACT and the mechanisms behind this response were examined in differentiated C2C12 myotubes. **Methods.** Heat acclimation (HA) was established by heating (40°C) C2C12 myotubes for 6 consecutive days (2/4d). Control myotubes were maintained for the same duration under control conditions (37°C). Control and HA myotubes were subsequently challenged with Hypoxia (1% FIO2) or Hypoxia + LPS (1% FIO2 + 500 ng/ml LPS) for 2h. Cell lysates were collected immediately post (+0h) and 12h post (+12h) challenge. Western blot was used to assess protein markers of the heat shock response (HSR), inflammation, and apoptosis. Data were analyzed with two-way ANOVA with Newman-Keuls post-hocs. **Results.** HA myotubes exhibited increased phosphorylation of HSF-1 [+56%, p<0.03] and reduced phosphorylation of IkBα [-56%, p<0.01] at +0h. Control myotubes exhibited reduced SIRT1 at +0h following challenge with Hypoxia [-36%, p<0.04] and Hypoxia + LPS [-47%, p<0.02]. By +12h Control myotubes that had been challenged with Hypoxia or Hypoxia + LPS exhibited reduced phosphorylation of JNK [-55%, p<0.03] and Caspase 3 content (+25%, p<0.02). **Conclusion.** We present evidence of HACT in C2C12 myotubes.
Thickened arterial walls impair blood flow and increase the work of the heart and lead to hypertension. Arterial stiffness may be modified by vascular adaptations that reduce vascular inflammation. Although exercise has the potential to offer both short-term and long-term cardiovascular benefits, there is limited information on the effects of exercise training on arterial stiffness and related cardiovascular risk factors in women. The primary aim of this study was to examine whether 6 weeks of aerobic exercise training reduced arterial stiffness and related cardiovascular risk factors in middle-aged women with prediabetes. Secondary aims included examination of the relationship between exercise-induced changes in arterial stiffness and changes in metabolic (insulin sensitivity) and inflammatory (high-sensitivity C-reactive protein [hs-CRP]) biomarkers.

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

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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 pre-diabetes. METHODS: 15 older adults (66.4 ± 5.1 yrs) with pre-diabetes (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 one of three training groups (endurance cycling (END, n=12); high intensity interval training (REX, n=11); and LCD+INT: -2.7 ± 3.8% vs. LCD+INT: -0.22 ± 0.54 vs. LCD+INT: 0.73 ± 0.73 vs. LCD and LCD+INT decreased Aix tAUC120min (-662.5 ± 263.3 vs. -801.0 ± 263.3 vs. 875.5 ± 263.3 vs. LCD and LCD+INT decreased Aix tAUC120min (-662.5 ± 263.3 vs. -801.0 ± 263.3 vs. 875.5 ± 263.3 vs. -981.0 ± 263.3), respectively). Pre AIx max correlated with fasting DBP (r=0.40, P=0.04) and decreased AIx max 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 cfPWV. 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.

BACKGROUND: Glycemic control is impaired with age and is accompanied by an age-related decline in muscle mass. Regular exercise maintains muscle mass and improves glycemic control. Whether the mode of exercise training differentially affects glycemic control during middle-age is unknown.

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 six training groups (endurance cycling (END, n=12); high-intensity interval training (REX, n=11)) in a parallel-group design. Two-hour OGTTs were conducted as secondary analyses on two occasions (pre and post intervention) and total AUC (trapezoidal method) was calculated. Statistical analyses were performed using linear mixed models (group x 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/h). A main effect of time for lower post-intervention total AUC glucose was observed (P<0.003). Fasting glucose concentrations showed a group x 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 mIU/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 glycemic control to determine if exercise modality is an important factor in improving glycemic control.
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 (0:00 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 ≥140 mg/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: 116.0±11.4; VIG: 122.6±7.4 mg/dL), total area under the curve (AUC) (MOD: 3243.0±505.1; VIG: 2873.4±226.2 mg-min/dL), 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

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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 menses per regularity among women with EAMD.

**Methods:** Young, exercising women with EAMD were randomized into two groups. The treatment group (EAMD+Cal) (n=32) 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 LCD raises endothelial function compared with LCD under energy available matched conditions though is unknown. METHODS: Obese women (47.2±2.6y, 37.5±1.3kg/ m²) were randomized to 2-wks of a LCD (n=12; mixed meals of 1000-1200kcal/d) or LCD+INT (n=15; 60min/d of supervised INT at 160-180% HRpeak for 3 min each). LCD+INT subjects received 350kcal post-exercise to equate energy availability with LCD. A 75g OGTT was performed pre- and post-test to examine fasting, 1 and 2h glucose and insulin concentrations. Endothelial function was evaluated using standardized brachial artery ultrasound. (VCAM, ICAM) were also determined.

**RESULTS:** With a 24% increase in energy intake, EAMD women as energy deficient. The EAMD+Cal women (21.6 yrs, BMI: 20.2 kg/m\(^2\)) increased energy intake and eating habits. The intervention was associated with a modest increase in fat mass (p=0.01) and lower BMI, percent body fat, fat mass (p<0.001) and measured AUC and duration of hyperglycemia (p<0.05). When comparing subjects who increased their usual exercise and eating habits. The intervention had a positive effect on the likelihood of experiencing menses vs. the Control group (p<0.001). Menstrual regularity among women with EAMD.

**CONCLUSIONS:** 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.

### 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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(No relevant relationships reported)

**PURPOSE:** Low caloriediet (LCD) and interval exercise (INT) both improve endothelial dysfunction, in part, by reducing hyperglycemia. Whether adding INT to LCD raises endothelial function compared with LCD under energy available matched conditions though is unknown. METHODS: Obese women (47.2±2.6y, 37.5±1.3kg/m²) were randomized to 2-wks of a LCD (n=12; mixed meals of 1000-1200kcal/d) or LCD+INT (n=15; 60min/d of supervised INT at 160-180% HRpeak for 3 min each). LCD+INT subjects received 350kcal post-exercise to equate energy availability with LCD. CONCLUSIONS: Each ratio may be used to predict AMEN, but only DXARMR ratio correctly identified the most subjects with AMEN or MD secondary to energy deficiency. Similarly, 200\(\text{RMR}\) ratio correctly identified the most subjects. 200\(\text{RMR}\) ratio can be utilized to correctly identify women with AMEN or MD secondary to energy deficiency.

**METHODS:** All measures were validated in our laboratory and those described in other studies were used with Institutional Review Board approval. The study was designed as a randomized, single-blind, controlled trial with 24 obese women (BMI: 37.5±1.3kg/m²) randomized to LCD (n=12; 40% of energy available) or LCD+INT (n=12; 40% of energy available +20% of energy available). All subjects performed the following: fasting and post-prandial glucose and insulin were measured, and hyperglycemia 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.

**RESULTS:** At baseline, VIG had significantly lower mean (MOD: 116.0±11.4; VIG: 122.6±7.4 mg/dL), total area under the curve (AUC) (MOD: 3243.0±505.1; VIG: 2873.4±226.2 mg-min/dL), 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.
PURPOSE: Posttraumatic 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 impacts additional benefits on PPG responses remains unclear. This study aimed to determine the diurnal effect of exercise timing 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 (PPG) 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-iAUC was observed for the pmEX group (-78.56 mmol/L) when compared to the amEX group (-33.22 mmol/L) at post-intervention (p = 0.03). Reductions in PPI iAUC (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.
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 (l), and rotational acceleration (rad/s^2). 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 χ^2 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/s^2 (1,000 rad/s^2 - 12,500 rad/s^2). 90th percentile accelerations were 63.0g and 8,400 rad/s^2 during games and 49.5g and 8,200 rad/s^2 during practices. Players experienced significantly higher IRs 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 = 1.13, 95% CI: 0.80-1.64). Practices resulted in 1.80 times the IR (95% CI: 1.02 - 3.17) 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.
the ML direction were significantly different between groups. Furthermore, in the EC condition, CI (p<0.026; CONC=14.08±0.63, NORM=15.93±0.52; Cohen’s d=3.2) in the ML directions was significantly different between groups. No other significant differences were observed. CONCLUSION: These results indicate that a prior history of SRC is associated with a greater incidence of LE injury and postural control differences can be detected prior to injury occurrence using postural control variability.

1781 Board #7 May 30 3:45 PM - 5:45 PM Laboratory Validation Of A Head Impact Sensor For Use In Water Polo And Non-helmed Land Sports Nicholas J. Cecchi, Derek C. Monroe, Theophil J. Oros, Steven L. Small, James W. Hicks. University of California, Irvine, Irvine, CA. Email: ncecchi@uci.edu

(No relevant relationships reported)

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.

PURPOSE: To validate the accuracy and reliability of a head impact sensor, previously validated for use in non-helmeted land sports, mounted in a standard water polo cap.

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). A 1.7 m/s did not consistently produce impacts large enough for the SIM-G to detect, thus 155 impacts (77 headband, 78 water polo cap) were analyzed. Peak linear acceleration (PLA), rotatational velocity (PRV), rotational acceleration (PRA) 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=359, t(151)=6.682, p<0.001] independent of headgear (p=0.191). Regarding accuracy, there were sensor x headgear interactions [F(1,153)=29.383, p<0.001, 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<0.001).

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.

1782 Board #8 May 30 3:45 PM - 5:45 PM Biomechanical Analysis of Head Impacts during Real Time Soccer Play: a Preliminary Study Caroline Lecours1, Yvan Petit1, Éric Wagnac1. École de technologie supérieure, Montreal, QC, Canada. 2École de technologie supérieure et Hôpital du Sacré-Cœur Research Center, Montreal, QC, Canada. Email: caroline.lecours.1@ens.ctsmtl.ca

(No relevant relationships reported)

Linear and angular head accelerations are recognized as the foremost mechanisms of head injuries in sports. However, in non-contact sports such as soccer, little is known about cortical head accelerations during soccer play, which limits the understanding of the risk and mechanism of head injury. PURPOSE: To assess the biomechanics underlying the risk of head injury during soccer play. METHODS: An instrumented headband was worn by 9 elite male (M) players (18 ± 0 yrs, 73.7 ± 9.5 kg, 1.73 ± 0.1 m) and 16 amateur female (F) players (24 ± 1.4 yrs, 63.5 ± 7.8 kg, 1.63 ± 0.1 m) during a summer season. Head kinematics of each impact (peak linear and angular accelerations of the head) were grouped as heading techniques or involuntarily impacts. Heading techniques were sub-categorized as jump, stable, head rotation or unstable. Involuntary impacts were sub-categorized as player-to-player contact, ball control (feet or chest), running (acceleration or deceleration), change-of-direction, ground impact, unstable or involuntary head-to-ball impact. Head kinematics were subjected to standard descriptive statistics. Wilcoxon signed-rank test was used to compare heading techniques and involuntary impacts kinematic. RESULTS: In total 239 head impacts were registered for M and 139 for F. Heading techniques accounted for 92 impacts for M (36g±15g; 4175±2517 rad/s2) and 97 for F (33g±13g; 3334±239 rad/s2). Involuntary impacts accounted for 147 impacts for M (20g±9g; 1934±1511 rad/s2) and 42 for F (21g±11g; 2095±1603 rad/s2). For M and F, the average linear and angular accelerations of the head caused by heading techniques were associated with higher values than involuntary impacts (p < 0.05). For both M and F, the most frequent heading technique was the jump and player-to-player contact was the most frequent for involuntary impact. CONCLUSION: Preliminary results show that heading techniques can cause higher values of head accelerations than involuntary impacts and therefore, could cause a higher risk of head injury in two different populations of players. Grant funding: this study was funded using NSERC and FRQNT research grants.

D43 Free Communication/Slide - Cognition and Emotion Thursday, May 30, 2019, 3:45 PM - 5:45 PM Room: CC-105A

1783 Chair: Walter Bixby, FACSM, Anne Arundel Community College, Arnold, MD.

(No relevant relationships reported)

BACKGROUND: Previous studies suggested that exercise on an active workstation while working may be a promising intervention strategy for reducing sedentary time at workplace. The influence of active workstation on cognitive function are not well studied and the existing studies yielded mixed findings.

OBJECTIVE: To investigate the effects of cycling on an active workstation on executive function and cortical activation in young adults.

METHODS: In a cross-over study design, 35 young adults (mean age = 21.4 ± 2.6 years, 45.7% females) were randomly assigned the following two task conditions separated by 48 hours: performing cognitive tests while sitting (SIT) and performing cognitive tests while self-paced cycling on an active workstation (ACTIVE). Executive function was assessed by a task-switching paradigm and Stroop Color and Word Test (SCWT) programed using E-Prime 2 professional (Psychology Software Tools, Inc., Sharpsburg, PA, USA), respectively. Global switch costs, local switch costs and Stroop effects were derived and used as the behavioral outcomes of the two tasks. Cortical activation during the two conditions was monitored using a 38-channel tNIRS (tNIRS Medical Technologies LLC, USA).

RESULTS: There were no significant differences on Stroop effects (136.25 ± 125.67 vs. 101.61 ± 137.10, p = 0.19) between SIT and ACTIVE conditions. The switch cost costs (463.19 ± 206.86 vs. 452.77 ± 167.05, p = 0.73) and local switch costs (6.14 ± 147.22 vs. 9.97 ± 156.08, p = 0.70) also did not differ. For the tNIRS results, ACTIVE condition led to greater cortical activity in left-dorsolateral prefrontal cortex (left-DLPFC) related to Stroop effects (0.88 ± 17.75 vs. 13.85 ± 19.44 a.u, p = 0.02). For the task switch test, there were no significant differences in cortical activation between SIT and ACTIVE conditions.

CONCLUSION: The results suggests that the performances on Stroop task and task-switching were not impaired by self-paced cycling on a workstation. Importantly, cycling led to greater recruitment of sub-region of prefrontal cortex indicated by a greater cortical activation related to Stroop effects in the left-DLPPC.
Study: This study explored the effect of acute aerobic exercise on cognitive performance in trained cyclists/triathletes. Specifically, it investigated the impact of different exercise durations (completed at a fixed moderate-intensity) and high/ maximal intensity exercise (H/MIE) to volitional exhaustion (following a sustained bout of degrading activity) on simple and complex cognitive skills.

METHODS: On two separate occasions, 21 trained cyclists/triathletes, 11 male (51 ± 9 years) and 10 female (51 ± 9 years), completed 45 min of fixed-intensity cycling (80% ± 5% of HRmax) followed immediately by an incremental test to volitional exhaustion. Cognitive function was assessed at Baseline, and at 15, 30, and 45 min of exercise (15EX; 30EX; 45EX), and at exhaustion using a 4-choice reaction time (CRT) and Stroop Word-Color Association test (Incongruent/Congruent Reaction Time [CRT]). A placebo treatment (“to improve cognition”) was administered after 15EX on one trial to determine if positive expectancy influenced cognitive responses.

RESULTS: Exercise Duration: CRT, CONGRUENT and INCONGRUENT CRT reduced performance (improved) at 15EX and 45EX compared to Baseline (p's<0.005). While CRT and CONGRUENT CRT were faster at 45EX than 15EX (p's<0.005), INCONGRUENT CRT was not (p=0.48). Exercise Intensity: The incremental test lasted ~11±2.8 min, with participants achieving a maximal rate of perceived exertion (RPE: 17±3) and HRmax (85±5%) after 15EX. CONGRUENT CRT and INCONGRUENT CRT reduced performance at exhaustion compared to Baseline, (p's<0.005), despite large fluid losses (M: -2.3±0.3% BM; F: -1.7±0.3% BM). The placebo treatment did not affect cognitive responses to E/MIE (p's<0.05).

Abstract: Age-related cognitive decline affects several aspects of cognitive performance, including processing speed, inhibition, executive function, and visual scanning. Aerobic exercise is a potential solution to mitigate age-related cognitive decline. Furthermore, older adults are more susceptible to benefits from the effects of both chronic and acute aerobic exercise compared to younger adults. PURPOSE: To determine the associations of life-long aerobic exercise as well as the effects of acute aerobic exercise on cognitive function among healthy older adults (65-84 years old). METHODS: Model-based cluster analyses were conducted using several demographic and physiological parameters of the participants’ cardiovascular health: (1) age; (2) VO2max; (3) Cardiot Augmentation Index; (4) Carotid-femoral pulse wave velocity (cPWV); (5) Aortic systolic blood pressure (SBP); (6) Carotid intima-media thickness (IMT). A cross-sectional design was utilized to compare 27 active (A) with 31 inactive (I) older adults (70±7 years). Cognitive function was measured at rest and after 15 minutes of moderate intensity exercise (55-65% HRmax) via the trial-making test (TMT Form A and B). A series of one-way ANOVAs was performed on dependent variables. A repeated measures MANOVA was used to test differences on the TMT-A and TMT-B at rest compared to after an acute bout of exercise. Pearson’s correlation analysis tested the associations among VO2max, age, carotid IMT, cPWV, and cognitive performance. RESULTS: VO2max was not related to carotid IMT (r=-0.15, p=.27) or cPWV (r=-0.12, p=.38). Time to complete TMT-A (261±1 vs 231±1 seconds, F(1,57)=15.12, p<0.001) 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=-0.16, p=.23), carotid IMT (r=-0.17, p=.21), and cPWV (r=-0.15, p=.26) were significantly correlated with cognitive performance on the TMT-A and TMT-B. Age was not correlated with cognitive performance on the TMT-A and TMT-B (r=.60, p=.01). CONCLUSION: An acute bout of aerobic exercise may diminish cognitive function among healthy older adults.

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, midlife light PE was associated with less decline in memory (time × PE interaction coefficient 0.044, p < 0.01); midlife vigorous PE was associated with less decline in memory (0.033, p < 0.05); and late-life vigorous PE was associated with less decline in visuospatial skills (0.025, p < 0.03) compared to baseline. Among APOE ε4 carriers, late-life vigorous PE was associated with less decline in memory (0.067, p < 0.05), attention (0.083, p < 0.01) and global cognition (0.073, p < 0.02); and late-life 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 R01 AG057708, U01 AG066786, 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.

Purpose: This study was designed to test the effects of a single session of either aerobic HIIT (HIA-A) or aerobic/resistance HIIT (HIA-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 HIA-A (n=20), HIA-AR (n=18), or the control group (n=19). Information processing was assessed via a reaction time (RT) task using a serial response box, integrated with a Biopac MP100 system allowing for measurement of sEMG. The sEMG signals of the agonist synergy with antagonist were temporally partitioned to assess central (premotor time (PMT)) and peripheral processing (motor time (MT)). A 3 (HIA-A, HIA-AR, & control) x 2 (pre-test & post-test) ANCOVA was performed for RT, PMT, and MT. RESULTS: For regular foreperiods (consistent time), the interaction between group and time for RT and MT was not significant (p > 0.05). There was no significant main effects for group and time for PMT, F(2, 51) = 4.194, p = .021, partial η2 = .141. This interaction was likely due to a simple main effect of time (p < 0.05) and not group allocation. For irregular foreperiods (variable time), the interaction between group and time for RT (F(2, 51) = 4.543, p = 0.015, partial η2 = .151) and PMT (F(2, 51) = 3.219, p = 0.048, partial η2 = .112) was significant while the interaction for MT was not (p > .05). For RT, there was a significant main effect of group, F(2, 53) = 7.271, p = .002, partial η2 = .215. Post hoc analyses revealed that both exercise groups had significantly faster RTs than the control group (p < .01). Additionally, for PMT, there was a significant main simple effect of group (F(2, 53) = 4.275, p = .019, partial η2 = .139).
High-intensity exercise results in a more negative affective response when compared to moderate- or low-intensity exercise. However, a large number of individuals continue participating in high-intensity exercise, in spite of these declines in affective state. PURPOSE: Determine whether differences exist in exercise-affect for those with higher versus lower exercise intensity preference and/or tolerance. METHODS: Undergraduates (n=245, 20.3±1.7yrs, 23.7±3.8BMI, 60.8% female, 82% regular exercisers) completed the Preference for and Tolerance of Exercise Intensity Questionnaire [Higher-intensity exercise preference, tolerance (HIFT; HIT) =24, n=155, n=154; lower-intensity preference, tolerance (LIFT; LIT)=24, n=45, n=51] along with completing 15-minutes of a high-intensity circuit (HIC), a walk, and a reading condition. Affective valence (via Feeling Scale) was taken prior to, every 3-minutes during, and 20-minutes post (P20) condition, while activity enjoyment was assessed immediately post. RESULTS: Multivariate ANOVAs revealed significant differences (P<0.05) for preference-intensity groups in valence during HIC at minutes 3 (HIFT=2.4, HIT=1.4, P=0.015), 6 (HIFT=2.5, HIT=1.1, P=0.002), 9 (HIFT=2.5, HIT=1.2, P=0.006), 12 (HIFT=2.3, HIT=0.9, P=0.025), 15 (HIFT=2.4, HIT=0.9, P=0.03), and at P20 (HIFT=3.1, HIT=2.0, P=0.054), and for enjoyment following HIC (HIFT=9.5, HIT=8.5, P=0.045), but not for walking or reading conditions. For those with differing intensity-tolerance levels, differences (P<0.05) in exercise-affect were only observed during minutes 3 (HIT-2.4, HIT-1.4, P=0.015) and 6 (HIT-2.5, HIT-1.1, P=0.002). Participants with differing intensity-tolerance levels, differences (P<0.05) in exercise-affect were only observed during minutes 3 (HIT-2.4, HIT-1.4, P=0.015) and 6 (HIT-2.5, HIT-1.1, P=0.002). Differences may be predictive of whether an individual will continue high-intensity exercise programming.

CONCLUSIONS: These findings suggest the intensity-preference trait influences how an individual feels during exercise at high-intensity intensity, but is less important during moderate/lower intensities. These differences may be predictive of whether an individual will continue high-intensity exercise programming.
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 (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 (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 consistent and sedentary during 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:** Up to 20% of pregnant women experience prenatal depression and up to 19% will continue to have depressive symptoms in the postpartum. Previous research supports exercise during pregnancy as an effective way to prevent prenatal depression, however evidence is lacking regarding exercise as a potential treatment for women who enter pregnancy already at risk for depression. Therefore the purpose was to determine if exercise during pregnancy is an effective option to treat depression during pregnancy. METHODS: This is a secondary analysis of two randomized controlled trials that followed the same exercise protocol and study methodology in Madrid, Spain. Women <16 weeks pregnant were randomized to an exercise group (EG) or standard care control group (CG). The EG participated in aerobics and resistance training in accordance to the American College of Obstetrics and Gynecology guidelines. All participants completed the Centre for Epidemiologic Studies Depression Scale (CES-D) at baseline and at the end of the intervention (36-38 weeks gestation). Women who scored ≥16 on the CES-D at baseline (at risk for depression) were included in the current study. A One-Way ANOVA was performed to determine if there was a difference in post CES-D scores between the EG and CG. A Chi-Square Analysis was performed to determine if there was a difference between trials. Brachial artery flow-mediated dilation decreased in sitting trial, but increased in the interrupted sitting trial (uninterrupted sitting: 9.2±2.16 to 9.0±2.23, interrupted sitting with stair-climbing: 7.9±2.55 to 10.3±2.89, p=0.009). Poblitical blood flow and shear rate were increased in the interrupted sitting trial with a significant interaction effect (blood flow: p<0.001, shear rate: p=0.006). Also, interrupted sitting attenuated the prolonged sitting-induced increase of systolic blood pressure and pulse pressure. CONCLUSION: Stair-climbing appears to be an effective way of breaking up prolonged sitting to improve vascular function with easy accessibility in various settings.
Differences of Plasma Metabolites in Prediabetes with Different Cardiorespiratory Fitness and the Effects of Exercise

Bowen Li1, Mian Jia1, Yan Wang2, Juan Wang2, Zhenghong Wang, FACSMM, Biao Sun3, 1Beijing Sport University and Nanjing Sport Institute, Beijing, China, 2Beijing Sport University, Beijing, China. 3Nanjing Sport Institute, Nanning, China. (Sponsor: Zhenghong Wang, FACSMM)

Email: libowen_sy@sina.com

Purpose: To indentify the most significant plasma metabolites for higher and lower cardiorespiratory fitness (CRF) in pre-diabetes mellitus (PDM), and the effect of aerobic exercise training on these metabolites. METHODS: All 80 PDM subjects were selected [age: (51.6±10.0) yrs; body mass index: (26.17±3.60) kg/m²; 24 males]. 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 analyzed by PCA and OPLS-DA. RESULTS: 1) Compared with lower CRF group, HOMA-IR, HOMA-β, LDL-C, BMI and Fat% of higher CRF group were lower, and analyzed by PCA and OPLS-DA. 2) At baseline, 11 metabolites were different in 7 metabolites in different CRF groups, including PC (20:1/14:1), PC(18:3/16:0), LysoPC(16:0), Valine, isocitric acid, Octyl carnitine and Linoleyl carnitine. 3) After 3-month exercise training, the fasting and OGTT-2h blood glucose of 61.11% of PDM program: 3 times/week, 50 min per session at 46%-64% VO2max, 3 month. Body increased significantly( 6.84%); but decreased 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)

PC-A-DA model of UPLC-MS metabolomics data for different cardiorespiratory fitness PDM

Decreasing levels of estrogen production, combined with the detrimental effects of aging, lead to large increases in cardiovascular disease (CVD) risk among midlife women. Physical activity has the potential to attenuate this increase in CVD risk; however, longitudinal associations of physical activity and blood lipid levels, important contributors to CVD, have not been studied in midlife women.

Purpose: To estimate the longitudinal associations of physical activity with blood lipid levels in midlife women. METHODS: We used data from 3,230 participants in the Study of Women’s Health Across the Nation (SWAN), a longitudinal cohort study spanning 14-17 years of nearly annual follow up. Women reported physical activity using the Kaiser Physical Activity Survey at 7 study visits. We used the sports and exercise physical activity index score to estimate leisure-time moderate to vigorous intensity physical activity. SWAN measured total cholesterol, triglycerides, HDL, LDL and DLD in blood collected at 8 study visits. We used generalized estimating equations to estimate longitudinal associations of moderate to vigorous intensity physical activity with each blood lipid biomarker, adjusted for age, race/ethnicity, education, and body mass index category. RESULTS: Women were 46 years old, on average, at study entry. Forty-seven percent were non-Hispanic white; 28% 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 associated with an average 1.9 mg/dl lower triglyceride level (95% CI: -3.5, -0.2) and 0.6 mg/dl greater HDL level (95% CI: 0.4, 0.9). 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.

Supported by NIH grants T32DK11668401, U01NR004061, U01AG012505, U01AG012553, U01AG012531, U01AG012539, U01AG012546, U01AG012553, U01AG012554, U01AG012495. The content of this abstract is solely the responsibility of the authors and does not necessarily represent the official views of the NIA, NINR, ORWH or the NIH.

Purpose: Physical activity studies often use inactive participants as a reference comparison group implying that all inactive participants can become more active. However, it remains unclear how much of this group is involuntarily inactive due to physical function limitations. This study aims to examine the involuntarily inactive and the association with mortality among older adults. METHODS: Study participants were from the National Health and Nutrition Examination Survey (NHANES), a population-based study with mortality follow-up through 2011. Participants were 60+ years old and wore the accelerometer for 4+ days (N=2415). Moderate-to-vigorous physical activity (MVPA) was derived using standard accelerometry cutoffs and categorized based on the US Federal Physical Activity Guidelines: 1) <15 minutes (inactive); 2) 15—37.5 minutes; 3) 37.5-150 minutes; 4) >=150 minutes per week (active). RESULTS: Women were 46 years old, on average, at study entry. Forty-seven percent were non-Hispanic white; 28% 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 associated with an average 1.9 mg/dl lower triglyceride level (95% CI: -3.5, -0.2) and 0.6 mg/dl greater HDL level (95% CI: 0.4, 0.9). 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. Supported by NIH grants T32DK11668401, U01NR004061, U01AG012505, U01AG012553, U01AG012531, U01AG012539, U01AG012546, U01AG012553, U01AG012554, U01AG012495. The content of this abstract is solely the responsibility of the authors and does not necessarily represent the official views of the NIA, NINR, ORWH or the NIH.
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 (Physiological Discomfort and Fatigue Questionnaire) were assessed at baseline and then hourly. Linear mixed models evaluated overall condition effects and differences at each hour following Boneferroni 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=0.116, d=0.18), physical fatigue (β=0.30 log-points, p=0.066, 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

<table>
<thead>
<tr>
<th>Question</th>
<th>Acceptability</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1: Willingness to Use REX</td>
<td>Very low or Low</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Neither low nor High</td>
<td>2</td>
<td>14.2%</td>
</tr>
<tr>
<td></td>
<td>High or Very High</td>
<td>12</td>
<td>85.8%</td>
</tr>
<tr>
<td>Question 2: Confidence to Use REX unsupervised</td>
<td>Very low or Low</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Neither low nor High</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>High or Very High</td>
<td>13</td>
<td>100%</td>
</tr>
<tr>
<td>Question 3: Coworker’s Acceptance of REX</td>
<td>Very low or Low</td>
<td>1</td>
<td>7.9%</td>
</tr>
<tr>
<td></td>
<td>Neither low nor High</td>
<td>3</td>
<td>21.9%</td>
</tr>
<tr>
<td></td>
<td>High or Very High</td>
<td>10</td>
<td>71.4%</td>
</tr>
<tr>
<td>Question 4: Supervisor’s Acceptance of REX</td>
<td>Very low or Low</td>
<td>1</td>
<td>7.9%</td>
</tr>
<tr>
<td></td>
<td>Neither low nor High</td>
<td>5</td>
<td>35.7%</td>
</tr>
<tr>
<td></td>
<td>High or Very High</td>
<td>8</td>
<td>57.1%</td>
</tr>
<tr>
<td>Question 5: Feasibility of Frequency and Amount of REX</td>
<td>Very low or Low</td>
<td>3</td>
<td>21.4%</td>
</tr>
<tr>
<td></td>
<td>Neither low nor High</td>
<td>2</td>
<td>14.3%</td>
</tr>
<tr>
<td></td>
<td>High or Very High</td>
<td>9</td>
<td>64.3%</td>
</tr>
</tbody>
</table>

D-45 Clinical Case Slide - Chest Pain and Medical Issues

Thursday, May 30, 2019, 3:45 PM - 5:25 PM
Room: CC-304E

1801 Chair: Poonam P. Thaker, FACSM. Presence Resurrection Sports Medicine Fellowship, Chicago, IL. (No relevant relationships reported)

1802 Discussant

Philip F. Skiba. Advocate Lutheran General Hospital, Park Ridge, IL. (No relevant relationships reported)

1804 May 30 3:45 PM - 4:05 PM

Chest Injury - Horseback Riding

Phillip J. Underwood, Bryan M. McCarty, Hillary Moss. North Shore University Hospital, Manhasset, NY. (No relevant relationships reported)

Chest Injury - Horseback Riding

Phillip J. Underwood, Bryan M. McCarty, Hillary Moss, North Shore University Hospital, Manhasset, NY

HISTORY: A 56 year old female fell off of her horse, causing her to land on her right shoulder. She experience 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-ossseoous suture 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 began 2 weeks post op.
6. Patient has returned to riding and experiences only minimal stiffness at right SC joint

1805 May 30 4:05 PM - 4:25 PM

Extremity Paralysis After Boot Camp Workout

Kulraj S. Dhah1, Roger Mortimer2, Robert Sallis, FACSM1.

Kaiser Permanente Fontana, Fontana, CA.1 University of California San Francisco, Fresno Medical Education Program, Fresno, CA.

(No relevant relationships reported)

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 weeks 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. Diffuse rash with attributed to diet pills and intermittent fasting. She was admitted for 5 weeks initially and readmitted four days after being discharged with recurrence of symptoms.


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-Barré 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/h) 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 for which she was not able to move the right shoulder due to severe pain. The lower extremities were normal.

Neuro-vascular exam of the upper extremities were normal and symmetrical. She 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.
1806 May 30 4:25 PM - 4:45 PM
Muscle Weakness: Boxing
Belmarie Rodriguez-Santiago, David Atkins, Brenda Deliz-Roldan, William Micheo, FACSM. University of Puerto Rico, San Juan, Puerto Rico.
(No relevant relationships reported)

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.
(No relevant relationships reported)

History: 22-year-old female collegiate Division I golfer presents with intermittent dizziness, palpitations, and pre-syncopal 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 cardiology referral for diagnostic evaluation.


Differential Diagnosis:

Test and Results:
- EKG: normal sinus rhythm.
- 7-day Holter monitor: Average HR 93 BPM. No ventricular or supraventricular ectopies noted.
- Tilt Table Test: Passive phase is non-diagnostic. Drug provocation phase with nitroglycerin challenge is positive for syncope, a HR decrease from 136 to 40, and then sinus arrest with a 6.1 second pause while blood pressure remains stable.

Final Working Diagnosis:
-Vasovagal syncope with sinus arrest consistent with cardio-inhibitory component.

Treatment and Outcomes:
- The cardiac electrophysiologist cleared her for participation in golf and to work out with activity modifications in order to moderate her physical workload and avoid excessive strain that might trigger vasovagal syncope.
- 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.
- She was counseled about the possibility of serious injury resulting from syncope.
- 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.
- She was counseled about the possibility of serious injury resulting from syncope.
- 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
(No relevant relationships reported)

Chest wall injury—Soccer
John C. Hannon, private practice, San Luis Obispo, CA
HISTORY: A 17-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 instant 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, worried 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-chorial joints and diminished respiratory excursion, accessory breathing muscle activity and elevated shoulders. Muscle splinting 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.

Differential Diagnosis:

Test and Results:
- Normal AP and Lateral chest-xray
- Final Working Diagnosis: Sternocostal sprain-Diaphragm strain
- Reassurance, explanation of the mechanics of injury, breathing exercises.
- Symptom-free return to play 5 day post-injury. 1 month later, accepted 4-year athletic scholarship.
D-46 Clinical Case Slide - Knee II

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

1809 Chair: Matthew R. Gammons. VT Ortho Clinic/Killington Medical Center, Rutland, VT.
(No relevant relationships reported)

1810 Discussant: Mary Lloyd Ireland, FACSM. University of Kentucky, Lexington, KY.
(No relevant relationships reported)

1811 Discussant: Pierre L. Viviers, FACSM. Stellenbosch University, Stellenbosch, South Africa.
(No relevant relationships reported)

1812 May 30 3:45 PM - 4:05 PM
Knee Pain and Effusion in a Medically Complex Patient
Aubrey Armento. University of Colorado Denver; Denver, CO.
(Sponsor: John Hill, FACSM)
Email: aubrey.armento@childrenscolorado.org
(No relevant relationships reported)

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 vincristine 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.

DIFFERENTIAL DIAGNOSIS:
1. Musculoskeletal lesion of Langerhans cell histiocytosis
2. Osteochondritis dissecans of the knee
3. Septic arthritis of the knee in an immunocompromised patient
4. New-onset juvenile idiopathic arthritis (JIA)

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

FINAL WORKING DIAGNOSIS: Juvenile idiopathic arthritis

Differential Diagnosis:
- Osteoarthritis
- Plica syndrome
- Osteochondritis dissecans

Tests and Results:
- X-rays grossly unrevealing.

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-away 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 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

Final Working Diagnosis:
- Isolated PCL rupture

Treatment and Outcomes:
- Knee immobilizer for 3-4 weeks
- Physical therapy with initial avoidance of hamstring activation for the first 4 weeks
- Over the counter analgesics as needed
- Return to sport progression

1814 May 30 4:25 PM - 4:45 PM
Osteochondritis Dissecans With Loose Body In A Golfer
Krishna Israni, Daniel Montero. Mayo Clinic, Jacksonville, FL.
(Sponsor: George Pujalte, FACSM)
Email: israni.krishna@mayo.edu
(No relevant relationships reported)

History:
A 63-year-old gentleman with no significant past medical history presented in sports medicine clinic due to left knee pain that began 3 months prior. He states that he stays physically active. Four months prior, he was on the golf range and noticed mild discomfort. He then noticed worsening discomfort with running. His symptoms improved with rest but then would return with activity. Mild pain relief with ibuprofen. Soon after, he started to have painful clicking and catching of the left knee. He returned to Montana where he saw an orthopedist who prescribed meloxicam and ordered x-rays that had essentially normal findings. He then underwent magnetic resonance imaging (MRI) which revealed cartilage defects. His pain improved but he still described occasional, sharp, left lateral knee pain, and less commonly, medial knee pain. He described the pain as aching, sometimes sharp, and measuring 4/10 on the pain scale. Running and walking exacerbated his symptoms; straightening his leg worsened the pain. He had occasional night pain also.

Physical Exam:
Healthy-appearing gentleman, had muscular legs, able to rise from a seated position without difficulty, with nonantalgic gait. Normal range of motion without restriction, minimally tender over the left lateral joint line, no ligament instability, no obvious effusion, positive McMurray, negative Lachman.

Differential Diagnosis:
- Meniscal tear
- Osteoarthritis
- Plica syndrome
- Osteochondritis dissecans

Tests and Results:
- X-rays grossly unrevealing.

Title: Knee Pain - Swimming in Dangerous Waters

Abstracts were prepared by the authors and printed as submitted.
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. Medical Collateral ligament sprain
2. Medical collateral ligament sprain with new left knee pain.
3. MRI R knee (initial) 5/18/2018: Extensive marrow edema present in the medial femoral condyle extending over 2.5 cm possibly related to stress reaction or early avascular necrosis. No subchondral or cortical fracture.
2. XR knee bilateral 7/20/18: patchy demineralization around the right knee. When correlating clinical history with outside MRI, findings suggest transient osteoporosis.
3. MRI L knee 7/31/18: Small subchondral insufficiency fracture of medial femoral condyle with very mild surrounding bone marrow edema. Faint bone marrow edema in the lateral femoral condyle without fracture.
4. MRI R knee (fu) 7/31/18: New subchondral insufficiency fracture of the lateral femoral condyle with moderate surrounding bone marrow edema. Resolution of medial femoral condyle bone marrow edema.
5. Labs, 8/18: PTH 44, Free T4 1.3, TSH 5.7, BMP 143/4.7/103/21/0.83/23<88, Ca 9.7, Vit D-25 OH 3.5

**FINAL WORKING DIAGNOSIS:**
- Transient osteoporosis of pregnancy
- Left subchondral insufficiency fracture of the medial femoral condyle
- Right subchondral insufficiency fracture of the lateral femoral condyle

**TREATMENT AND OUTCOMES**
- Tylenol/ Norco PRN
- Started weight bearing with crutches 5 months after initial injury
- PT
- Ca 500mg QD, plus 1000mg dietary for breastfeeding
- Vit D 2000IU QD
- After discussion with her pediatrician, bisphosphonates were held because she was breastfeeding and improving on current therapy.
Right Elbow Pain in a Teenage Softball Player
Shelby E. Johnson, Edward R. Laskowski, FACSM. Mayo Clinic, Rochester, MN.

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

TEST AND RESULTS:
Elbow X-ray: Negative for effusion, fracture, or osseous abnormality.
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 ulnar neuritis with a dislocating ulnar nerve and snapping medial triceps

TREATMENT AND OUTCOME:
Athlete underwent surgery to repair the Grade 3 UCL strain with pronator muscle group avulsion.

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
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@wuslst.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 prednisone 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 negative belly press and bear hugging. 5/5 strength to full range of motion at the 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 Xray

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 Powers1, Leda Ghannad2. 1Rush University Medical Center, Chicago, IL. 2Midwest 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 tenderness to palpation at C7 spinous process, right-sided cervical paraspinal muscles, right upper trapezius muscle, and right pectoralis muscle insertion. There is full pain-free range of motion in the cervical spine, right shoulder, and right elbow. Swirling 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. Apxaban initiated. 5. Underwent transaxillary first rib resection, subclavian tenolysis and arteriography, and right brachial plexus neurolysis.
6. Returned to sport 6 weeks post-operatively and completed physical therapy. 7. Underwent right upper extremity venogram with angioplasty for occluded right subclavian vein 3 months post-operatively.

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1825 May 30 5:25 PM - 5:45 PM
Arm Injury - Carpentery
Dylan Homen, Mimi Zumwalt, E.L. Domingo-Johnson, Matthew Helm, Melinda Schalow. Texas Tech University Health Science Center; Lubbock, TX. (Sponsor: Jacalyn Mccomb, FACSM)
(No relevant relationships reported)

HISTORY: 70yo M RHD presented to consultant hand clinic for R elbow evaluation 8 weeks post injury. He was building a deer hunting blind when the platform fell and landed on the posterior aspect of his right elbow. He noted immediate pain, swelling, and echynousness about the elbow at the initial traumatic episode. He also complained of a painful popping sensation whenever he ranged the elbow. He had difficulty straightening his arm, with pain and weakness upon attempted elbow extension. Past medical history included hand osteoarthritis and former 30-year smoker, quit in 2010. Denies history of pain, prior trauma at the site or exogenous corticosteroid use. PHYSICAL EXAMINATION: R upper extremity-tenderness to palpation over olecranon tip, pain with elbow range of motion (ROM); unable to maintain active elbow extension against gravity or resistance. Unrestricted, passive ROM arc 0-140 with no blocks & full pronation/supination. Distally no neurological or vascular deficits. DIFFERENTIAL DIAGNOSIS: Olecranon fracture Triceps bony avulsion Triceps tendon rupture TESTS and RESULTS: Radiographs - elbow lateral view revealed a small osseous fragment ~5 cm proximal to the olecranon tip. MRI - showed complete tear of the triceps with hematoma at its insertion site and ~3 cm tendon retraction.

FINAL WORKING DIAGNOSIS: R triceps tendon rupture

TREATMENT and OUTCOMES: Underwent delayed primary repair 2 months post injury. Posterior splint x 2 weeks with elbow 60-70 degrees of flexion. Hinged elbow brace x 2 months with weight restriction of 5 lbs. Gradual increase in ROM progressing to strengthening exercises for another couple of months. Latest follow-up 4 months post-op after OT patient with near full elbow ROM, pain free and functional

D-54 Free Communication/Poster - Blood Flow
Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1845 Board #1 May 30 2:00 PM - 3:30 PM
No Relationship Between Muscle Flexibility and Blood Flow in the Lower Legs of Competitive Runners
Megan Battles1, Rachel Bowden1, Cameron Greene1, Justin Stanek1, Arbin Thapaliya1, Jeffrey Williams1
(No relevant relationships reported)

Megan Battles1, Rachel Bowden1, Cameron Greene1, Justin Stanek1, Arbin Thapaliya1, Jeffrey Williams1

(No relevant relationships reported)
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 training.

METHODS: Healthy young men (n=7, 20±2 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 breath-holding either with or without respiratory inspiratory resistive load of 5 min (40% of maximal inspiratory mouth pressure, inspiratory duty cycle of 50% and a breathing frequency of 40 breaths/min). Mean arterial blood pressure (MAP) was measured using a finger photoplethysmograph. Blood flow to the brachial artery (inactive limb) and in femoral artery (active limb) were recorded using Doppler ultrasound. RESULTS: MAP during exercise was higher (P<0.05) with inspiratory resistive load (121.3±20.9 vs. 106.2±13.8 mmHg, P<0.05). Brachial arterial blood flow increased during exercise without inspiratory resistance (127±38 ml/min) as compared with resting level, while it decreased with inspiratory resistive load (93±25 ml/min). Femoral artery blood flow increased at the onset of exercise and was maintained throughout exercise without inspiratory resistance (242±67 ml/min) and was unchanged when inspiratory resistance was added (251±65 ml/min) (P>0.05). CONCLUSIONS: These results suggest that sympathetic control of blood redistribution to active limbs is promoted, partly, by respiratory muscle-induced metaboreflex.
The purpose of the present study was to assess the relationship between the 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. Our results indicate that increased resting muscle blood flow was associated with muscle force reduction after repeated ECs. Our results suggest that increased resting muscle blood flow could result from EIMD-induced inflammatory vasodilation after repeated ECs.

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.

Uncustomed 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 blood 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 between 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. Our results suggest that increased resting muscle blood flow could result from EIMD-induced inflammatory vasodilation after repeated ECs.

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, the nutraceutical Capsaicin has been shown to have cardioprotective effects, enhancing vasorelaxation and attenuating sympathetically 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 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 (Capsaicin: 105 ± 28 vs 105 ± 21 uM, Placebo: 114 ± 3.9%). Femoral artery blood flow was also not significantly augmented (p > 0.05) under Capsaicin (Capsaicin: 362±119% Placebo: 295±61% in response to PLM). Expectedly, there were no significant differences in basal microvascular perfusion, basal femoral blood flow, and central hemodynamic responses (HR, SV, CO, MAP) following ingestion of Capsaicin compared to Placebo (p > 0.05). CONCLUSION: These results indicate that 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.
1853 Board #9 May 30 2:00 PM - 3:30 PM
The Effect Of The Speed And Range Of Motion Of Movement On The Hyperemic Response To Passive Leg Movement
Brady Hanson, Travis Bloomfield, Trevor Davis, Amy Addington, Erin McMullin, Taysom Wallace, Meagan Proffit, Jayson Gifford. Brigham Young University, Provo, UT.
(No relevant relationships reported)

PURPOSE: Passive leg movement (PLM)-induced hyperemia is used to assess the function of the vascular endothelium. This study sought to determine the impact of movement speed and ROM on the hyperemic response to PLM and determine if the currently recommended protocol of moving the leg through a 90° ROM at 180°/s provides an optimal peak hyperemic response to PLM.

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

RESULTS: Movement speed generally exhibited positive linear relationships with the hyperemic response to PLM, eliciting ~20-30% increase in hyperemia and conductance for each 60°/s increase in speed (P<0.05). However, increasing the movement speed above 180°/s, which was physically difficult, did not elicit significant increases in hyperemia in many cases. ROM exhibited curvilinear relationships (P<0.05) with 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.

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 90°/s and 90° ROM, which offers a large hyperemic response, while maintaining test feasibility.

1854 Board #10 May 30 2:00 PM - 3:30 PM
The Relationship Between Left Ventricular Systolic Function And Cerebral Blood Flow
Ai Hirasa1, Tomoya Suda1, Kazukuni Hirabuki1, Noritaka Hata1, Yuki Sano1, Maruna Fukuc1, Takahiro Uechi1, Takaki Matsu1, Shigeki Shibata1, Kyorin University, Tokyo, Japan.
1University of Tsukuba, Ibaraki, Japan.
(No relevant relationships reported)

PURPOSE: The positive relationship between cardiac output and cerebral blood flow (CBF) has been indicated in healthy individuals and patients with cardiovascular diseases. Previous studies reported that the reduced cardiac output was related with a low brain volume and an increased risk for Alzheimer’s disease. Also, compromised left ventricular (LV) diastolic function was reported to be associated with a cerebral white matter lesions. Therefore, cardiac function may play an important role for the maintenance of CBF. However, the relationship between LV systolic function and CBF is still unclear. The purpose of this study was to test our hypothesis that the LV systolic function would be associated with CBF.

METHODS: Sixty-three patients who presented to our hospital due to transient loss of consciousness were enrolled (59 ± 22 years old, range 17 to 93 years old, 31 females). LV function was assessed by stroke volume (SV), LV ejection fraction (LVEF) and mass (LVmass) by echocardiography, and preejection period (PEP), ETc was significantly correlated with both systolic (β = 0.32, P = 0.01) and mean (β = 0.39, P = 0.00) arterial pressure. SV, LVEF, LVmass and PEP were not correlated with MCAv. In contrast, ETc was significantly correlated with both systolic (β = 0.32, P = 0.01) and mean (β = 0.39,0.00) arterial pressure. SV, LVEF, LVmass and PEP were not correlated with MCAv. In contrast, ETc was significantly correlated with both systolic (β = 0.32, P = 0.01) and mean (β = 0.39, P = 0.00) arterial pressure. SV, LVEF, LVmass and PEP were not correlated with MCAv. In contrast, ETc was significantly correlated with both systolic (β = 0.32, P = 0.01) and mean (β = 0.39, P = 0.00) arterial pressure.

CONCLUSIONS: These results indicated that LV systolic function evaluated by phonoangiogram may play more significant role for regulating CBF as compared with that by echocardiography such as LVEF.

1855 Board #11 May 30 2:00 PM - 3:30 PM
Differential Cardiovascular Responses to Acute Exercise in Children with Autism Spectrum Disorder
Jacob A. Manriquez, Kauialoha P. Kekuawa, Romina Shafikhi, Areum K. Jensen. San Jose State University, San Jose, CA.
(No relevant relationships reported)

Autism Spectrum Disorder (ASD) is a complex neurological disorder identified in early childhood and is characterized by impaired social interaction and atypical behaviors. A very few studies reported that children with ASD tend to have higher heart rate (HR) and blood pressure (BP) at rest compared to typically developing children (TDC). Although structural abnormalities have been identified in the brain stem where cardiovascular control center is located, the physiological basis for ASD has not been established. Furthermore, whether there are alterations in cardiovascular responses to exercise in ASD is unidentified. PURPOSE: To determine differential cardiovascular responses to acute handgrip exercise in children with ASD. METHODS: Total of 23 adults, TDC and children with ASD participated in the study. HR from ECG, beat to beat arterial BP from Finapres and brachial BP, and respiration from pneumo belt were continuously measured before, during and after 2 minutes of dynamic handgrip exercise at 50% of maximal voluntary contraction. In addition, diameter, blood flow velocity, and flow of the brachial artery were measured using Doppler Ultrasound on the contracting arm throughout the experiment. RESULTS: Mean BP was significantly increased from rest to exercise in adult and TDC groups (58.2±2.1 adult vs. 78.2±2.2 TDC at rest, 65±2 adult vs. 85±2 TDC exercise bpm; P<0.05); however, there was no change in HR to exercise from rest in children with ASD (172±4 at rest, 178±4 TDC exercise bpm). Both adult and TDC groups had similar increase in blood flow velocity during exercise compared to rest (Δ17.6±3.2 adult vs. Δ13.5±2.2 TDC cm/s; P<0.05). However, blood flow velocity in ASD did not change from rest to exercise (Δ0.6±2.2 ASD cm/s). CONCLUSION: While HR increased to exercise in both adult and TDC groups in similar fashion, HR did not change in children with ASD. It suggests that higher total peripheral resistance may contribute to increase BP during exercise in ASD. Such increase in BP can be attributed to attenuated vasodilation in contracting skeletal muscles during exercise in children with ASD. Supported by CASA RSCA Infusion and Undergraduate Research Grant, SJSU.

1856 Board #12 May 30 2:00 PM - 3:30 PM
Altered Blood Flow In Lower Legs Of Runners Over The Course Of a Competitive Season
Rachel L. Bowden, Cameron Greene, Megan Battles, Arbin Thapaliya, Jennifer Austin, Jeffrey Williams. Franklin College, Franklin, IN.
(No relevant relationships reported)

Forcible 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.

Purpose: To examine blood flow in lower legs of collegiate runners over the course of a competitive season.

Methods: BIG: 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 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 (123.3±43.73) and non-dominant (112.64±40.31) posterior tibial arteries was not significantly different (t(df=90) =3.73). Blood flow in the dominant legs, however, significantly decreased from pre- season (118.26±46.52) to post-season (102.99±30.76) (t(df=90) =2.089, P<0.05). However, increasing the movement speed above 180°/s, which was physically difficult, did not elicit significant increases in hyperemia in many cases. ROM exhibited curvilinear relationships (P<0.05) with 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.

Conclusion: This study reveals blood flow significantly decreased in the dominant posterior tibial arteries among runners over the course of a competitive season. Such findings support the idea of limb lateralization and asymmetrical adaptations among this population. Changes in blood flow may predispose runners to injury. These flows may predispose runners to injury. These findings may be due to factors in running gait and potentially disproportionate use of one limb during the stabilization and propulsive phases of gait. Further research should examine mechanisms underlying changes in blood flow and its influence on injury incidence among runners.
Inhaled thermography (IR-T) is a non-invasive and mobile tool to measure and portray changes of the body surface radiation (Tsr) or the surface radiation pattern (Tsrp) in real-time. PURPOSE: The comparison and examination of the Tsr changes 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. Tsr was measured with IR-T with a high-resolution detector. Tsr 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. Tsr 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 arterioles and their resolution, we were able to recognize the anatomy of subcutaneous arterioles and their

### Table 1

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<th>Condition</th>
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<th>Blood Analysis</th>
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CONCLUSION: The Tsr increases across groups during an exercise test. The Tsr can be distinguished between rest, IAT and max for endurance athletes. In short-term ill patients, the increase in the difference of Tsr appears less pronounced, which could be due to the limited capacity of the patients. The adjustment of arterioles 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 Tsr.

### Effects of External Calf Compression on Microvascular Oxygenation in the Lower Limb of Young Men

Compression garments are used in clinical and sports settings to improve blood flow. Pressure applied by the compression garments varies widely with some garments applying as little as 5 mmHg and as much as 60 mmHg of pressure. Although compression can increase blood flow, compression to a pressure of 60 mmHg for short periods of time (~30 min) has been shown to cause endothelial damage. This is important because endothelial dysfunction is a precursor of atherosclerosis and may impair microvascular oxygenation. PURPOSE: Examine the effect of lower versus higher external compression pressures on microvascular oxygenation in healthy, young men. METHODS: Near-infrared spectroscopy (NIRS) was used to measure microvascular oxygenation and increases across groups during an exercise test. The Tsr can be distinguished between rest, IAT and max for endurance athletes. In short-term ill patients, the increase in the difference of Tsr appears less pronounced, which could be due to the limited capacity of the patients. The adjustment of arterioles 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 Tsr.

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: Reactive arterial inflow and reactive hyperemic blood flow (RHBF) 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 measured during 2.5 minutes of normal-paced walking over a 20-meter course. The association between RHBF and walking economy and RHBF and gait speed was modeled using linear regression, adjusting for age, height, and fat-free mass. Sobel tests were used to assess possible mediating effects. RESULTS: In fully adjusted models, RHBF (mean RHBF: 18.0 ± 5.9 mL/100mL tissue (“min”)) 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: RHBF 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.

### 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: 66 ± 52; CA: 71 ± 60 mL/min; p = 0.5), MAP (e.g. 24 kg: AA: 109 ± 5; CA: 99 ± 6 mmHg; 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 = 0.6), 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: 0.00136 ± 0.00034; CA: 0.00004 ± 0.00003; p = 0.7) or superficial femoral artery (AA: 0.0013 ± 0.0003; CA: 0.0002 ± 0.0007; p = 0.6).

### Conclusion
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.

### References
No relevant relationships reported.

### Abstracts
**Board #19**
**Visceral Adiposity is Associated with Lower Cerebral Blood Velocity in Older Adults**
Natalia S. Lima1, Alexander J. Rosenberg2, Georgios Grigoriadis1, Elizabeth C. Schroeder1, Wesley K. Lefferts1, Tracy Baynard, FACSM1. University of Illinois at Chicago, Chicago, IL. 1University of North Texas Health Science Center, Fort Worth, TX. (Sponsor: Tracy Baynard, FACSM)
Email: nlima3@uic.edu

### Summary
Aging is associated with an increased prevalence of obesity and preferential increase in visceral adiposity. Visceral adiposity has detrimental effects on vascular function, which may contribute to reductions in brain blood flow with aging, thereby contributing to stroke risk and cognitive decline. The impact of visceral fat and 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 (MCAd) was assessed using a 2-MHz transcranial Doppler ultrasound probe on the right temporal window: Mean MCA conductance (MCAd) 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), MCAd (0.30 - 1.05 cm/s/mmHg), MAP (79 - 116 mmHg), LM (30.73 - 68.80 kg), FM (15.55 - 63.25 kg), VF (202 - 3. kg), and body weight (51 - 123 kg). Absolute LM and VF were negatively associated with MCAd, however, only VF remained after controlling for body weight (p < 0.05; Table). No relationship was observed for relative LM or FM (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.

### Table

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### References
No relevant relationships reported.

### Abstracts
**Board #15**
**D-55**
**Free Communication/Poster - Cardiorespiratory Disease**
Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

### Board #20
**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 Vongpatanasin1, Jere H. Mitchell, FACSM1, Scott A. Smith1, Masaki Mizuno1. 1University of Texas Southwestern Medical Center, Dallas, TX. 2Chubu University, Kasugai, Japan.

### Summary
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 heightened metaboreflex function in T2D may be caused by enhanced muscle afferent responsiveness to chemical stimulation. **Purpose:** The purpose of this study was to...
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/100 μl) 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: 362±25 vs. 92±17 %, 1.0 μg: 55±26 vs. 246±72 %, P<0.05) and MAP (0.3 μg: 15±8 vs. 45±9 mmHg, 1.0 μg: 23±8 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 Cardiovvascular 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: mp riccardi@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-referred exercise program. METHODS: Maximal cardiopulmonary exercise (CPX) tests and MetSyn risk factors were analyzed prospectively from 364 adults aged 46.1 years (45.5% 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-referred exercise program. RESULTS: The SD1 indices that represent a global variability in the system also 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 (24.0±7.23) and control (22.37±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, Choon-Sub KIM, Min-Ghyu SUN, Yong-Woo KIM. Kyungpook National University, Daegu, Korea, Republic of.

Email: kim mk@ knu.ac.kr

(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 (24.26±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 (250ml) twice a day for 8 wks whilst 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 had completed for consecutive 7 days. For evaluation of cardiac autoregulation, 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 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 had completed for consecutive 7 days. For evaluation of cardiac autoregulation, 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.

PURPOSE: Analyze and compare the effects of different protocols of high intensity of 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 (24.0±7.23) and control (22.37±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.
Obesity is associated with chronic inflammation characterized by increased levels of inflammatory cytokines. Exosomes are small microvesicles secreted by cells that contain a variety of molecules including microRNAs (miRs), mRNAs, and proteins. Typically, miRs act through post-transcriptional regulation of mRNA targets via miRNA degradation and/or translational repression. Exercise training reduces chronic inflammation. **PURPOSE.** The current study examined if obesity and concurrent exercise training alter skeletal muscle: (1) exosomal miR content, and (2) inflammatory signaling. **METHODS.** Vastus lateralis biopsies were obtained from sedentary lean (LN) and obese (OB) (n=8/group) men and women for analysis of targeted whole skeletal muscle mRNA, miR, and protein; and skeletal muscle derived exosomal miR (via small RNA-seq) before and after seven days of concurrent aerobic and resistance training. Significance at p ≤ 0.05. **RESULTS:** Pathway analysis of skeletal muscle derived exosomal miR indicated: 1) obesity increases miR targeting cancer, Wnt/β-catenin, and neuroinflammation in which transforming growth factor β receptor 1 (TGFβR1) is common; 2) exercise training decreases miR targeting IL-10, IL-8, and toll like receptor signaling (TLR), and NF-κB pathways in which RELA, an NF-κB subunit, is common. In whole skeletal muscle, IL-8 mRNA was reduced 50% (LN: Pre=1.0, Post=0.57; OB: Pre=0.89, Post=0.37) and Jun mRNA was reduced 25% after exercise training (58%; Pre=1.0, Post=0.774). No significant main or interaction effect was observed for TSC2 or AMPKT172.

**CONCLUSION:** Vastus lateralis biopsies were obtained from sedentary lean and obese men and women for analysis of targeted whole skeletal muscle mRNA, miR, and protein; and skeletal muscle derived exosomal miR (via small RNA-seq) before and after seven days of concurrent aerobic and resistance training. Significance at p ≤ 0.05. **RESULTS:** Pathway analysis of skeletal muscle derived exosomal miR indicated: 1) obesity increases miR targeting cancer, Wnt/β-catenin, and neuroinflammation in which transforming growth factor β receptor 1 (TGFβR1) is common; 2) exercise training decreases miR targeting IL-10, IL-8, and toll like receptor signaling (TLR), and NF-κB pathways in which RELA, an NF-κB subunit, is common. In whole skeletal muscle, IL-8 mRNA was reduced 50% (LN: Pre=1.0, Post=0.57; OB: Pre=0.89, Post=0.37) and Jun mRNA was reduced 25% after exercise training (58%; Pre=1.0, Post=0.774). No significant main or interaction effect was observed for TSC2 or AMPKT172.

**CONCLUSION:** Using a crossover design, ten recreationally-active males (n=5) and females (n=5) performed a bout of MICT (60 minutes at 55% max velocity [V_{max}]) and HIIT (6 bouts of 1 minute at 100% V_{max} and 1 minute at 3 MPH, followed by 5 minutes at 3 MPH, followed by 6 bouts of 1 minute and 100% Vmax 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 inflammation.

**CONCLUSION:** Consumption of alcohol after exercise (RE) is a common practice and might have negative effects on muscle recovery. Separately, alcohol and RE have opposite effects on signaling through mTOR complex 1 in skeletal muscle, a key pathway involved in muscle protein synthesis. **Purpose:** To investigate the effect of alcohol consumption after heavy RE on the phosphorylation of key proteins upstream of mTOR in vastus lateralis muscle of resistance trained men. **METHODS:** Eleven recreationally-active males (n=5) and females (n=6) completed 2 sessions of 6 sets of 10 repetitions of Smith machine back squats at 80% of 1 repetition maximum with 2 min of rest between sets. Immediately after exercise participants consumed 30 g of whey protein, followed by a drink (10 min after exercise) containing either alcohol (ALC: 1.09 g EtOH/kg fat free body mass) or no alcohol (PLA). Muscle samples were obtained using biopsy before exercise (PRE) and 2 hrs after exercise (2H) and analyzed for phosphorylation at mTOR and mTOR phosphorylation was (2.9 ± 1.3) times greater at 2H compared to PRE (F_{1,22} = 77.585, p < 0.001, η² = 0.774). No significant main or interaction effect was observed for p38MAPK (TGFβR1) or AMPK (S2448, TSC2S939, TSC2S1387, and AMPK (S172) using western blotting. Blood was collected at PRE and 24 hours after exercise (24H) and analyzed for creatine kinase (CK) activity. **RESULTS:** Significant (p = 0.005) main effect of time was observed for mTOR and mTOR phosphorylation was (2.9 ± 1.3) times greater at 2H compared to PRE (F_{1,22} = 77.585, p < 0.001, η² = 0.774). No significant main or interaction effect was observed for p38MAPK (TGFβR1) or AMPK (S172). A significant main effect of time with a large eta squared effect size was observed for CK activity. CK activity was greater at 24H (312 ± 137 U/L) compared to PRE (135 ± 69 U/L) (F_{1,22} = 28.856, p < 0.001, η² = 0.558) indicating that the exercise protocol effectively induced a modest amount of muscle damage on both trials. **CONCLUSION:** Consumption of alcohol after heavy resistance exercise did not affect phosphorylation at mTOR(S2448), TSC2(S939), TSC2(S1387), or AMPK(S172) at 2 hours after exercise in resistance-trained men. Supported in part by grants from the National Strength and Conditioning Association Foundation and the Texas Chapter of the American College of Sports Medicine.
migration. This study provides evidence that exosomes function as part of the SASP in satellite cells and may propagate a senescent phenotype to neighboring endothelial cells in skeletal muscle with aging.

**1872 Board #28 May 30 2:00 PM - 3:30 PM Effects Of Different Doses Of D-galactose On Skeletal Muscle In C57Bl/6J Mouse**
Yuta Sato1, Yuki Tamura1, Masafumi Noda2, Karina Kouzaki1, Koichi Nakazato1. 1*Nippon Sport Science University, Tokyo, Japan. 2The University of Tokyo, Tokyo, Japan.

(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 intra-peritoneally 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 histochromic 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 also 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.

**1873 Board #29 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 injured. Recently, we found that TSCs increase in their number and quality after 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 injury. Now, we hypothesize that TSCs demonstrate improved mitochondrial function following exercise training. To test the hypothesis, we performed an exercise training protocol on HGFA-injected cell cultures. We found that HGFA-injected TSCs exhibited increased mitochondrial function following exercise training. Our findings suggest that HGFA may play a role in the regeneration of tendon cells following injury.

**1874 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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(No relevant relationships reported)

Peripheral artery disease (PAD) is a significant medical condition caused by blockages in the arteries of the leg. Some PAD patients 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. **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 pair 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 neuromuscular network of myofibers are remodelled 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 (YJC) and Regenerative Engineering and Medicine research grant.

**1875 Board #31 May 30 2:00 PM - 3:30 PM Increased Muscle Salph-5alpha-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/TRC/1D1 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.

RESULTS: Muscle 5α-reductase protein expression and DHT level were significantly increased immediately and an hour after acute resistance exercise (climbing ladder) with and without treatment of 5α-reductase inhibitor (N=6 each group).

CONCLUSIONS: These results suggest that the increase in DHT secretion by acute resistance exercise may partially contribute to enhancement of muscle GLUT4 translocation via activation of Akt/AS160 phosphorylation in type 2 diabetic rats. Supported by Grants-in-Aid for Scientific Research (#17H02182 and #16K13059, M. Iemitsu).

1876 Board #32 May 30 2:00 PM - 3:30 PM The Development of Cancer Cachexia Negatively Impacts Skeletal Muscle Extracellular Matrix Remodeling


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(No relevant relationships reported)

Cancer cachexia is the largely irreversible wasting of lean body mass as a result of cancer progression, affecting ~80% of all cancer patients with as much as ~40% of cancer-related deaths being attributed directly to cachexia. Cachexia has been associated with increased fibrosis and reduced physiological function in cardiac muscle, but the possible role and development of fibrosis and associated extracellular matrix (ECM) remodeling in skeletal muscle has lacked evaluation. PURPOSE: To examine the effects of cancer cachexia on ECM remodeling and the development of fibrosis in skeletal muscle.

METHODS: 40 C57BL/6J mice were injected with either Lewis Lung Carcinoma cells or a PBS control into their hind-flank at 8 wks of age. The tumor was allowed to develop for 1, 2, 3, or 4 wks (n=8 per group). Tibialis anterior (TA) muscle was extracted and immediately frozen for morphology and mRNA abundance analysis using RT-qPCR. RESULTS: There were no changes in TA muscle weight until 4 wks post-tumor implantation which resulted in a ~22% lower muscle wet weight compared to PBS control (p=0.05). Sirius Red staining of TA muscle sections resulted in no change in collagen abundance in all groups with the exception of a 2-3-fold increase at 4 wks relative to all other groups (p=0.05). Collagen 1 gene expression was ~50% lower than control at 4 wks post tumor injection, respectively (p<0.05). Collagen 1 gene expression was ~2-fold higher at 1 and 2 wks but there was no difference at 3 or 4 wks, all relative to control (p=0.05). The ratio of Collagen 3:1 gene expression decreased ~30-50% from 1-3 wks compared to control (p=0.05), but there was no difference at 4 wks. MMP-2 gene expression was ~50% higher at 1-wk compared to control (p=0.05), but was not different 2-4 wks from control (p=0.05). MMP-9 gene expression was 3-6 fold greater than control at 3 and 4 wks post-injection, respectively (p=0.05). There was a main effect of tumor implantation to reduce TIMP-1 gene expression ~20-70% (p=0.05).

CONCLUSION: The development of cancer cachexia results in dysregulation of ECM remodeling and increased collagen deposition within skeletal muscle. This dysregulation could negatively affect skeletal muscle’s ability to maintain muscle mass and respond to other environmental stressors.

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 sarcolemmal 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 (Ks_ATP channel), 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 yrs; height: 166±5 cm; weight: 60±7.5 kg; VO2max 50.5±5.1 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+, Cl- and La 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 β1 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 Ks_ATP 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-1 (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, the interplay between different sarcolemmal 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 (Ks_ATP channel), 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 yrs; height: 166±5 cm; weight: 60±7.5 kg; VO2max 50.5±5.1 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+, Cl- and La 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 β1 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 Ks_ATP 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.

Abstracts were prepared by the authors and printed as submitted.
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 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 (VsD) bout at 15% ventilatory threshold for 30 minutes and a moderate intensity/long duration (MsD) bout at ~5% ventilatory threshold for 120 minutes. Blood was collected pre-exercise, 15 minutes from the start of exercise, mid-exercise, and immediately, 1hr-, 2hr-, and 3hr-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 MsD (81.2±7.4 ng/mL) than VsD (52.8±4.3 ng/mL), and GDF-15 was higher (p<0.0002) in MsD (200.3±48.6 ng/mL) than VsD (183.7±31.2 ng/mL). Follistatin was higher in VsD 1hr post-exercise (MsD 97.1±3.1 ng/mL vs. VsD 121.7±7.3 ng/mL; p<0.0001), and higher in MsD 2hr post-exercise (MsD 11.2±3.4 ng/mL vs. VsD 7.6±1.2 ng/mL; p<0.0008) and 3hr post-exercise (MsD 10.1±3.3 ng/mL vs. VsD 8.8±4.9 ng/mL; p<0.0001). GDF-15 was higher in MsD immediately post-exercise (MsD 335.0±75.9 ng/mL vs. VsD 193.5±34.9 ng/mL; p<0.0001), 1hr post-exercise (MsD 461.0±84.7 ng/mL vs. VsD 225.2±45.7 ng/mL; p<0.0001), and 3hr post-exercise (MsD 338.2±70.2 ng/mL vs. VsD 224.3±48.4 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.

**Conclusions**: The exercise-induced increase in follistatin and GDF-15 are 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.

**Conclusion**: The exercise-induced increase in follistatin and GDF-15 are 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.
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 primarily type II extensor digitorum longus (EDL) muscle. METHODS: Thirty-six male Sprague-Dawley rats were randomly assigned to one of four groups: sedentary/saline (S5S), sedentary/DOX (S5D), resistance training/saline (RT55), or resistance training/DOX (RT5D). 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 progressively detached from actin, because myosin's ATPase rate also recovered back toward the activity during fatigue. However, this was likely due to an accelerated rate of myosin's hydrolyze ATP by roughly 90% (p < 0.05) in a solution assay. By contrast elevated levels of Pi (0 vs. 10-15mM), in the presence of low pH (6.5), caused a similar reduction in force. However, this was likely due to an accelerated rate of myosin's detachment from actin, because myosin's ATPase rate also recovered back toward the control value (pH 7.4, no Pi) when Pi was added. CONCLUSION: Thus, these data provide unique insight into the molecular mechanisms that underlie the loss of muscle function during fatigue. In our current work we are using these findings to explore methods to mitigate these effects in vitro in a first step toward attenuating fatigue in diseases such as chronic heart failure.

### 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 SSD2 than SSS was observed (-25% and -37%, respectively). 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.

### REFERENCES

Xbp1 Promotes Skeletal Muscle Regeneration And Growth In A Cell Non-autonomous Manner

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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 injected with 100 µl of 1% BAC into the tibialis anterior muscle to induce a necrotic injury. In a separate experiment, control and KO mice were subjected to the synergistic ablation model of overload hypertrophy of the plantarius muscle. Skeletal muscle was collected and analyzed using histological and biochemical techniques.

Results: Protein levels of XBP1 are increased in regenerating muscle fibers (1 ± 0.21 vs. 17.66 ± 13.9, p < 0.05). Moreover, genetic deletion of XBP1 inhibits regeneration and growth of the plantaris muscle. Skeletal muscle was collected and analyzed using histological and biochemical techniques.

Conclusion: 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 myoblasts 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.

Effects of Obesity and Acute Resistance Exercise on Skeletal Muscle Intercellular Communication Pathways

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Results: The gene expression of the exosome biogenesis components hepatocyte growth factor-regulated tyrosine kinase (HGS) and vacuolar protein sorting mutant (VPS4a) were lower in OB than LN at rest (~25%) and at 15 min post (~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 REX only in OB (~230% 3hr post-exercise). mRNA-expression of Atrogin-1 in APCL compared to WT (~20% lower than WT). mRNA-expression of Atrogin-1 in APCL compared to WT (~20% lower than WT). mRNA-expression of Atrogin-1 in APCL compared to WT (~20% lower than WT).

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.

Skeletal Muscle Antioxidant Antioxidant Capacity Correlates With Both Oxidative And Glycolytic Profile In Trained Women Athletes

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Results: 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; 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 VO2max test, a repeated sprint test (RST), as well as the Yo-Yo Intermittent Endurance test, level 1 (YYIE1) and Recovery test, level 1 (YYIR1). Int-individual relationships between selected variables were analysed using Pearson’s product-moment correlation coefficients. Results: VO2max and SOD2 correlated (P < 0.05) with VO2max explaining 24% of the variance in SOD2 protein expression. Myostatin Heavy Chain (MHC) and Ila (MHCila) 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 expressing (P=0.03) to monocarboxylate transporter 4 (MCAT4) and phosphofructokinase (PFK; r=0.92). 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<0.01; 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+ and 9% were CD31 positive; an endothelial cell marker. Identification of other cell types is under investigation. Senolytic therapy 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.

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**Skeletal Muscle Stress Protein mRNA Response to Aerobic Exercise in Different Environmental Temperatures**

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Stress proteins protect skeletal muscle from internal and external stress. Heat shock proteins respond to temperature, exercise and oxidative stress. Cold shock proteins respond to temperature and hypoxia in animals or in cell cultures but have not been studied in humans. The response of cold shock proteins to exercise and physiologically-relevant environmental temperature in human skeletal muscle is not known. PURPOSE: The purpose of this study was to determine the early mRNA response of human cold shock and cold shock stress proteins to endurance exercise and environmental temperatures. METHODS: Seven recreationally trained males (age: 24 ± 1.2 years; height: 178 ± 1.7 cm; weight: 76.8 ± 1.9 kg; VO2peak: 4.5 ± 0.2 L·min⁻¹; Wmax = 290 ± 7.8 W) cycled for 1 hour at 60% Wmax, 20°C, and 33°C environmental temperature. Gene expression for heat shock and cold shock proteins were analyzed using qRT-PCR on muscle biopsy samples taken from the vastus lateralis pre- and 3 hours post-exercise. RESULTS: RBM3 mRNA was reduced 1.43 ± 0.10 fold (p = 0.006) and there was a trend for CIRP to decrease 1.27 ± 0.14 fold (p = 0.059) from pre- to 3 h post-exercise. CIRP and RBM3 mRNA were not different between temperatures (p = 0.273 and p = 0.688, respectively). HSP70 mRNA was 2.27 ± 0.23 fold higher post-exercise vs pre-exercise (p = 0.002) but was not significantly different between temperatures (p = 0.103). HSP27, HSP90, and HSF1 mRNA did not change from pre- to post-exercise (p = 0.052, p = 0.324, p = 0.795) and were not different between temperatures (p = 0.247, p = 0.134, p = 0.808). CONCLUSIONS: These data indicate that exposure to mild heat and cold during aerobic exercise have limited effect on the skeletal muscle mRNA expression of heat shock and cold shock proteins. However, this novel study found cold shock protein mRNA of skeletal muscle decreases, whereas HSP70 mRNA increases in response to a low to moderate intensity aerobic exercise bout. Supported by the National Institute for General Medical Science, Nebraska IDEA Networks for Biomedical Research Excellence (INBRE), and the University of Nebraska at Omaha Committee on Research and Creative Activity.

**Mitochondrial Ant2 And Ucp2 Expression In Mouse Liver During Colon-26 Tumor-induced Cachexia**

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(No relevant relationships reported)

**Mitochondrial Ant2 And Ucp2 Expression In Mouse Liver During Colon-26 Tumor-induced Cachexia**

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**Purpose:** It is well known that “Exercise is Medicine.” Exercise is a publically recognized and effective intervention strategy for a series of chronic diseases including obesity, diabetes, sarcopenia, and aging-related cognitive dysfunction. However, its molecular mechanisms for the beneficial prevention and treatment of chronic diseases and health promotion have not been systematically explored and elucidated. Since autophagy has been gained extensive attention in the field of medical science, the Nobel Prize in Medicine has been awarded to Yoshinori Ohsumi in 2016 as the pioneer scientist due to his achievements of autophagy in the prevention and treatment of diseases, health promotion, anti-aging, and lifespan extension. Therefore, elucidating the mechanisms of chronic diseases through exercise-induced autophagy and exploring its potential applications are highly desired.

**Methods:** A series of animal models were established for evaluating exercise intervention efficacy of chronic diseases, and exploring the underlying mechanisms and potential applications through western blotting, RT-PCR and TSM techniques.

**Results:** Our studies have confirmed that appropriate exercise intervention is a promoter of autophagy, which can rescue the dysfunctional status of autophagy and abnormal mitochondrial energy metabolism in chronic diseases. The autophagy or microRNA-mediated autophagy pathway, when dysfunctional in the cachectic liver, mitochondrial quality control, thereby realizing the prevention, treatment and rehabilitation of chronic or aging-related diseases.

**Conclusion:** Exercise-induced autophagy is benefit for the prevention and treatment of chronic diseases and health promotion. These promising studies also provide clear targets to develop novel drugs, food supplements, or mimic exercise pills for the prevention and treatment of chronic diseases, and health promotion.

**Mitochondrial Ant2 And Ucp2 Expression In Mouse Liver During Colon-26 Tumor-induced Cachexia**

Adrianna J. Castro, Gabriel S. Pena, Hector G. Paez, Jessica L. Halle, Nishant P. Visavadiya, Michael C. Zourdus, Michael A. Whitehurst, FACSM, Andy V. Khamoui. Florida Atlantic University, Boca Raton, FL.

(No relevant relationships reported)
synthase activity was assayed as a proxy for mitochondrial density. The respiratory control ratio (RCR), an index of OXPHOS coupling efficiency, was determined in the complex I-linked state. RESULTS: RCR was ~25-60% lower in all C26 groups compared to PBS-WS (p<0.05). C26-SEV also had lower RCR than C26-MOD (p<0.05). Together this may signify an early loss of liver OXPHOS coupling efficiency due to cancer, that subsequently worsens when severe cachexia develops. Citrate synthase activity was not different between groups (p>0.05), suggesting the impairment of respiratory function to be independent of mitochondrial mass. Ucp2 expression was not different between groups (p>0.05). However, Am2 expression was greater in C26-SEV compared to PBS-WS, C26-WS, and C26-MOD, by 15-30% (p<0.05). Am2 expression related inversely with RCR in the liver (r=-0.547, p<0.05), implying higher liver Am2 content to be associated with uncoupling of OXPHOS.

CONCLUSION: We highlight an under-recognized role of liver mitochondria in cancer cachexia, and suggest hepatic mitochondrial function to be a therapeutic target.

**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:** Male Brazilian Army cadets (n=163; 21.6±4.0 years) were genotyped for the LEP (rs12176570) and -2548G>A (rs7999039) SNPs, and LEPR (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. Considering all subjects VO2max correlated negatively with fat mass (r=-0.723, P<0.001) and negatively with VO2max (r=0.642, P<0.005). Fat mass was positively correlated with plasma leptin levels (r=0.212, 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), after 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**

Twenty professional soccer players (n=193; age: 21.6 ± 4.4 years, height: 180.2 ± 10 cm, weight: 78 ± 11.2 kg), free from illness and injury, was to generate lower limb reference ranges for lean tissue mass (LTM) and muscle function reference ranges in professional players. 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 56±15%, P<0.01; 14 of 17 deficit >20%) but no weakness in 20° DF (deficit 8±15%, 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%). 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.

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<th>Table 1</th>
<th>MG MF [Hz]</th>
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**Abstracts were prepared by the authors and printed as submitted.**
eight participants, and Stim (p < 0.05) in five participants. In addition, there were significant interactions for Stim by P (p = 6, p < 0.01) and ACC by P (p = 1, p < 0.01).

CONCLUSIONS: The results support a validity for CAI associated sensorimotor impairments. This lower plantar stiffness may influence ankle joint stiffness during activities, which may be a risk factor for recurrent ankle sprains.

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
Chihiro Edamatsu, Tomiko Odagaki, Kazuki Kusumoto. Kurashiki University of Science and the Arts, Kurashiki, Japan. Email: edamatsu@kusa.ac.jp (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 gastrocnemius medialis (distance from the muscle tendon junction to the calcaneus along the line of action of the tendon) during DJSs 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.

1905 Board #61
May 30 2:00 PM - 3:30 PM
Reliability Of Isokinetic Eccentric Hamstring To Concentric Quadriceps Torque Ratio Between Velocities, Sexes, And Limbs
Sean P. Langan. Georgia Southern University-Armstrong, Savannah, GA. (No relevant relationships reported)

The ratio of eccentric hamstring strength to concentric quadriceps strength has recently been suggested to potentially have utility for prospectively identifying risk for injury. However, there has been little research on the reliability of these ratios and furthermore, the differences and reliability of this ratio between different velocities, sex, and limbs. Purpose: To establish the reliability of eccentric hamstring to concentric quadriceps ratios, and further investigate differences between ratios at different angular velocities, sex, and limbs in healthy and physically active young adults.

Methods: Following a standardized warmup, 20 women (23.3±3.5 years) and 20 men (23.3±3.0 years) performed eccentric (e30 and c240 degrees·s−1) and eccentric (e30 and c120 degrees·s−1) knee flexion and extension protocols using both the dominant (D) and non-dominant (ND) limbs. Average peak torque from each set was used to create two ratios of eccentric hamstring to concentric quadriceps strength: e30/c240 and e120/c240. Results: For both sexes, the intraclass correlation coefficient (2,1) for the e30/c240 ratios (♀: .66 - .68, ♂: .62 - .71) were slightly higher than the e120/c240 ratios (♀: .45 - .59, ♂: .46 - .51). The Standard Error of Measurement (SEM) was similar across the two ratios within each sex; however, the SEM was smaller for men (4.5-5.0%) compared to women (5.2-7.3%). The D (P<.001, 95% CI: .03 to .10) and ND (P<.035, 95% CI: .003 to .09) e30/c240 ratios for the women demonstrated a significant systematic decrease across the two sessions. There were no limb differences for either of the ratios (P>.05); however, the e30/c240 ratio for the women was significantly higher (P<.046) than the men (95% CI: .01 to .72). Conclusion: No potent reliability differences appeared between the two ratios, which may be attributable to using average peak torque across repetitions without considering
FOCUS: The effect of knee joint angle difference on the neuromuscular activation of rectus femoris.

METHODS: Twenty-two healthy subjects (22.5 ± 2.7 years old) were recruited. Knee angle was randomized in five conditions: 60°, 75°, 90°, 105°, and 120°, with each condition repeated three times. Subjects performed bilateral knee flexion movements with a 40% MVC effort. Electromyography (EMG) data were collected using surface electrodes and normalized to the maximum voluntary contraction (MVC) of each subject. Results were analyzed using repeated measures ANOVA.

RESULTS: The EMG data showed significant differences in rectus femoris activation across different knee angles. Activation was highest at 120° and lowest at 60°, with intermediate values at 75° and 90°.

CONCLUSIONS: The knee joint angle significantly affects the neuromuscular activation of the rectus femoris, with the highest activation observed at a knee angle of 120°.

Effect of knee joint angle on the neuromuscular activation of the rectus femoris

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The gluteus maximus (Gmax) and medius (Gmed) have shown altered strength and activation in patients with patellofemoral pain (PFP) and have been addressed commonly in rehabilitation programs. However, the relationship between strength and a visual method of quantifying muscle activation through ultrasound imaging has not been explored. **PURPOSE:** To determine relationships between muscle thickness (at rest and during contraction) and strength using hand-held dynamometry of the Gmax and Gmed in various positions (side-lying, bipedal stance, unipedal stance) before and after a 4-week impairment-based rehabilitation program. **METHODS:** 19 patients with PFP (23.7±4.8yrs, 168.7±6.8cm, 69.6±15.1kg, 14F) completed 12 sessions of supervised impairment-based rehabilitation focused on lower extremity range of motion, strength, functional movement, and core stability. Ultrasound imaging and strength of Gmax and Gmed was performed before and after rehabilitation. Ultrasound images were collected at rest while side-lying, during side-lying hip abduction, bipedal stance, and unipedal stance. Both strength and thickness measurements were normalized to body mass (kg). **RESULTS:** There were no significant relationships found between strength and muscle thickness at the pre-rehabilitation session. Following rehabilitation, both Gmax and Gmed exhibited significant relationships between strength and muscle thickness during side-lying positions. For Gmax, side-lying at rest, there was a moderate relationship (r=0.50, p<0.03) and during side-lying hip abduction (r=0.46, p=0.05). Gmed revealed similar relationships following rehabilitation with side-lying at rest (r=0.65, p<0.003) and during hip abduction (r=0.46, p=0.04). **CONCLUSION:** Muscle thickness, as captured with ultrasound imaging, increases as strength increases for both the Gmax and Gmed in individuals with PFP, while side-lying, and only following rehabilitation. The strongest relationship was found in the Gmed, which is supported by the positioning being the same for both thickness and strength measures. The concentric nature of the Gmed contraction during side-lying hip abduction could also be a major contributor to this relationship.

**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.
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. Kinesio tape (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 evaluate the role of attentional focus on force output by assessing the usage of stimulation techniques likely distracted participants from the attentional focus cues provided during the stimulation session. Therefore, we were unable to successfully assess changes in corticospinal excitability between focus cues. However, we were still able to show that external cues direct greater production of the elbow flexors compared to internal cues.

**METHODS**: A normal daily degree of cervical flexion will decrease some upper extremity strength over the course of 30 minutes.

**RESULTS**: There are sufficient evidence to confirm the adverse effects of air pollution and the positive effects of active travel mode on the health. Future studies should consider the more factors that may impact the children active travel mode time.
effects of exercise 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 exercising’s effectiveness on health outcomes in this age group. This study’s purpose, therefore, was to examine a school-based exercise intervention’s impact 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 = 119.05 ± 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) exercising intervention group (8 weeks of 100 minutes [5 days x 20 minutes] school-based exercising/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 used 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, η² = 0.04), but not perceived competence (F(1, 52) = 0.83, p = 0.37, η² = 0.02) or motor skill competence (F(1, 52) = 0.02, p = 0.88, η² = 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 < .001, η² = 23) and Gender effect for MVPA (F(1, 52) = 5.06, p = 0.02, η² = 0.09). In detail, while all preschoolers’ motor skill competence improved over time, boys demonstrated higher MVPA than girls at both time points.

DISCUSSION: Exercising 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. A research model of “pretest-posttest” was used. The “independent t” and the “paired samples t” statistical package program were used to analyze the data.

RESULTS: The study results indicated that transfer coordination (t = 2.89, p < 0.05), click-to-click (t = 2.76, p < 0.05), climbing obstacles (t = 4.47, p < 0.05), and rolling skills (t = 3.81, p < 0.05) that four indicators were significantly higher in the experimental group than the control group (t = 2.13, p < 0.05), no significant differences in other variables.

CONCLUSIONS: As the results of this study, it follows that apart from clearly mentioning the importance of physical pricing practices. The extracurricular physical education program through long-term proper practices will enable children to develop their basic motor skill. (This study was supported by NPOPSS Grant 15CTY01.)
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 wore an accelerometer 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. Outdoor and indoor 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 outdoor and indoor 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=0.40, 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 further research to be considered in future studies using a larger sample size. Funding: ACSM Foundation, MWACSM, NASPEM, SHAPE.

Exercise training is mainly prescribed for obese children to decrease cardiometabolic risks, however, studies examining the difference between high-intensity interval training (HIIT) and moderate-intensity continuous training (MCT) are limited. PURPOSE: The purpose of this study was to determine if HIIT differentially impacted on cardiovascular risk factors compared with MICT in obese children. METHODS: The relevant literature was searched from the databases of PubMed, Web of Science, Embase, the Cochrane library, and CNKI, which was completed in September 2018. Only randomized controlled trials involving both HIIT and MICT on obese children were included, and studies involving only one intervention would be excluded. Two researchers independently performed literature screening, literature quality evaluation, and data extraction according to inclusion and exclusion criteria. RESULTS: A total of 9 studies with 309 obese children were included. Compared with baseline, both HIIT and MICT were taught by a student teacher who is familiar with SPARK K-5 curriculum. All participants were pre- and post-tested on their in-school PA for three days prior to and after the intervention using ActiGraph GT3X+. Everson’s cut points were applied to generate the percentage of time engaged in MVPa. A two-way mixed ANOVA was conducted to examine the effects of interventions (between-subjects) and time (within-subjects) on participants’ in-school MVPa percentage. RESULTS: There was no significant main effect of time (F(1, 63) = .72, p>.05), partial r² = 0.01 on participants’ in-school MVPa percentage. There was, however, significant main effect of interventions (F(1, 63) = 23.5, p<0.001, partial r² = .27) on students’ in-school MVPa percentage, with SPARK PE group (mean = 3.9) had higher percentage than did the Kinect AVG group (mean = 2.7). In addition, there was no significant interaction between time and intervention groups (F(1, 63) = 1.60, p>.05, partial r² = 0.03). CONCLUSIONS: Neither Kinect AVG nor SPARK PE changed participants’ in-school MVPa percentage. The effect of PA interventions on children’s in-school MVPa need to be explored in future studies.

PURPOSE: To identify significant predictors and assess the acceptability of shared physical activity (PA) in young children and their parents. METHODS: Twenty-eight parent-child dyads (mean±SD; age, parents: 38.0±6.6, children: 6.0±1.7) completed sessions in a fitness center that included five different shared PAs (brisk walking, dancing, tag games, body-weight exercises, and jumping games) and were instructed to try to complete at least one PA per day in the following week at home. One week later, parents reported their dyad’s participation in the shared PAs. Parents reported demographic characteristics, family chaos, parent PA self-efficacy, parent PA self-efficacy for their child, and average min/week of shared PA. A forward stepwise regression analysis was used to determine the optimal model to predict the total number of minutes parent-child dyads spent completing each PA together at home. McNemar’s test was used to determine differences between perceived acceptability and completion of the five PAs as a dyad during shared time. RESULTS: Lower family chaos (B=19.41, p<0.034), higher parent body mass index (BMI) (B=7.65, p<0.003), and higher annual household income (B=11.85, p<0.023) significantly predicted minutes of shared PA at home. The proportion of parents who perceived brisk walking as an acceptable PA was not different (p=0.125) than those who briskly walked with their child. The proportion of parents who perceived jumping games, body-weight exercises, dancing, and tag games as acceptable PAs was greater than those who completed these PAs with their child (all, p<0.05). CONCLUSIONS: Shared PA participation may be higher when participants have lower family chaos, higher parental BMI, and higher annual household income. Brisk walking could be considered in future family-based PA programs since it was perceived as acceptable and was completed in the home environment, whereas the other shared PAs were perceived as acceptable but not completed at home.
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 with the zoning and 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 accounted 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.

Physical literacy addresses the ability, confidence and desire needed to optimize physical activity participation. Ability to perform, or competency in, fundamental movement skills, has not been recently evaluated among children in the United States, which is the population for which we know the least about evidence linking physical activity with health outcomes in this population. This cross-sectional study examined the associations among physical activity (PA), motor skill competence (MSC), perceived physical competence (PPC), cardiovascular fitness (CF), and cognition in preschool children.

**METHODS:** Sixty-five preschool children (33 girls; 27 White, 21 Hispanic, 7 other; X̄age = 4.45 ± 0.46; X̄baseline = 59.05 ± 32.04) were recruited from two local elementary schools in Minneapolis, Minnesota. Children’s 3 days PA during school time included moderate-to-vigorous PA and steps were assessed via Actigraph Link; MSC was measured via the Test of Gross Motor Development-Second Edition; PPC was assessed via the Pictorial Scale of Perceived Competence and Social Acceptance; CF was assessed via a modified YMCA 3-Minute Step Test; and cognition was assessed via the computer-administered NIH Toolbox. Multiple linear regression was performed to determine the associations among outcome measures.

**RESULTS:**

Children’s MVPA was not significantly related to MSC (r = -0.182, p = 0.05), PPC (r = 0.121, p = 0.05), CF (r = -0.141, p < 0.05), and preschool children’s MSC was a significant predictor of step counts [F(4, 63) = 4.65, β = 0.178, p < 0.05; R² = 0.24] after age, gender, and BMI were adjusted. In addition, PPC was significantly positively correlated with MSC (r = 0.366, p < 0.01), and was a significant predictor of MSC [F(4, 63) = 2.66, β = 0.26, p = 0.04, R² = 0.15]. Preschool children’s cognition was significantly positively correlated with MSC (r = 0.266, p < 0.01) and CF (r = -0.372, p < 0.01), respectively, but only CF seemed to be a significant predictor of cognition [F(2, 42) = 4.52, β = 0.35, r = 0.273, p = 0.01, R² = 0.14].

**CONCLUSIONS:** The findings support the need for effective strategies that simultaneously promote motor skill competence, cardiovascular fitness, cognition, and physical activity behaviors in early childhood. Future research with larger and more diverse samples is warranted.
tasks involving object control. Similarly, over 20% of children in middle school lack competence in object control tasks. These areas need to be addressed in order to optimize long-term physical activity.

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**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-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 (ISAAC) 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 246±80 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±1.8%; 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.

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**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 accelerometers 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 changing 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.

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**PURPOSE:** The Association between Sex and Directly Observed Physical Activity in Preschool-Age Children

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**METHODS:** Sex disparities in physical activity (PA) are evident in preschool-age children (2-5 years old). Preschool-age boys have been reported to participate in more PA during free play. However, it is unknown if this disparity is evident when participating in a structured PA intervention. **Purpose:** To examine the association between sex and directly observed PA levels in preschool-age children while participating in a PA intervention. **Methods:** This study utilized data from the Short bouts of Exercise for Preschoolers (STEP) study. STEP was a 6-month cluster randomized controlled study that examined the effects of short bouts of structured PA implemented within the classroom setting as part of designated gross motor playtime in ten preschool centers. STEP consisted of structured PA during the first 10 minutes of gross motor playtime followed by 20 minutes of free playtime. PA levels during the 10-minute intervention session were measured using a modified Observational System for Recording Physical Activity in Children-Preschool Version. PA intensity was classified as sedentary, light, or moderate-to-vigorous (MVPA). This secondary analysis focused on the baseline and 3-month data of participants randomized to the intervention group (preschool centers, n = 5; participants, n = 75; age = 3.9 ± 0.67 years). Spearman correlations were used to examine the association between sex and PA intensity during the intervention. Repeated measures ANOVAs were used to examine the effect of sex on PA intensity. **Results:** Participants spent similar percent of intervals in MVPA at baseline (boys, 41.77±6.59%; girls, 38.27±5.16%) and 3-months (boys, 46.61±7.59%; girls, 43.89±7.55%). There were no significant associations between sex and directly observed MVPA at baseline (r=0.035, p=0.37) or 3-months (r=-0.039, p=0.81). Similarly, there were no significant effects of sex on any PA intensity (all P > 0.80) during the intervention. **Conclusion:** In this sample, sex was not associated with or impacted the number of intervals that preschool-age children spent in MVPA during the structured PA intervention. Future studies are needed to determine if these trends remain the same in a larger sample size.

Funded by: Robert Wood Johnson Foundation, Active Living Research 68509
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, defined as a change in youth MET (MET), occurs during outdoor play on a natural playground and in a garden setting in preschool children. METHODS: Twenty-six children (4.5 ± 0.7 y; 13 boys) wore an ActiGraph GT3X+ accelerometer on the right hip during two 30 min free living conditions; free play on a natural playground and semi-structured play in a garden. The Patel et al. equation was used to calculate VO2 from accelerometer data. MET values were calculated by dividing predicted VO2 by predicted basal metabolic rate (Scholfield equation). Hierarchical linear models were used to demonstrate the changes in MET, over time (level one variable = time, level 2 variable = individual child, predictor variables = sex (boy or girl) and location (garden or playground)). There was a three-way interaction among time, location, and sex (F(1, 725.984) = 7.858, p < 0.001), thus separate models were run for each sex. RESULTS: For both, there was no time by location interaction (F(1, 387.174) = 1.038, p = 0.309) and no main effects for time (F(1, 177.036) = 3.115, p = 0.268) or location (F(1, 384.913) = 1.234, p = 0.078). For girls, there was a significant time by location interaction (F(1, 313.624) = 9.925, p = 0.002), yielding the following equation: MET = 2.81 - 0.44 (location; playground = 0, garden = 1) - 0.02 (time) + 0.02 (location*time). The figure represents the average change in MET, for each location and by sex.

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.

US Lacrosse’s Athlete Development Model (LADM) currently encourages small-sided game (SG) field dimensions to increase development and skill acquisition for youth athletes. No studies have evaluated changes in game-play subsequent to SG participation in boys’ youth lacrosse (BYL). PURPOSE: To describe game-play characteristics during SG (35–45 yd) and full-field games (FG, 60–70 yd) in BYL. METHODS: Data was collected from 33 BYL players in Virginia (8.5±0.5 years, 133.8±5.7 cm, 35.9±6.5 kg) on SG (n=15) and FG (n=18) teams. All games were filmed using a digital camera affixed to a camera lift system. Game-play characteristics were measured by reviewing the game video and coding for characteristics of unsuccessful passes, successful passes, shots on goal, goalie saves, changes of possession, loose balls, and intercepted passes. Descriptive statistics were reported (Frequency, Mean) for all observed game-play characteristics. RESULTS: Teams participated in 12 games total with 159 total athlete-exposures. Overall game characteristics were: unsuccessful passes (SG=587, FG=399), successful passes (SG=165, FG=347), shots on goal (SG=81, FG=143), goalie saves (SG=84, FG=79), changes of possession (SG=419, FG=335), loose balls (SG=799, FG=670), and intercepted passes (SG=31, FG=24). The average characteristic per game were: unsuccessful passes (SG=97.8, FG=66.5), successful passes (SG=27.5, FG=57.8), shots on goal (SG=13.5, FG=23.8), goalie saves (SG=4.7, FG=13.2), changes of possession (SG=69.8, FG=55.8), loose balls (SG=133.2, FG=111.7), and intercepted passes (SG=5.2, FG=4.0). Further characteristics included: percent successful passes (SG=22%, FG=47%), and percent completion of successful shots on goal (SG=60%, FG=41%). CONCLUSION: Generally, FG had a greater percentage of successful passes than SG with comparable attempts per game between the two groups. In addition, SG had a greater successful shot percentage on less shots but had fewer goalie saves per game. Lastly, the SG team had more unsuccessful passes, loose balls, and turnovers. Further research is required to understand the effects of all aspects of the LADM on player development in BYL.
Purposes: 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 (26.6% 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. 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.

Purposes: 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 descriptive statistics (Frequency, Mean) for game-play characteristics were calculated. Results: A total of 137 athlete-exposures (AE) occurred across 12 games (SG=95AE, FG=72AE). Total characteristics for the season were: unsuccessful passes (SG=476, FG=378), successful passes (SG=59, FG=110), shots on goal (SG=193, 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=9.83, 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 YL.

Purposes: US Lacrosse developed the Lacrosse Athlete Development Model (LADM) to provide every athlete the opportunity to enter, enjoy and excel by 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 full-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 included in 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%). Among girls, moderate physical activity was higher in full field games (12.6%) compared to modified field games (10.3%).

Conclusions: There were modest differences in activity level by game type among youth (U10) boys and girls and 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
bend for more of the game on the modified fields than full size fields; • Coaches stopping the game on multiple occasions to provide instructions to inexperienced players in the modified field game; • Local (rather than US Lacrosse) rules were used, allowing more players on the field and longer game times.

1941
Board #97  May 30 3:30 PM - 5:00 PM
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) youngsters 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 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.

This study was supported by FCT (UID/DTP/00617/2013).

1942
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 pre-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=.000) and PACER laps (Gain Score=-6.18, F=9.502, p=.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= .000,.000,.002)

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

1943
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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Girls with intellectual disabilities (ID) exhibit poor fitness and low physical activity (PA) levels, and are considered a vulnerable, at-risk population. Girls with ID have limited access to many PA opportunities, but dance is accessible, widely available, and perceived as enjoyable. 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 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 (n=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 who 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.

1944
Board #100  May 30 3:30 PM - 5:00 PM
Relationship Between Physical Activity, Sedentary Time, Cardiorespiratory Fitness And Academic Achievement In Norwegian Adolescents.
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(Sponsor: Ulf Ekeland, FACS)

Background: There is increasing evidence of positive associations between physical activity (PA), cardiorepiratory 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 accelerometer (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
MVP 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.

1945 Board #101 May 30 3:30 PM - 5:00 PM Intervention With Exergames For Adolescents Promote Moderate To Vigorous Physical Activity

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(No relevant relationships reported)

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 MVPA (20.7min vs. 24.4min), in favor of the group with the largest 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.

1946 Board #102 May 30 3:30 PM - 5:00 PM Twelve Years Follow Up - Prevalence Trends Of Physical Inactivity And Overweight In Brazilian Adolescents

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(No relevant relationships reported)

PURPOSE: Determine the physical inactivity and overweight prevalence in adolescents living at São Paulo State (Brazil) from 2005 to 2017.

METHODS: We evaluated 3,845 adolescents as part of a cohort study that started in 2005 in São Paulo city. In this study we analyzed 2,012 both sex adolescents that were followed in 2005, 2009, 2013, 2015 and 2017. In 2005, adolescents were from 15 to 18 years of age. We assessed the habitual physical activity practice by International Physical Activity Questionnaire (IPAQ-short-8 version) considering active (AT) the adolescents that accumulated at least 300 minutes per week of moderate-vigorous PA and inactive (INA) if less than 300 min/week were reported. Body weight (kg) and height (m) were self-reported by questionnaire. BMI was calculated and the respective criteria for overweight classification were considered for Brazilian adolescents (CONDE and MONTEIRO, 2006). The anthropometry tended changed overtime, and a linear regression model was designed to express the annual physical inactivity prevalence average and the excess of body weight. The significance was p<0.05.

RESULTS: In general, the prevalence of physical inactivity in 2005 was 50.4%, with significant increase to 53.2% (2009); 56.7% (2013); 59.2% (2015) and 60.2% (2017), with 0.91% annual increase. Higher variation was observed in girls than boys (1.32% x 0.89% per year). The overweight prevalence followed similar trend: 2005 (16.7%); 21.2% (2009); 25.8% (2013); 28.2% (2015) and 29.3% (2017) with 1.29% increase per year (p<0.05). Girls presented significantly and higher percentage change than boys (1.56 vs. 1.15% per year).

CONCLUSIONS: Data showed progressive trend of high physical inactivity and body fat increase, leading to an incidence of obesity in the next 10 years around 71.0% of all adolescents living in Sao Paulo State 37.2% of physically inactive behavior. These data suggests an early development of cardiovascular disease, with higher impact in girls than boys. Also data strongly suggest to effectiveness of public health policies towards the physical inactivity prevention and the excess of body mass among adolescents are related to unhealthy behaviors of eating, drinking and PA.

1947 Board #103 May 30 3:30 PM - 5:00 PM Compliance With The 24-h Movement Guidelines In Hong Kong Adolescents: Associations With Body Mass Index

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(No relevant relationships reported)

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 yrs) wore the waterproof activPAL™ 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 the sample), provided valid activPAL™ 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 (H=0.34; 95% CI, 0.32 to 0.36; p=0.007) and those who did not met the combination of PA and ST recommendation (H=0.89; 95% CI, 0.82 to 0.92; p=0.011) 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).

1948 Board #104 May 30 3:30 PM - 5:00 PM The Effects Of HIIT And LIT On Weight Loss In Obesity Children/adolescents: A Systematic Review And Meta-analysis

Zhao Xiaochen, Cao Chunmei, Li Qing. Tsinghua university, Beijing, China.

Email: 18614222993@163.com

(No relevant relationships reported)

PURPOSE: To explore the effect of high-intensity interval training and low-intensity training on weight loss in obese children and adolescents.

METHODS: Search database (MEDLINE, PubMed, websites of science core database), the deadline is May 20, 2018. The screening conditions were as follows: Randomized controlled trials; Writing in English; Participants in the study were obese children/adolescents between the ages of 6 and 18. The intervention model is HIIT or LIT.

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=4.14p<0.0001], 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 values of the two training methods were significantly different. However, LIT is better than HIIT [HIIT=-0.27(95%CI=-0.49, -0.04)] vs. LIT=[-0.94(95%CI=-1.12, -0.75)]; % body fat, HIIT is better than LIT [HIIT=-0.56(95%CI=-0.84, -0.29)] vs. LIT=[-0.45(95%CI=-0.70, -0.21)].

CONCLUSIONS: HIIT is more effective for obese children/adolescents than LIT. LIT 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.

The subgroup analysis of low intensity training

<table>
<thead>
<tr>
<th>Variable</th>
<th>Subgroup</th>
<th>Potential confounding factors</th>
<th>Number of study</th>
<th>Std. Mean Difference</th>
<th>t'</th>
<th>p'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight</td>
<td>&lt; 14</td>
<td>4</td>
<td>0.41(1.29, 0.23)</td>
<td>P = 0.005</td>
<td>z = 3.27 (P &lt; 0.001)</td>
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</tr>
<tr>
<td>Training cycle</td>
<td>&lt; 12 weeks</td>
<td>2</td>
<td>0.67(1.76, 1.80)</td>
<td>P = 0.005</td>
<td>z = 2.26 (P &lt; 0.05)</td>
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<tr>
<td>Training cycle</td>
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<td>0.19(0.98, 0.19)</td>
<td>P = 0.005</td>
<td>z = 0.76 (P &gt; 0.0001)</td>
<td></td>
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<tr>
<td>Body fat</td>
<td>&lt; 14</td>
<td>3</td>
<td>0.01(0.01, 0.01)</td>
<td>P = 0.005</td>
<td>z = 0.76 (P &gt; 0.0001)</td>
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<tr>
<td>Training cycle</td>
<td>&lt; 12 weeks</td>
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<td>0.00(1.39, 0.22)</td>
<td>P = 0.005</td>
<td>z = 2.41 (P &lt; 0.001)</td>
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<td>Training cycle</td>
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<td>0.01(0.15, 0.01)</td>
<td>P = 0.005</td>
<td>z = 0.76 (P &gt; 0.0001)</td>
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Body image is an important marker of health and well-being among young people. Instruments to assess body image use contour images that participants use to describe their body image self-perception. These images must be culturally sensitive and adequate for different age groups. Although the Contour Drawing Rating Scale (CDRS) has been validated among adolescents in Spain, no previous studies have compared the body image CDRS with anthropometric measures among Chilean adolescents.

PURPOSE: To assess body image using the CDRS among Chilean adolescents, and compare with anthropometric measures including body mass index (BMI) and waist circumference (WC).

METHODS: A group of 156 Chilean adolescents (87 males, 69 females) aged 13-14 years old participated in the study. They completed the body image CDRS consisting of 9 images from which they selected the one representing their body image self-perception. Values for selected images ranged from 1 (underweight) to 9 (obese). Subsequently, body weight was measured with a Tanita-HD313® scale, height with a SECA-206® stadiometer, and waist circumference with a Lufkin W606PM® tape, while participants were barefoot, and wore short-sleeve t-shirts and shorts. BMI was then calculated (kg/m²). To determine sex differences, Chi-Square and t-test were used, and correlation analyses were performed to detect association between variables.

RESULTS: Body image CDRS values ranged from 2 to 8 in males, and 1 to 9 in females (Z=4.237, p<0.001). Mean (standard deviation) BMI in males and females was 21.3±3.5, and 22.3±3.3 kg/m², respectively (Z=2.168, p<0.05). Spearman correlation coefficients showed a moderate but significant association between the CDRS score and BMI (males, rho = 0.68; females, rho = 0.49, p<0.01 for both) and waist circumference (males, rho = 0.66; females, rho = 0.52, p<0.01 for both). The significant correlation between anthropometric measures and the CDRS in our group of Chilean adolescent males and females suggest that body image self-perception closely represent objective measures of body image assessment; thus, providing an adequate body image assessment tool in this population.
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 examine the influence of frequency of meeting the MVPA guidelines on cardiometabolic risk in youth.

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, assessment 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 89.6-94.1). Diastolic blood pressure was higher in Quartile 1 and Quartile 2 compared to Quartile 3 (p<0.05). The proportion of children with waist-to-height ratio, systolic blood pressure, cholesterol, triglycerides, glucose, or insulin associations of quartiles to individual cardiometabolic risk factors. Covariates included age, sedentary time, MVPA, sex, race/ethnicity, asthma, physical disability, assessment period, quartiles of the Healthy Eating Index, and poverty-income ratio.

CONCLUSION: This cross-sectional analysis found no association between proportion of DMG and cardiometabolic risk factors in children and adolescents. Achieving an overall 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.
PA to improve physical fitness and academic achievement in children. (This study was supported by NPOPSS Grant 15CY011.)

CONCLUSIONS: The results of this randomized trial are expected to provide schools and policy-makers with significant new insights into the potential of extracurricular

Menarche causes body changes such as increased body fat and classic changes occur in secondary sexual characteristics. In this way due to body changes, the body perception also needs to be adjusted. The regular practice of physical activity has been considered a key element to improve the perception of size and body image in different populations, however, to our knowledge, the association between menarche and the level of physical activity in perception of the dimension and of the body image still unexplored. PURPOSE: Verify the influence of menarche in the perception of the dimension and the body image of active and inactive girls. METHODS: After the approval of the São Judas Tadeu University Research Ethics Committee, thirty-eight girls were distributed into two groups active and insufficiently active subjects and analyzed semiannually by 2.5 years by identification before and after menarche. An anthropometric parameters (height, weight and body mass index), perceptions of body size (using the Image Marking Procedure) and body image (silhouettes scale) were used as evaluation parameters. RESULTS: After menarche, all the girls in both groups presented alteration (p < 0.05) only in the anthropometric parameters and in the body perception index of the hip after the menarche. No significant changes were identified (p > 0.05) between groups. CONCLUSION: Menarche induced anthropometric alterations and perception of the hip dimension, but without promoting changes in the general perception of the body, as well as in the indication of the silhouettes and in the corporal satisfaction regardless of the level of activity physical.

Physical activity is associated with many physical and mental health benefits. The activity improves mood, reduces stress and anxiety and as shown previously increases

PURPOSE: To examine the relationship between physical activity habits and academic achievement among undergraduate adult male and female students. METHODS: Two hundred and thirty two male students (34.5 ± 10.2 yrs) and seventy two female students (36.5 ± 7.6 yrs) from the Faculty of Health Sciences at Ariel University volunteered to participate in this study. The cross-sectional study was conducted using a quantitative method and data was collected by a closed questionnaire, which included questions about physical activity in view of intensity, type of activity, time duration and frequency per week and was analyzed vis-à-vis academic achievements. RESULTS: A significant positive correlation (p < 0.03) was found between physical activity habits and higher grades only among the male students. For the younger male students and the adult male students - the higher the physical activity time duration and frequency the higher the grades were. No correlation between adult female students’ physical activity and academic grades were found (p > 0.05). CONCLUSIONS: Older male students’ academic grades were correlated to their physical activity habits. The awareness of the importance of physical activity habits among undergraduate male students is not limited to the younger age students but is also true for all age groups.

PURPOSE: To investigate Hispanic college students’ awareness and knowledge related to metabolic syndrome (MetS) conditions.

METHODS: Hundred and thirty-nine Hispanic college students (age = 22.43 ± 4.07) volunteered to participate in the study. Each participant read and signed the consent form prior to any data collection to take place. Demographic data including age,
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 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 diet 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.

1960 Board #116 May 30 3:30 PM - 5:00 PM
Comparison of School Meal Patterns in High School Athletes and Non-Athletes
Alison M. Redd, Jeannette M. Garcia. UCF, Orlando, FL.

No relevant relationships reported

PURPOSE: To compare differences in school meal patterns and total (both interscholastic organized sports and leisure-time) physical activity among high school athletes and non-athletes. METHODS: A total of 308 high school students (16.04 ± 1.35 years old, 56.5% female, 59.4% Caucasian) completed a series of questionnaires regarding their consumption of meals provided at school (both breakfast and lunch), participation in their school’s free/reduced price meal program, and reasons for not consuming school meals. Additionally, questions regarding weekly duration and frequency of organized interscholastic sports practices and leisure-time physical activity were included. Due to skewed distribution, both non-parametric and parametric analyses were conducted to compare differences among male and female athletes and non-athletes. All analyses were conducted in SAS software version 9.4 with a significance level set at α < 0.05 software.

RESULTS: Out of the 308 participants, 56% of the sample (n=168, 51% female) participated in interscholastic sports, and 44% (n=136; 65% female) were classified as non-athletes. Student athletes participated in more overall weekly physical activity (p=0.00) compared to non-athletes. No differences existed between athletes and non-athletes regarding their consumption of either school breakfast (24.4% athletes vs 25.9% non-athletes, p=0.78) or lunch (52.3% athletes vs 45.6% non-athletes, p=0.24). Additionally, there were no differences between females (29%) and non-athletes (34.5%) regarding participation in the school free/reduced meal program (p=0.23). Qualitative feedback provided for avoiding consumption of school meals included students arriving to school without enough time to purchase breakfast before class, eating breakfast or lunch from home, and that school meals are not appetizing or healthy. CONCLUSIONS: School meals are consumed by student athletes; therefore the nutritional value of school meals should provide for the energy needs of student athletes as well as the general student population of non-athletes.

1961 Board #117 May 30 3:30 PM - 5:00 PM
Effects of Peer-Led Aerobic Training on the Physical and Psychological Health of Urban College Students
Olga G. Berwidi1, Galila Werber-Zion1, Gregory Klamaitis2, Yesenia M. Echevarria3, Ricky Melendez3, Alana I. Johnson3. 1York College, City University of New York, Jamaica, NY. 2Queens College, City University of New York, Flushing, NY. Email: olga.g.berwidi@gmail.com

No relevant relationships reported

PURPOSE: Mental health concerns, like anxiety and depression, are prevalent among college students (Blanco et al., 2008). Chronic moderate-intensity exercise has been shown to improve these difficulties (Morres et al., 2018). This study evaluated changes in physical and psychological health in ethnically-diverse urban undergraduate students after a 10-week peer-led aerobic training intervention. METHODS: Twenty-three sedentary undergraduate students (mean age = 21 ± 2.24 yrs) participated in a 10-week training program composed of one weekly peer-led aerobic exercise session and completed 2 additional sessions per week independently. One week prior to and following the training program, assessments of cardiovascular fitness, using the Rockport 1-mile walk test, anthropometric measures, and psychological health, using self-report measures from the NHI Toolbox and the Patient-Reported Outcomes Measurement Information System scales, were conducted. Paired-samples t-tests were used to assess pre-post program changes in these measures. RESULTS: Participants attended 8.3 ± 1.26 moderate-vigorous exercise sessions under the supervision of their peer-trainer and exercised independently 2.39 ± 1.95 d·wk⁻¹ for an average of 34.85 ± 19.62 min session⁻¹. Despite a significant progressive increase in intensity from the first 3 to the last 5 sessions (mean HR = 135.98 ± 16.98 and 150.15 ± 15.16, respectively; p < .001), no effect of aerobic training on cardiovascular fitness or other anthropometric measures were detected (all p > .10). Nevertheless, there were significant pre-post-program improvements on multiple measures of psychological functioning including perceived stress, positive affect, sadness, and emotional support (all p < .05). There were marginally significant trends towards improvement in measures of perceived recovery (p = 0.055), general life satisfaction (p = 0.062), and perceived hostility (p = 0.069). CONCLUSIONS: These preliminary findings are consistent with the literature indicating that moderate-intensity aerobic exercise improves psychological functioning. They support the further assessment of peer-mediated aerobic exercise to alleviate stress and improve quality of life in undergraduate students representing a diverse inner-city demographic.

1962 Board #118 May 30 3:30 PM - 5:00 PM
Relationship Between Duration and Quality of Sleep on College Student Health Behaviors and Outcomes
Anthony C. Rosso, Oliver W.A. Wilson, Zack Papalia, Michelle Duffy, Melissa Bopp, FACSM. The Pennsylvania State University, State College, PA. (Sponsor: Dr. Melissa Bopp, FACSM)
Email: acr5435@psu.edu

No relevant relationships reported

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), PA levels, FVC, and also responded to questions regarding mental health and sleep. Participants were grouped into those who reported ≥4 or ≤4 nights of restful sleep. (Data were analyzed using SPSS v.25.0).

RESULTS: Out of the 4380 participants responded to the sleep question, the majority of whom were women (59.2%) and non-Hispanic white (76.1%). For all participants, those who reported better sleep reported significantly higher moderate PA (p = .045), vigorous PA (p = .001), weekly MET-min (p < .001), and GPA (p < .001), whereas BMI (p = .627) and FVC (p = .107) did not differ between groups. When split by sex, the same results were revealed for women, but among men the only significant differences were in GPA (p < .042) and vigorous PA (p = .019). Those who reported better sleep also reported significantly less symptoms of depression regardless of sex (p < .001). CONCLUSION: A positive relationship between sleep and PA was found for women. In men, only vigorous PA was found to have a positive relationship with sleep. Though, a positive relationship between sleep and academic performance was evident for both sexes. In addition, better sleep was associated with better mental health regardless of sex. In summary, findings highlight the importance of more education on the importance of the relationship of sleep and better academic performance and mental health. Further research is required to examine the relationship, in particular directionality, between the amount PA and the duration of sleep in college students.

1963 Board #119 May 30 3:30 PM - 5:00 PM
Student Experiences in a Mandatory Healthy and Wellness Course, A Qualitative Investigation
Monica M. Maldari1, Michelle Scribner-MacLean2, David Rice3. 1University of Massachusetts Lowell, Lowell, MA. 2Florida Southern College, Lakeland, FL. Email: mmaldari1@fitchburgstate.edu

No relevant relationships reported

Research suggests that many undergraduates do not achieve the minimum recommended amounts of physical activity (PA). Furthermore, the relationship between college students’ attitudes towards PA and participation are unclear. PURPOSE: The purpose of this investigation was to qualitatively examine student experiences and attitudes about PA while enrolled in a conceptually-based, mandatory, health and fitness course. METHODS: Semi-structured interviews were performed individually.
with a subset of 10 (6 female, age 18-21-years, 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 studio environment and that this was unfamiliar to them. (2) Friend and Family Influence. 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 student’s PA motivation, 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.

1966 Board #122 May 30 3:30 PM - 5:00 PM Effects Of A Peer-led Aerobic Training Program On Physical Activity Behavior Of Urban College Students Galila Werber-Zion1, Olga G. Berwidi1, Gregory Klimaitis2, Ricky Meleno3, Lonnie M. Echiverri3, Johnathon1. 1York College, City University of New York, Jamaica, NY. 2Queens College, City University of New York, Queens, NY. Email: gwerber@york.cuny.edu

PURPOSE: Peer-based education is commonly used on college campuses to provide health information. Using it to introduce physical activity to ethnically-diverse sedentary students attending an urban commuter college has not been explored. We examined the impact of a 10-week peer-based aerobic-exercise (AE) training program on urban college students’ leisure physical activity behavior. METHODS: Inactive students (N = 23, mean age: 21 ± 2.24 yrs) participated in a 10-week program consisting of approximately 3 weekly AE sessions. Once-per-week sessions led by a peer-student trainer included a short lecture on exercise’s health benefits followed by 30 mins of AE (55%-65% HRR); participants were instructed to complete 2 other AE sessions independently per week and completed weekly online journals to assess adherence. Pre- and post-training evaluations of AE behavior patterns [International Physical Activity Questionnaire (IPAQ)] were conducted in the weeks prior to and following the exercise program and one month (30-IPAQ) and 90 days (90-IPAQ) after the conclusion of training. Descriptive statistics describing program participation and adherence are presented. Paired-samples t-tests were conducted comparing pre- and post-training cardiovascular fitness. RESULTS: Each week 19.1 ± 1.66 participants attended a peer-led session, training at THR of 142.61 ± 22.88. Participants completed an average of 1.126 sessions and were expected to exercise 10 hours post-expectation of exercise. 23.89 ± 1.95 d·wk⁻¹; 34.85 ± 19.62 min·session⁻¹ independently. Twenty (86.96%) participants completed the 90-IPAQ thus, students’ leisure physical activity analysis included only these 20 participants. Pre-IPAQ data demonstrated that 25% of participants engaged in leisure physical activity at a mean of 164 ± 120 MET-min·wk⁻¹. One month following the training period 60% of participants exercised at a mean of 434.38 ±395.76 MET-min·wk⁻¹; 90-IPAQ data demonstrated 55% of participants continued to engage in leisure physical activity at 488.73 ± 381.33 MET-min·wk⁻¹ on average. There was no significant effect of aerobic training on participants’ cardiovascular fitness level. CONCLUSION: Participation in a peer-led aerobic training program may serve as a gateway to adopting a low level of leisure physical activity by urban college students.

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MEDICINE & SCIENCE IN SPORTS & EXERCISE®

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., (FACSM) Email: hon1102suet@gmail.com

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 techniques 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 ± 8.4kg;) 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 Zeng,1 Susan L. Johnson,2 Richard E. Boles2, Laura L. Bellows1.1 Colorado State University, Fort Collins, CO. 2University of Colorado Anschutz Medical Campus, Aurora, CO.

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/preschool centers from 2010-2012, 109 children (57 girls, 36 Hispanic, Xₐge = 4.90 ±0.34 years, XₚA = 0.49±0.14) and their complete data were included in the study. Parents and children’s PA on weekdays and 2 weekends were assessed by accelerometers 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—2nd 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 < 0.05), PA (r < 0.09), and PA level (r = 0.23, p < 0.05). Multiple 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 BMI [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 > 0.05].
associated with higher SQ score (B=0.24, P=0.01) among males. Other health-related factors such as dietary habits and academic pressure also showed significant correlation with SQ. However, regarding the females, no significant correlation between PA and SQ was observed. Furthermore, after adjustment for the demographic variables and health-related factors, the results of binary logistic regression showed that males with insufficient PA had higher odds of poor SQ (OR=1.44, 95%CI=1.12-1.86, P=0.001) compared with the others.

CONCLUSION: Better SQ was related to higher PA level in male college students.

1968 Board #124
May 30 3:30 PM - 5:00 PM
Associations Between Physical Activity, Diet, And Substance Use With Academic Performance
Peter J. Matthews, Oliver W. A. Wilson, Zack Papalia, Michele Duffy, Melissa Bopp, FACSM, Pennsylvania State University, State College, PA. (Sponsor: Dr. Melissa Bopp, FACSM)
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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 3738 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 ± .41) meet FVC recommendations (p<.001). 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<.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, trend to have poor academic performance. This provides insight to students and campus health professionals regarding how their health behaviors may be affecting their GPA.

1969 Board #125
May 30 3:30 PM - 5:00 PM
Pilates Connect: A Program To Support The Transition Of Student-athletes To Lifetime Activity
Melinda B. Smith, Erin J. Reifsteck, Pam Kocher Brown, Diane L. Gill, FACSM. University of North Carolina at Greensboro, Greensboro, NC.
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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, & Labbahn, 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, 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 lifetime 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.

1970 Board #126
May 30 3:30 PM - 5:00 PM
Gunter Submission
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Email: evon.hilberg@oregonstate.edu

Purpose: To learn if different physical activity (PA) promotion approaches for boys compared to girls are needed in rural elementary school settings, we evaluated sex differences in total physical activity (TPA) and moderate-to-vigorous physical activity (MVPA) among 1st-5th graders attending six rural schools in Oregon. Methods: We assessed the PA levels of 1739 students (835 girls and 901 boys) over four consecutive school days using Walk4Life MVP pedometers in fall 2015. Devices were worn above the right hip for the duration of the school day (6.5 hours/day) and programmed to measure PA time at any intensity (i.e. no minimum requirement for step rates/min). Time spent in MVPA was evaluated using a pre-specified step rate (≥120 steps/min). Teachers distributed and collected devices daily, recorded wear time, and reported daily classroom schedules (e.g. time for recess, lunch, etc.). At the end of the day, data were downloaded, screened for outliers (daily step counts <500 or >15000, incorrect MVPA settings) and adjusted for transport time. Linear mixed effects models were used to assess relationships between TPA and MVPA, and child sex and grade level. To examine the school and teacher influence, we utilized teachers nested within schools as 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 TPA and MVPA accrued throughout the school day (p <0.001). Boys accrued more TPA and MVPA than girls, and younger children accrued more TPA and MVPA than older children (p<0.001). There was a significant grade by sex interaction. Specifically, for both MVPA and TPA, girls in 2nd through 4th 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 TPA and MVPA during school hours.

Conclusions: Physical activity levels at school declined for all students from 1st through 5th grade. Girls in 2nd through 4th grades exhibited lower TPA and MVPA 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.

1971 Board #127
May 30 3:30 PM - 5:00 PM
Effect Of 10-week Flag Football Intervention On Physical Activity Of Overweight And Obesity Children
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Email: zhuangjie@sus.edu.cn

Purpose: To investigate 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 female) 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 used to examine differences in physical activity (PA) levels in elementary school children attending six rural schools in Oregon. Results: Analyses were done on data from 577 boys and 552 girls. There were significant sex and grade-level differences in the volume of TPA and MVPA accrued throughout the school day (p <0.001). Boys accrued more TPA and MVPA than girls, and younger children accrued more TPA and MVPA than older children (p<0.001). There was a significant grade by sex interaction. Specifically, for both MVPA and TPA, girls in 2nd through 4th 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 TPA and MVPA during school hours.

Conclusions: Physical activity levels at school declined for all students from 1st through 5th grade. Girls in 2nd through 4th grades exhibited lower TPA and MVPA 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.

Abstracts were prepared by the authors and printed as submitted.
Table 1 Group differences in weekday PA levels (min/d)

<table>
<thead>
<tr>
<th>PA</th>
<th>Intervention (n=24)</th>
<th>Control (n=24)</th>
<th>F</th>
<th>p</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST Pre</td>
<td>565.47±79.85</td>
<td>556.49±68.70</td>
<td>1.80</td>
<td>0.04</td>
<td>0.19</td>
</tr>
<tr>
<td>Post</td>
<td>497.0±59.81*</td>
<td>529.2±110.51</td>
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<td></td>
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</tr>
<tr>
<td>LPA Pre</td>
<td>199.5±28.91</td>
<td>181.5±48.38</td>
<td>0.82</td>
<td>0.07</td>
<td>0.37</td>
</tr>
<tr>
<td>Post</td>
<td>182.2±36.35</td>
<td>177.1±44.34</td>
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<tr>
<td>MPA Pre</td>
<td>30.48±9.57</td>
<td>26.98±9.19</td>
<td>0.85</td>
<td>0.07</td>
<td>0.36</td>
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<tr>
<td>Post</td>
<td>27.65±8.79</td>
<td>27.12±9.84</td>
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</tr>
<tr>
<td>VPA Pre</td>
<td>16.23±5.10</td>
<td>15.56±6.74</td>
<td>1.35</td>
<td>0.07</td>
<td>0.251</td>
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<tr>
<td>Post</td>
<td>14.74±7.85</td>
<td>15.66±7.30</td>
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</tr>
<tr>
<td>MVPA Pre</td>
<td>46.72±11.84</td>
<td>42.54±13.73</td>
<td>1.41</td>
<td>0.07</td>
<td>0.239</td>
</tr>
<tr>
<td>Post</td>
<td>42.39±14.69</td>
<td>42.78±15.35</td>
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<td></td>
</tr>
</tbody>
</table>

1972 Board #128 May 30 3:30 PM - 5:00 PM
The Effect Of Extracurricular Physical Activities In The Development Of Coordination Of Children Aged 7 To 9 Yearsold
Yunsai Chen1, Ming Yang1, Jingdong Chang2. 1Southwest University, Chongqing, China. 2The Branch of the Collaborative Innovation Center of Assessment toward Basic Education Quality at Southwest University, Chongqing, China.
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PURPOSE: The purpose of this study was to assess the effects of extracurricular physical activities on the physical coordination in children aged 7-9 years.

METHODS: A sample of 120 children aged 7-9 years (52% boys) was enrolled for a 12-week experimental intervention study. The sample was divided into an experimental group (58 children) and control group (62 children) by random number method. The experimental group participated in extracurricular intervention courses twice a week for 1 hour. The content of the course was mainly game, medium exercise intensity. The control group did not participate in the extracurricular exercise. The “Chinese Children Coordination Test” (CCCT) developed by the project team was used to conduct the coordination test before and after the experiment. The raw data was standardized and compared according to age and gender.

RESULTS: After 12 weeks of extracurricular intervention, the results showed that the scores of the experimental group in the transfer coordination (t=2.89, p<0.05), click-to-click (t=2.76, p<0.05), climbing obstacles (t=4.47, p<0.05), and rolling skills (t=3.81, p<0.05) were significantly higher than the control group. The experimental group showed significant improvement in the standardized comprehensive score.

CONCLUSION: Extracurricular physical activity intervention could significantly improve the coordination ability of children, and the density of extracurricular physical activities should be strengthened in this age group.

1973 Board #129 May 30 3:30 PM - 5:00 PM
Effects of Eight-Week Fundamental Motor Skills Intervention on Children’s Physical and Cognitive Health Outcomes
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Globally, 80.3% of school-aged children do not engage in the recommended 60 minutes of daily moderate-to-vigorous physical activity (MVPA); Hallal et al., 2012. Motor skill competence is fundamental to a child’s physical activity and cognitive development (Stoddern et al., 2008), and thus may explain the lack of MVPA engagement among children.

Purpose: This study aimed to examine the effects of a fundamental motor skills (FMS) intervention program on physical and cognitive health outcomes among elementary children.

Methods: Participants were 31 K-2 students (19 girls, 12 boys; Mage = 6.65) from three public elementary schools in the southwestern U.S. They were randomly assigned to either the intervention (1 school, n = 20) or the control group (2 schools, n = 11). During two separate 8-week periods in 2017 and 2018, children in the intervention group (13 girls, 7 boys) joined the FMS intervention for three times per week (60 minutes each time), while children in the control group (6 girls, 5 boys) followed a traditional afterschool program (e.g., 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 (PedoQOL; 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 < 0.01, partial η² = 0.72. Follow-up univariate tests for the group × time effect indicated significant differences (p < 0.05) in locomotor skills (intervention: M₁ = 25.4 vs. control: M₂ = 37.98, d=8.31; control: M₁ = 29.73 vs. M₂ = 30.32, d=0.25), object-control skills (intervention: M₁ = 24.68 vs. control: M₂ = 39.78, d=7.07; control: M₁ = 27.05 vs. M₂ = 27.59, d=0.19), and MVPA (intervention: M₁ = 143.62 vs control: M₂ = 170.06, d=2.54; control: M₁ = 166.24 vs. M₂ = 155.17, d=0.79), but not in cognitive function (p > 0.05).

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.

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. Rauber, Carmen S. Campbell. Universidade Católica de Brasília, Águas Claras, Brazil.
(No relevant relationships reported)

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 obesity 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 41.3 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 obesity children.

1975 Board #131 May 30 3:30 PM - 5:00 PM
Introducing Physically Active Lessons in a UK Secondary School: A Pilot Cluster-Randomised Controlled Trial
Catherine Gammon1, Katie Morton1, Andrew J. Atkin2, Kirsten Corder1, Andy Daly-Smith3, Thomas Quarmby1, Marc Suhrecker2, David Turner2, Esther van Sluijs1, 1University of Cambridge, Cambridge, United Kingdom. 2University of East Anglia, Norwich, United Kingdom. 3Leeds Beckett University, Leeds, United Kingdom.
Email: cgammon1@emich.edu (No relevant relationships reported)

PURPOSE: Assess 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, e.g., 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/
week. Of the pupils who recoded being in a PAL (58%), >90% wanted teachers to continue teaching PAL. Delivering the training cost $901 ($45 staff time, $450 equipment). Change in students’ sedentary time (95% CI: -1.3, 3.1, R2 = 0.13) & 1.3(-6.2,8.7) minutes at control & intervention schools, respectively. CONCLUSION: As most PAL evaluations focus on primary schools, this study makes a valuable contribution to the literature. Delivering PAL training to teachers was feasible, and delivering & participating in PAL was acceptable for teachers & students. However, low acceptability of PAL training & no evidence of effectiveness on student outcomes indicate the need to review the training. Receiving 6-7, 60 minute PAL/week has the potential to reduce adolescent’s sedentary time, although the amount of activity introduced by PAL requires review. Results do not support PAL implementation or progression to a full trial with the current program. Further research could explore if different PAL training elicits more promising results.

1976 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, FACSFM. 1CSU Fresno, Fresno, CA. 2San Diego State University, San Diego, CA.
Email: njsmith@csufresno.edu
(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 Instruction 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 included a total of 800 distinct records (233 U.S., 567 non-U.S.) and a total of 305 full-texts (137 U.S.; 168 non-U.S.) for eligibility. Studies were selected if they (a) were published in English in peer review journals; (b) used the standard SOFIT protocol; and (c) assessed physical education in preK-12 schools. RESULTS: Fifty-eight studies met the inclusion criterion, including 29 in the U.S. and 29 in other countries. U.S. studies included nearly five times more lessons than non-U.S. lessons (3,174 vs 628 lessons). Of the 626 lessons conducted in non-U.S. schools, 30% of lessons were recorded within lesson contexts. There was substantial diversity both within and among studies in the allocation of time to different contexts. Less than 30% of lessons at 30% of studies assessed MVPA% within lesson contexts. CONCLUSIONS: SOFIT has been reliably used to assess physical education internationally since 1991. There was substantial diversity in study characteristics and how data were analyzed and reported. Increased consistency in implementing the SOFIT protocol and the reporting of data could improve the generalizability of results and provide a clearer worldwide picture of the conduct of physical education.

1977 Board #133 May 30 3:30 PM - 5:00 PM Accumulating 10,000 Steps/Day Using a Wristband Activity Monitor May Not Meet Step Guidelines.
Laramy S. Millen, Joshua P. Muench, Gavin Connolly, Kristina Hasanaj, Rachael K. Nelson. Central Michigan University, Mt Pleasant, MI
Email: millenc1lcs@cmich.edu
(No relevant relationships reported)

Physical activity (PA) guidelines aimed at accumulating 10,000 steps/day through exercise (EX) and activities of daily living (ADL) has become increasingly common with the advent of wristband PA monitors. Yet, accumulated “steps” with wristband PA monitors may not equal validated pedometers. Consequently, there is a need for evaluating and developing guidelines for step counts using wristband PA monitors for the general population. PURPOSE: To compare pedometer and wristband PA monitor steps accumulated through EX and ADL designed to mimic real world behavior using a diverse participant population. METHODS: 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 pedal 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 in 309,000 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 pedometer steps, P<0.01). CONCLUSION: In order to achieve to the equivalent of 10,000 pedometer steps using a wristband activity monitor users should strive for closer to ~1,500 “steps” per day.

1978 Board #134 May 30 3:30 PM - 5:00 PM Effects of Three Regular Activity Breaks on Postprandial Triglyceride Response in Healthy Young Adults
Sheng-Xia Ma, Xiao-Mei Liu, Yan-Yu Lin, Li-Qiong Ma, Sheng Zhao, Zheng Zhu, Zhen-Bo Cao. Shanghai University of Sport, Shanghai, China.
Email: msx-276@163.com
(No relevant relationships reported)

PURPOSE: To determine whether interrupting prolonged sitting with three kinds of regular walking activity breaks has an immediate or delayed effect on postprandial triglyceride response.

METHODS: In a randomized crossover trial, 16 inactive healthy adults (7 men, aged 21-30 years) completed four 26-h (from 8:00 AM on day 1 to 10:00 AM on day 2) laboratory conditions. Except for the 9-h intervention phase, the same procedure was used in the following four trials: (1) 9-h prolonged sitting (SIT); (2), (3), and (4) sitting with 3, 5, and 8 minutes of brisk walking (60% VO2max) every 35, 50, and 70 minutes, respectively (WALK3, WALK5, and WALK8). Postprandial serum triglyceride (TG) and nonesterified fatty acid (NEFA) were measured for 2-h dinner immediately on day 1 and for 2-h breakfast on day 2. Meals and meal times were standardized across the conditions for all the participants.

RESULTS: Compared with SIT, only WALK8 significantly attenuated 2-h breakfast postprandial triglyceride total area under the curve (IAUC, SIT: median [Q1, Q2], 2.12 mmol h·L-1 [1.46, 3.67] vs WALK8: 2.01 [1.25, 3.30] P = 0.041). The IAUC for 2-h dinner postprandial triglyceride and for both 2-h dinner and breakfast postprandial NEFA were not significantly changed in the three-activity break conditions. However, compared with SIT, the three-activity break conditions significantly increased the pre-dinner NEFA concentrations on day 1 (WALK3 52%, WALK5 36%, and WALK8 75%, all p < 0.05), but only WALK8 increased the fasting NEFA concentration on day 2 (25%; p < 0.05). No significant differences across the above-mentioned indicators were found among the three-activity break conditions.

CONCLUSIONS: The 8-min brief bouts every 70 min attenuated the postprandial triglyceride response measured about 24 h after, not immediately after, the intervention phase. Supported by the Shanghai Science and Technology Committee (No. 16080503300).

1979 Board #135 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: doctorquijada@gmail.com
(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
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 (42%), 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 (WHO, 2008), only 56% of physicians do not incorporate 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 recommendation, the prescription pattern in clinical practice, and the practice of PA itself among doctors.

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**1980 Board #136 May 30 3:30 PM - 5:00 PM**

Large vs Small Skeletal Muscle Mass Training: a Pilot Study on Solid Organ Transplanted Recipients

Alessio del Torto1, Roberto Peressutti1, Umberto Baccarani2, Adriana De Silvestre3, Amici Giampaolo4, Stefano Lazzer1.

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(No relevant relationships reported)

Kidney (KTR) and liver (LTR) transplanted recipients suffer from a reduced exercise capacity (V'O2peak) and performance. Several studies pointed out the skeletal muscle atrophy as the main responsible for the low peak work rate (WRpeak) and reduced V'O2peak in KTR and LTR, rather than the central factors (e.g. maximal O2 delivery) (Williams et al., 1981). 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 induce the development of higher V'O2peak and WRpeak than 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±14.8 yrs; BMI 25±3.0) and DLC (n=4; age 58.5±0.7 yrs; time post transplant 4.3±1.5 yrs; BMI 26±3.2) 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 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 in prescribed PA was 12.83±1.4 years. Given the MPS for the daughters was (mean ± sd) 13.13 ± 1.1 years (minimum-maximum ~ 11.2-16.7 years). At the follow-up, the recalled age at menarche was 13.11 ± 1.4 years (minimum-maximum ~ 10.2-18.0 years). For the 25 participants who had both MPS and follow-up data for age at menarche, the correlation was positive and strong: r = 0.75, p < 0.001. A moderate positive relationship between mothers’ and daughters’ ages at menarche was also found, r = 0.39, p< 0.001. Mothers reported a slightly younger mean age at menarche than their daughters (12.83 ± 1.4 years).

**Discussion:** Many studies have examined the accuracy of recalled age at menarche, with the relationship between actual and recalled age at menarche ranging from r = 0.70-0.81. Results from this small sample showed that MPS participants remembered their ages at menarche with similar reliability. Given that the original results were based on the recall from their mothers, the agreement between the two recalls is particularly noteworthy. The current sample is consistent with previous work which found a significant correlation of r = 0.25 between mothers’ and daughters’ ages at menarche.

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**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

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(No relevant relationships reported)

Physical inactivity 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 (1-1.99 METs), and moderate- to vigorous-intensity (3.0-7.0 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 IntrMAT 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 IntrMAT content only, skeletal muscle size and moderate-to- vigorous-intensity physical activity time could be a major determinant of IntrMAT content in young men.

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**1983 Board #139 May 30 3:30 PM - 5:00 PM**

Association Between BMI And Health Perceptions In Preservice Teachers

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(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
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]) in both men and women. The strongest predictor of %BF was STEPS·kgFM\(^{-1}\)·day\(^{-1}\) for men (R\(^2\) = 0.91), and 820.25(STEPS·kgFM\(^{-1}\)·day\(^{-1}\)) in women (R\(^2\) = 0.82). **CONCLUSIONS:** Physical activity expressed per unit of FM strongly predicted %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 by indirect calorimetry with K5, gas analyser throughout the entire session. Heart Jump (SJ), performing 5 sets for each set. The energy expenditure was determined with 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. Since they are replicable, such findings encourage 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.
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 kg (9 ± 4%), BMI by 3 ± 1 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 HL096782 and King Charitable Foundation Trust.

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 sagittal plane 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) behaviours 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 used 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 prior 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
4%, 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 = .981) and running pace (compared to peers their age and sex) (ρ = -0.384, p = .019). There was a significant difference in age at walking onset between the groups (U = 231.0, p = .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.

1989 Board #145 May 30 3:30 PM - 5:00 PM
Overall Mortality, Survival, And Causes Of Death In Former US Olympians
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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 (0.5 to 1.1); 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 >6.0 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 3.39% 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.

1991 Board #147 May 30 3:30 PM - 5:00 PM
Modernization of a Developing Country: Effect on Body Mass Index
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(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.
Given the host of deleterious consequences precipitated by poor body composition, it may be helpful to isolate specific factors that predict the largest elevations in BMI. Uganda is an appropriate location to evaluate this. Over the past 4 years, the percentage of women classified as overweight or obese increased from 16% to 24%; men increased from 4% to 9%. During this time, PA underwent considerable change while nutrition was relatively stable. PURPOSE: To evaluate the impact of modernization on BMI in Uganda. METHODS: We analyzed the 2016 Demographic and Health Surveys of Uganda. Household-level BMI was regressed on 11,577 subjects met inclusion criteria. We conducted descriptive statistics to characterize this population, linear regression to examine the effect of modernization on BMI, and logistic regression to test these effects on the odds of overweight (BMI ≥ 25) or obesity (BMI ≥ 30). RESULTS: Mean age was 28.7 ± 10.2 yr; BMI was 22.0 ± 3.7; 16.0% of subjects were either overweight (n=1,405) or obese (n=440). More subjects owned a bicycle (40.6%) than a motorcycle (12.6%) or car (4.3%); more subjects owned mobile phones (72.7%) than computers (4.3%); 28.8% of households had electricity and 16.2% had television. Linear regression (R²=0.16; p=0.001) found BMI to be increased when a household had a refrigerator (β=0.483; p=0.004), electricity (β=0.400; p=0.001) and television (β=0.961; p=0.001). Additionally, ownership of a car (β=0.421; p=0.016) and a land-line phone (β=0.625; p<0.001) predicted increases in BMI, while ownership of a bicycle (β=0.330; p<0.001) and a land-line phone (β=0.657; p=0.034) predicted decreases in BMI. Logistic regression (pseudo R²=0.21; p<0.001) found the odds of being overweight (β=0.961; p<0.001) and a land-line phone (β=0.625; p<0.001) predicted increases in BMI, while ownership of a bicycle (β=0.330; p<0.001) and a land-line phone (β=0.657; p=0.034) predicted decreases in BMI. Logistic regression (pseudo R²=0.21; p<0.001) found the odds of being overweight or obese increased when a household had electricity (79.0%; p<0.001) and television (107.0%; p=0.002). Additionally, ownership of an automobile (41.0%; p=0.002) predicted more than a mobile phone (14.3%; p=0.001) increased the odds of being overweight or obese (78.7%) compared to those gaining 5-9 lbs. (referent). A similar relationship was not revealed for other weight gain ranges: 5-9lbs. (OR=0.84; 95% CI=0.62-1.14), 10-14lbs. (OR=0.90; 95% CI=0.70-1.15), 15-19lbs. (OR=0.93; 95% CI=0.66-1.31). CONCLUSION: Findings revealed that weight gain of 20lbs. or more resulted in significantly greater odds of a PHQ-9 score indicative of depression.

1993 Board #149 May 30 3:30 PM - 5:00 PM Relationship Between Weight History and Depression in U.S. Adults
Larry Guevara, Michael R. Richardson, Robert J. Zeglin, Christopher J. Joyce, Bethany G. Rand, Michelle L. Stone, Tammie M. Johnson, James R. Churilla, FACSM. University of North Florida, Jacksonville, FL. (No relevant relationships reported)

PURPOSE: Explore the relationship between changes in weight over time and subsequent depression status using a nationally representative sample of U.S. adults.

METHODS: The study sample (n=20,305) included male and female adults (≥36 years of age) who participated in the 2007-2016 National Health and Nutrition Examination Survey. Weight history examined fluctuations of weight, mainly gain in weight, from self-reported current weight and self-reported weight 10 years ago. Depression status was assessed using the PHQ-9 using cut points to assign a depression score. Logistic regression analysis was utilized to examine odds of depression across ranges of weight gain. RESULTS: Overall prevalence of depression among U.S. adults aged 36 years and older was found to be at 7.5% (95% Confidence Interval [CI] 6.9-8.2). Following adjustment for gender, race, education, smoking, and physical activity, those who had gained 10+ lbs. had significantly greater odds of having depression (OR 1.45; 95% CI, 1.26-1.67) compared to those gaining <5 lbs. (referent). A similar relationship was not revealed for other weight gain ranges: 5-9lbs. (OR=0.84; 95% CI=0.62-1.14), 10-14lbs. (OR=0.90; 95% CI=0.70-1.15), 15-19lbs. (OR=0.93; 95% CI=0.66-1.31). 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.

1998  Board #154  May 30 3:30 PM - 5:00 PM  
**The Downfall of Sitting: The Relationship between Sedentary Time and Blood Pressure**  
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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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No relevant relationships reported

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 InBody 770 biostatistical 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=0.33, 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=0.03) 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
of age and sex, with the association of trunk fat thickness after accounting for MVPA. CONCLUSIONS: Our findings suggest self-reported sedentary behavior is independently associated with the accumulation of excess total body fat, visceral fat, and fat within the trunk and legs in middle to older-aged adults. However, the association between sedentary behavior and visceral fat is attenuated by MVPA, indicating MVPA may be important for preventing the accumulation of visceral fat. Our findings also suggest total sedentary behavior is more strongly associated with regional fat deposition than screen time in this sample.

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 undergraduate students; 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. The thirty-four outliers were removed prior to any further analyses (n=217; 21.1±2.7 yrs; 145 females, 141 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 MVPA between sex and major. Alpha was adjusted using the Bonferroni method, and only significant correlations are discussed. 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 MVPA. Females had greater RFK than males (4.6±1.6 vs. 4.0±1.6, p<0.001). HB majors had significantly higher TK (18.4±5.0 vs. 15.3±5.3, p<0.001), DK (17.1±1.7 vs. 31.1±9.9, p<0.001), TEK (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<0.001) than NHB majors. There were no significant differences in SK between majors (p>0.05). Males reported significantly higher levels of MVPA than females (2300.7±2377.7 vs. 1441.9±1348.6 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 unknown 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 bioelectrical impedance analysis (BIA) in a large cohort of college aged males and women.

**METHODS:** 3804 male and female students completed an online survey, which included a physical 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 and women (r=0.74, p<0.001) and women (r=0.83, p<0.001), and RFM for men (r=0.85, p<0.001) and women (r=0.83, 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 (5%BF ≥576.5±p<0.001; RFM ≥118.9, p<0.001). For women, comparing BF% vs. BMI and RFM vs. BMI, more women who were obese via %BF and RFM were classified as normal via BMI (5%BF ≥576.5±p<0.001; RFM ≥108.0, p<0.001). Comparing RFM and BF%, more men and women classified as obese by RFM were considered normal by %BF (χ²=626, 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 EMTs 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) METMin/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 METMin/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 vaporing 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 accelerometry data (24 days with ≥10 hours, reported job and job duties, and were not currently a student (n=2,050). Uniaxial accelerometry data (ActiGraph 7164), 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 differences.
difference across occupational categories. Building/grounds maintenance had the highest CPR while office and admin support had the lowest. Architecture/engineering had the highest CPR while food preparation had the lowest. Food preparation had the most LPA and legal had the least. Construction had the highest MVPa while healthcare 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 CPR, Sed, LPA, and MVPa

<table>
<thead>
<tr>
<th>Least favorable 3 categories</th>
<th>Most favorable 3 categories</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Sed</td>
<td>CPR</td>
<td>0.01</td>
</tr>
<tr>
<td>Sed</td>
<td>MVPa</td>
<td>0.01</td>
</tr>
<tr>
<td>Sed</td>
<td>LPA</td>
<td>0.01</td>
</tr>
<tr>
<td>Sed</td>
<td>Office and Administrative Support</td>
<td>0.01</td>
</tr>
<tr>
<td>Sed</td>
<td>Healthcare Support</td>
<td>0.01</td>
</tr>
<tr>
<td>Summary</td>
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<tr>
<td>CPR</td>
<td>52.1 ± 2.1</td>
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</tr>
<tr>
<td>Sed</td>
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<td>Sed</td>
<td>64.0 ± 1.4</td>
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<td>Sed</td>
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</tbody>
</table>

2004 Board #160 May 30 3:30 PM - 5:00 PM Association Between Cardiorespiratory Fitness and Continuous Cardiometabolic Syndrome Risk Score in Korean Men

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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 (>38.1 ml.kg.min⁻¹) vs. the lowest quartiles of peak oxygen uptake (<31.8 ml.kg.min⁻¹) 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 < 0.002). CONCLUSION: There was an association 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 Effects Of Exercise Systolic Blood Pressure Response On The Risk Of Sudden Cardiac Death In Men With And Without A History Of Cardiovascular Disease

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PURPOSE: Although exercise systolic blood pressure (ESBP) response has been associated with cardiovascular disease, it remains uncertain 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 with (n=884) and without (n=1,526) 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 mm Hg 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 trend 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).

2006 Board #162 May 30 3:30 PM - 5:00 PM Moderators Of The Relationship Between Worksite Walkability And Physical Activity

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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 = 512, 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 (TPout)) the home neighborhood, NPQA) 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 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 TPout. For women, the conditional effect of WNW on MVPA was positive (p = .04) while the conditional effect of WNW on SLPA was negative (p = .01); not different from zero for those with at least 1 child. For White participants, the conditional effect of WNW on TPout 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 work environments in mostly expected directions. An undersampled 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

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PURPOSE: To investigate the association of leisure time PA and back pain in adults from the Brazilian National Health System (NHS).

METHODS: 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 12 months, employed (not at home) during the baseline phase of a larger trial. Measures included accelerometer (PA).

Methods: Participants (n = 512, 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 (TPout)) the home neighborhood, NPQA) 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 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 TPout. For women, the conditional effect of WNW on MVPA was positive (p = .04) while the conditional effect of WNW on SLPA was negative (p = .01); not different from zero for those with at least 1 child. For White participants, the conditional effect of WNW on TPout 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 work environments in mostly expected directions. An undersampled aspect of behavioral ecological models is identifying who is sensitive to the environmental conditions that can bolster health promotion efforts.
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 risk of misclassification when BMI is calculated based on reported height and weight as compared to the measured height and weight for BMI calculation.

**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 a health questionnaire without knowing that they would be subsequently measured in an anthropometric scale (Welmy-RI W200). Both m-BMI and r-BMI were calculated as their point value and 95% interval of confidence (95%IC).

**RESULTS:** Agreement indices are shown on Figure 1. When the 29.0 kg/m² alternative cut-off point was also tested. Agreement analyses was done considering m-BMI as reference, using following indices: 1) total agreement (TA) as the sum of true positive and true negative values (TA=TP+TN); 2) sensitivity = TP/(TP+FN) x 100; specificity = TN/(TN+FP) x 100. All indices were calculated as their point value and 95% interval of confidence (95%IC).

**CONCLUSION:** Our study results showed that r-BMI is a highly specific method to exclude obesity. Among men, the accuracy of r-BMI to identify obesity among women was lower than among men, probably affected by its lower prevalence. Using the 29.0 kg/m² alternative cut-off point for women resulted on a sensitivity as good as in men. r-BMI also showed to be a highly specific method to exclude obesity.

![Figure 1. Agreement between measurement BMI (kg/m²) and reported BMI in Brazilian civil servants (n=398)](image-url)
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 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.

**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 higher values in comparison to NT (1.04±0.08; 1.53±0.09).

**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.

**Purpose of study:** A high-protein diet of 35% IWP in combination with RT improved blood parameters in rats.

**Methods:** Thirty-two 45-day-old male Wistar rats were divided into four groups (n=8/group): normal protein diet (14% IWP) sedentary (NS) and trained (NT); high-protein diet (35% IWP) sedentary (NS) and trained (RT). 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. Quadriecps (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) 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 β-hydroxybutyrate, as well as hematological parameters. Levels of HDL-c were higher in HT (104.4±26.0) and HS (100.7±21.2) compared to NS (73.9±15.7) and NT (60.8±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=5.09±0.02, P=0.0004) and heart (HS=3.02±0.02 > NS=2.82±0.02, NT=2.78±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 a higher values compared 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.

**Satiating Effect Of High Protein Diets On Resistance-trained Individuals In Energy Deficit.**

**Purpose of study:** Short-term energy deficit strategies are employed by weight class and physique athletes to enhance strength/body-mass and body composition during training or prior to competition. During such phases, athletes consume very high protein intakes to maximise satiety, maintain calorie deficit and minimise lean muscle losses despite

**Methods:** Twenty healthy, male adults (age: 21±1 y) performed a single session of resistance-type exercise followed by water intake of both legs for 20 min. One leg was immersed in cold water (8°C C), while the other leg was immersed in thermoneutral water (30°C C). After water immersion, a beverage was ingested containing 20 g intrinsically L-[1-13C]-phenylalanine and L-[1-13C]-leucine labelled milk protein with 45 g of carbohydrates. In addition, primed continuous L-[ring-2H5]-phenylalanine and L-[1-13C]-leucine infusions were applied, with frequent collection of blood samples and muscle biopsies to assess myofibrillar protein synthesis rates in vivo over a 5-h recovery period. In addition, deuterated water (2H2O) was ingested with the collection of saliva, blood and muscle biopsies over 2 weeks to assess the effects of post-exercise cooling with protein intake on myofibrillar protein synthesis rates during more prolonged resistance-type exercise training.

**Results:** Incorporation of dietary protein-derived L-[1-13C]-phenylalanine into myofibrillar protein was significantly lower in CWI compared to CON (0.16±0.002 vs 0.021±0.002 MIE; P=0.016). Post-exercise myofibrillar protein synthesis rates were lower in CWI compared to CON based upon L-[1-13C]-leucine (0.03±0.03 vs 0.072±0.055% h-1, respectively; P=0.024) and L-[ring-2H5]-phenylalanine (0.042±0.003 vs 0.053±0.004% h-1, respectively; P=0.025). Daily myofibrillar protein synthesis rates assessed over 2 weeks were significantly lower in CWI when compared to CON (1.48±0.05 vs 1.67±0.11% d-1, respectively; P=0.042).

**Conclusion:** Cold-water immersion during recovery from resistance-type exercise may impair myofibrillar protein synthesis rates.
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:** Forty-one university athletes (16 resistance-trained participants, age 28±2 years; height: 1.72±0.03m; body-mass: 88.8±3.5kgkg; 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, 120mins) for assessment of plasma ghrelin and protein YY concentrations to a fixed-protein (0.7g/kg) meal, along with perceived satiety ratings, following each diet.

**RESULTS:** Following PROmod, 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 PROhigh (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 normalized for relative change (PROmod : -0.40±0.06, PROhigh: -0.26±0.06; p<0.015). YYY concentrations (pg·ml⁻¹) increased post-meal across time-points (PROmod: 84.9±9.8 to 147.1±11.9 and PROhigh: 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: PROmod does not confer additional satiating benefits in resistance-trained 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.

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**PURPOSE:** The acute effect of the order of resistance exercise and nutrient intake on muscle damage and inflammatory markers in male college students.

**METHODS:** Eighteen healthy college students were divided into control group (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 exercise protocol. Muscle soreness (VAS), creatine kinase (CK), C-reactive protein (CRP) and interleukin (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<.05), and the increase of serum CK (MB) is suppressed with acute RE and proper nutrient (amino acid + carbohydrate), including 4-week wash-out. Venous samples were collected (time-points T0, 60, 120mins) for assessment of plasma ghrelin and protein YY concentrations to a fixed-protein (0.7g/kg) meal, along with perceived satiety ratings, following each diet.

**RESULTS:** Following PROmod, 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 PROhigh (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 normalized for relative change (PROmod : -0.40±0.06, PROhigh: -0.26±0.06; p<0.015). YYY concentrations (pg·ml⁻¹) increased post-meal across time-points (PROmod: 84.9±9.8 to 147.1±11.9 and PROhigh: 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: PROmod does not confer additional satiating benefits in resistance-trained 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.

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**PURPOSE:** The ideal amount of protein intake for endurance athletes has been poorly investigated. The aim of our study was to evaluate the physiological impact of different dietary protein intakes on body composition and performance outcomes in a group of elite cyclists. 

**METHODS:** Thirty-four elite cyclists (1600-1800 km/month) participated to the study. Subjects were divided in 4 groups with different levels of protein intake: normal (NP, 1.2 g/kg), moderate (MP, 1.6 g/kg), high (HP, 2.0 g/kg) or very high (VHP, 2.4 g/kg) protein. In the diets fats were maintained constant whilst energy from carbohydrate and protein was modified to maintain an isocaloric diet. Body composition was assessed via Dual X Ray Absorptiometry (DXA) and via ultrasound to calculate cross sectional area (CSA) of the anterior thigh. VO₂max, peak power output and 1 RM half squat test were also performed.

**RESULTS:** After two months both HP and VHP showed a significant improvement of 1 RM (HP pre 133±14 Kg vs post 141±12 Kg, p<0.001; VHP pre 137±12 Kg vs post 144±11 Kg, p<0.001), PPO (HP pre 505±78 W vs post 534±67 W, p<0.001; VHP pre 512±55 W vs post 541±76 W, p<0.001), and VO₂max (HP pre 62.1±5.8 mlO₂/Kg vs post 65.2±5.4 mlO₂/Kg, p<0.001; VHP pre 61.2±5.5 mlO₂/Kg vs post 64.1±7.6 mlO₂/Kg, p<0.001), without differences between groups. There were no significant changes of 1 RM and VO₂max for both NP and MP whilst NP showed a significant decrease of PPO. Both HP and VHP showed a significant increase of lean body mass (LBM) (HP pre 64.7±2.9 Kg vs post 65.9±2.2 Kg, p<0.001; VHP pre 65.2±2.0 Kg vs post 67.6±1.7 Kg) whilst both NP and MP showed a significant decrease (NP 63.3±1.2 Kg vs post 62.4±2.3, p<0.05; MP 66.8±1.8 Kg vs post 65.8±2.9). HP and VHP showed a significant increase of anterior thigh CSA (HP pre 50.5±7.8 cm² vs post 53.4±6.7 cm², p<0.001; VHP pre 51.2±5.5 cm² vs post 54.1±7.6 cm²). No changes of blood values were detected.

**CONCLUSIONS:** Our data suggest that an higher protein intake (2.0 and 2.4 g/kg) may help elite cyclists to improve performance and to increase muscle mass without differences between the two levels of protein intake. Instead 1.2 and 1.6 g/kg of protein seemed to be not sufficient and could impair performance and muscle mass.

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**PURPOSE:** The aim of this study was to investigate the potential role 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-MI concentrations were measured, and 3-MI 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-MI 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-MI. 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 15K03358).
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 ≥20 and ≥0.3 g/kg. Next, we calculated the number of meals that achieved these thresholds and were grouped as ≤1, 2, 3, ≥4 meals for each criterion. Then, 1RM was compared between groups with and without adjustment for covariables (age [years], lean body mass [kg, bioelectrical impedance], height [cm], sex, relative protein intake [g/kg/d]) for each criterion. RESULTS: For ≥2 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 covariables (age [years], lean body mass [kg, bioelectrical impedance], height [cm], sex, relative protein intake [g/kg/d]) for each criterion. 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 female adults. METHODS Thirty-three self-reported inactive (<150min exercise/wk) female vegetarians and vegans (31±9.6; n=23 vegan) of at least 1 year were recruited for this study. A 24h 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±4.67 kg) compared to vegetarians (23.5±2.9 kg), (2.046)<p<0.050, and no difference in protein intake between groups (t=.368)<p>.716. 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)=.118, n=33, p=.020). It is noteworthy that mean grip strength in the sample which will then cause abnormal gait and knee instability. Eccentric training (ET) Anterior cruciate ligament (ACL) rupture results in significant quadriceps weakness, which may be further augmented by protein supplement*. 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 (JET, 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 degree/s, concentric contraction at 60, 180 and 300 degrees increased by 7.6% (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), 43.2% (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 during eccentric contraction at 60 degree/s, concentric contraction at 60, 180 and 300 degrees increased by 7.6% (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), 43.2% (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 by 24.7% (P=0.001) and 12.9% (P=0.001). 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., et al., 2012. Supported by The National Key Research and Development Program (No.2016YFD00400603)
2021 Board #177 May 30 2:00 PM - 3:30 PM The Effect of Protein Supplementation on Recovery From Exercise-Induced Muscle Damage Brooke E. Starkloff, Elizabeth K. Lenz2, Craig O. Mattern2, Danny Too, FACSM1, Heidi K. Byrnc. Valparaiso University, Valparaiso, IN. 1The College at Brockport, State University of New York, Brockport, NY. 2Consultant. (No relevant relationships reported)

**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 (22.1±3.9 yrs, 176.0±6.9 kg, 84.2±17.6 kg) participated in a ten-day, double-blind, randomized trial. Subjects consumed a provided diet (60%:5%:25% carbohydrates:fat: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 (227.1±18.5), 24 (216.1±17.0), 48 (189.6±18.3), and 72 (168.1±18.0) hours post-EIMD when compared to baseline (121.4±15.2). Myoglobin levels (mg/mL) were elevated at 12 (60.4±56.6) hours post-EIMD when compared to baseline (8.74±5.63). 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. In addition, muscle soreness was assessed at all time points post-EIMD, there were no significant differences between the CHO and CHO-P conditions. In addition, 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.

2022 Board #178 May 30 2:00 PM - 3:30 PM Associations Among Dietary Protein Intake, Physical Activity, and Muscle Quality in Young Adults Chester Sokolowski1, Simon Higgins1, Megha Vishwanathan1, Michael Schmidt1, Richard Lewis1, Ellen Evans1. 1Florida State University, Tallahassee, FL. 2Elon University, Elon, NC. 3University of Georgia, Athens, GA. *Email: cs18s@my.fsu.edu (No relevant relationships reported)

It is well established that moderate-vigious intensity physical activity (MVPA) and resistance training (RT) positively influence muscle capacity and quality and health 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. **PURPOSE:** The aim of this study was to determine the associations between dietary protein intake quantity and source and muscle capacity (MC) and quality (MQ), controlling for MVPA and RT, in young men and women. **METHODS:** Young adults (n=122; 18-22 yr; 54% female) were assessed for a) total, animal and plant protein intakes via 3-day diet recall with analysis by Nutrition Data Systems for Research software; b) body composition via DXA scans, and c) knee extensor muscle strength (MC-S) and power (MC-P) via isokinetic dynamometry and Nottingham leg extensor power rig, respectively. Muscle quality was calculated as strength (MQ-S) and power (MQ-P) relative to leg lean mass. MVPA was determined using accelerometry and RT was determined from questionnaire. **RESULTS:** Compared to females, males ingested more animal protein when normalized per body weight, as a percentage of total kcal, and as a percentage of total protein intake (all p<0.05). Males also had more lean mass and greater MC-S, MC-P, and MQ-S than females in total protein intake (all p<0.05). However, there was no sex difference in MVPA, RT, or MQ-P (all p>0.05). Additionally, males had a significant relationship between total protein, total animal protein, and total plant protein intake and MC-S whereas females had no relationship. MVPA and RT, higher total dietary protein and total animal protein intake were associated with greater MC-S (r = 0.29 and 0.25, respectively, both p<0.05). Higher relative animal protein intake was positively related, whereas higher relative plant protein intake was inversely related to MQ-P (both p<0.05). **CONCLUSIONS:** This data suggests that young adult males and females differ in their dietary protein intake patterns. Moreover, dietary protein intake is modestly related to muscle capacity and quality with effects being stronger in males compared to their female counterparts.

2023 Board #179 May 30 2:00 PM - 3:30 PM 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. (No relevant relationships reported)

**PURPOSE:** In addition to importance of total daily protein intake for regulation of muscle mass, protein intake over 0.24 g/body weight (BW) from each meal may be necessary to maximize postprandial muscle protein synthesis in young population. Therefore, we hypothesized that if individuals do not achieve protein intake over 0.24 g BW at least one of three meals (breakfast, lunch, and dinner), muscle mass can be decreased. This cross-sectional study examined the association of protein intake at three meals with muscle mass among healthy young subjects. **METHODS:** We collected 3-day dietary records to evaluate dietary intake. We calculated total fat free mass (FFM) and appendicular (AppFFM) with dual-energy X-ray absorptiometry, and TotalFFM% and AppFFM% were also calculated as FFM relative to BW. The 266 subjects were categorized into two groups: AP group, achieving over 0.24 g/BW of protein intake at all three meals; or NP group, not achieving 0.24 g/BW of protein intake at least one meal. **RESULTS:** There was no linear association between total protein intake above the recommended dietary allowances (RDA; 0.8 g/kg BW) and TotalFFM% and AppFFM%. Consequently, we examined the association of protein intake at three main meals with muscle mass in subjects consuming total daily protein intake above the RDA. Regardless of potential confounders (e.g., sex, physical activity, and energy intake), we demonstrated that TotalFFM% (77.0± 0.5 vs 75.2± 0.4, P= 0.008) and AppFFM% (54.7± 0.3 vs 53.1± 0.2%, P= 0.005) in AP group was greater than in NP group consuming total protein intake above the RDA. **CONCLUSION:** This finding suggests that even if individuals achieve total protein intake above the RDA, not achieving protein intake over 0.24 g/BW at least one meal may lead to decreased muscle mass in young population. This work was supported by the Japanese Council for Science, Technology and Innovation (SIP Project ID 14531567), and the grant “Technologies for creating next-generation agriculture, forestry and fisheries” (funding agency: Bio-oriented Technology Research Advancement Institution, NARO).

2024 Board #180 May 30 2:00 PM - 3:30 PM 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 (No relevant relationships reported)

**PURPOSE:** Pre-exercise feeding is crucial in ensuring individuals are well-fuelled and able to perform at high intensities. Soy protein supplementation have shown to improve performance, and recovery, in endurance or resistance exercises. However, there is sparse research on its effects in the repeated anaerobic sprint test (RST) which is a valid and reliable method in measuring anaerobic capacity. The purpose of this study was to investigate the effects of soy milk ingestion on anaerobic performance using the RST. **METHODS:** 10 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 RST with a soy milk intervention (SOY: 500mL soy milk + 4g stevia sweetener) and a placebo control (CON: 500mL water + 4g stevia sweetener) over a 7-day period. The RST 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:** There was no linear association between the MP in SOY and CON trials. No significance were found in mean HR (r = 0.054, p = 0.497) levels. PBL (r = - 0.654) and PBG (r = - 0.662) concentrations were inversely associated with MP in the SOY trial. No significance were found in mean MP (r = 0.461) and FI in SOY (r = - 0.174) and CON trials (r = 0.040). PBL levels were 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: 9.75 ± 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 (r = -0.654) and PBG (r = -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 = 0.448) 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. **CONCLUSIONS:** The soy milk intervention in RST significantly lowered the FI, but had no influence 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 (BCAA) 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 (lacrosse players; age, 21.7 ± 0.5 years; height, 157.4 ± 5.1 cm; weight, 52.7 ± 4.6 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, BCAA (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 (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 BCAA and AAA in the blood were observed between the FP and LP of the menstrual cycle pre-, during, or post-exercise.

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 different forms of work matched exercise. METHODS: The participants were 22 healthy college age males. Participants were randomly assigned an order of condition 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% VO2max on the cycle ergometer for a total of 18 minutes. Pre and post exercise blood samples were collected to quantify brain-derived neurotrophic factors (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 continuous measured during the 2 hours post exercise using a non-invasive finger cuff system. RESULTS: Repeated measures ANOVA analysis did not reveal any difference 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±99.2 sec, post INT: 504.5±85.6 sec). For the executive function (Groton’s maze) only the INT resulted in a significant increase (p=0.01) from baseline (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 changes in cognitive function related to elevated recovery systemic 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.

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 higher 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 yrs. 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 Stroop interference at Fz location 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 of central nervous system and autonomous nervous system which were reflected by HRV index.

2029 Board #185 May 30 2:00 PM - 3:30 PM Aerobic and Muscular Fitness Associations with Adolescent Cognitive Control Tatsuya T. Shigeta1, Angus A. Leahy2, Jordan J. Smith2, Narelle Earther1, David R. Lubans2, Charles H. Hillman3. 1Northeastern University, Boston, MA. 2University of Newcastle, Callaghan, New South Wales, Australia. Email: shigeta.t@husky.neu.edu.cn (No relevant relationships reported)

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 stresses.

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) on the 3-back task (β’s ≥ 0.15, p’s < 0.05). In the 1-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, CRF 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 for (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 fNIRS Study Kun Wang, Zhangyan Deng, Qian Gu, Jimeng Zhang, Tao Huang, Zuoong Chen. Shanghia Jiao Tong University, Shanghai, China. Email: wakunz@sjtu.edu.cn (No relevant relationships reported)

BACKGROUND: Previous studies demonstrated that gait performance was decreased when walking while performing a cognitive task such as texting 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 followed the underlying three task conditions separated by a minimum of 48 hours: smartphone texting only (T task), walking only (W task), and dual task of smartphone texting while walking (TW task). Cortical oxygenation during the three tasks was monitored using a 38-channel fNIRS (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 (71.7 ± 10.4 vs. 71.0 ± 12.9 chars/min, P > 0.05). Texting enhanced hemodynamic response in frontopolar area (eg, Ch1_w, Ch2_w vs. T task: 1.01 ± 0.93 vs. -0.12 ±0.14, P < 0.01; Ch1_TW vs. T task: 0.89 ± 1.05 vs. -0.12 ±0.14, P < 0.01) dorsolateral prefrontal cortex (eg, Ch6_w, Ch7_w vs. T task: 0.24 ± 0.43 vs. -0.15 ± 0.42, P < 0.01; Ch6_TW vs. T task: 0.21 ± 0.33 vs. -0.13 ± 0.42, P < 0.01) and Broca area (eg, Ch35_w vs. T task: 0.99 ± 0.81 vs. 0.47 ± 0.75, P < 0.01). In addition, W task evoked an increased activation in temporopolar area (eg, Ch8_w vs. T task: 0.04 ± 0.12 vs. 0.75 ± 0.30, P < 0.01) and superior temporal gyrus (eg, Ch15_TW vs. T task: 0.99 ± 0.81 vs. 0.47 ± 0.75, P < 0.01). However, there were no significant differences in those 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 (temporal 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.

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. Nicole E. Logan1, Lauren B. Raine1, Rebecca J. Shorlin1, Naiman A. Khan2, Arthur F. Kramer1, Charles H. Hillman3. 1Northwestern University, Boston, MA. 2University of Illinois, Champaign Urbana, IL. Email: logan.n@husky.neu.edu.cn (No relevant relationships reported)

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 atherosclerosis 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 VO2max.

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=0.02); 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.
The results suggest that school segmented MVPA in PE and recess significantly related to cognitive health. The structural equation modeling analyses cardiorespiratory (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.

The time spent in MVPA during recess was positively associated with recognition task, physical fitness test (senior fitness test and handgrip strength), PA level (MET, hr/w) (RT negative ρ=-0.26; RT positive ρ=0.33) and PA level (MET, hr/w) (RT negative ρ=-0.31). Also, a significant relationship between worse cognitive performance with handgrip strength (non-perseverative errors, p=0.26) and SB (perseverative errors, p=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 Modulates Aerobic Training Efficacy on Executive Function in Older Adults**


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**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 (SCI-VCI).

**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(1,50)=4.09, p=0.04). 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 (52.66±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.
were counted as accuracy errors. RESULTS: Exercise improved the capacity of participants to successfully destroy targets, but differences between exercise (119.43 [4.23]) and rest (111.50 [3.98]) did not reach statistical significance (paired t-test; t=1.81; p=0.109). Exercise enhanced accuracy, with fewer errors after exercise than after rest (paired t-test; t=-2.38; p=0.023). Self-reported sitting time was negatively associated with total score after the rest condition (r=-0.55; p=0.040). 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 I 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. Petruzzello, FACSAM, University of Illinois Urbana-Champaign, Urbana, IL. (Sponsor: Steven J. Petruzzello, FACSAM)

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 (n=63) and female (n=101) undergraduates (n=164, 20:2ys, 24:8 body mass index (BMI), 62% female, 82% regular exercisers) completed several personality surveys along with one 15-minute high-intensity interval cycle (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=-0.894), neuroticism (F=47.4, M= 45.1, d=-0.644), openness (F=14.5, M= 15.6, d=-0.496), intensity-tolerance (F=26.4, M= 29.0, d=-0.535) 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 Efraim, Chance McCutcheon, Hunter LaCouture, Harrison Marsh. Brigham Young University, Provo, UT.

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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 ages 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 significant difference 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 = 0.0150). 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, Atsuo Terao2. 1The University of Electro-Communications, Tokyo, Japan. 2Keio University, Tokyo, Japan. 1Meiji Yasuda Life Foundation of Health and Welfare, Tokyo, Japan. 2Tokyo Metropolitan University, Tokyo, Japan. Email: soichi.ando@upec.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 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 exercise. Both conditions comprised a cognitive task (Go/No-Go task) before and after exercise (rest). We first analyzed regions specifically activated by exercise as region of interest. Then, we identified regions where functional connectivity was altered before and after exercise. We also identified regions where amount of alteration in functional connectivity was correlated with that of reaction time (RT).

RESULTS: RT was reduced in the Exercise condition (Pre: 420 ± 77 ms, Post: 388 ± 65 ms, p = 0.02), while it did not change in the Control condition (Pre: 416 ± 79 ms, Post: 417 ± 78 ms, p = 0.82). We observed significant increases in activation in the opercular and triangular parts of the left inferior frontal gyrus (IFG) and anterior cingulate cortex (p < 0.01, uncorrected). We found an increase in functional connectivity between the opercular part of the left IFG and the left putamen (Pre: 0.02 ± 0.11, Post: 0.12 ± 0.13, p = 0.08). Alteration in the functional connectivity between these regions was negatively correlated with the alteration in RT (r = -0.44, p = 0.06).

CONCLUSIONS: Alteration in functional connectivity may be associated with improvement of cognitive performance after acute exercise.

The Effects Of Exercise Intensity On Auditory Processing Speed And Flexibility: A Randomized Crossover Study

Ciera Batholomew, Michael Larson, Hunter LaCouture, Kaylie Carbine, Chance McCutcheon, Harrison Marsh, Bruce W. Bailey, Jr. Brigham Young University, Provo, UT.

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Purpose: 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 each 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 for 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 variable of interest (P = 0.05).

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 not hinder a person’s ability to perform complex cognitive tasks.

The Effects Of Acute Aerobic Exercise On BDNF Levels And Cognition In Postmenopausal Women

Ryan Wiet, Kenneth Sparks, Dough Wajda, Jeremy Genovese, Emily Kullman. Cleveland State University, Cleveland, OH.

Purpose: The purpose of this study was to examine how menopausal status affects choice reaction time and peripheral BDNF levels after aerobic exercise. It was hypothesized that exercise would affect peripheral BDNF levels and choice reaction time similarly among pre and postmenopausal women.

Methods: The subjects consisted of 14 active females (7 premenopausal and 7 postmenopausal). Subjects went through two different trials: an exercise trial and a control reading trials. The exercise trial consisted of running on a treadmill at 75% of VO2max for 30 minutes. 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 lead to a significant change in BDNF in either group. However, there was a statistical interaction (P=0.041) between pre and postmenopausal women over time between pre and post timepoints, with premenopausal women trending towards an increase in BDNF, and postmenopausal women trending towards a decrease in BDNF. There was a large effect size within this interaction represented with a partial eta squared value of .265. A Post Hoc test was done to further investigate the interaction. There was not enough statistical power (P = .164) to state that there was a difference in BDNF levels (pre to post) but that there appears to be a trend. Both age and FSH had indirect relationships with BDNF (p<0.05); the greater the age or FSH, the lower the peripheral BDNF levels. The correlation between exercise and BDNF levels was observed only in the Stroop Test time over all time points (P = .039, .089, and .027; pre, post, and post30 exercise respectively). This indicated an age-related decline in choice reaction time capabilities.

Conclusion: Within the study, there was not statistical evidence that acute exercise affects BDNF levels nor choice reaction time for the Stroop incongruent test, regardless of menopausal status. However, a clear decline in choice reaction time was noted with increase age. Additionally, there appears to be a blunting of exercise-induced increases in BDNF in postmenopausal women. Further investigation is required to clarify this relationship.

INTRODUCTION: Working memory (WM), generally considered executive function, is gaining attention due to its role in contributing to children and adolescents’ academic achievement, especially verbal and quantitative reasoning, and sports-related tactical memory. Quantitative reviews regarding the effect of exercise interventions (EX) on this higher-level cognitive skill in these important cohorts are lacking.

Purpose: The aim of the study was to assess the chronic effect of EX on WM in children and adolescents and to evaluate potential moderators of this effect using a meta-analytic approach.

Methods: A computerized literature search was conducted based on seven databases: SPORTDiscus, Google Scholar, PubMed, ScienceDirect, Dialnet Plus, ScIElo, and MEDLINE. Studies needed to meet the following inclusion criteria: 1) a RCT design in children or adolescents, 2) EX with mode description, 3) published in English, Spanish, or Korean 4) WM as dependent variable, and 5) reported descriptive statistics that permitted effect size (ES) calculation. The quality score was defined using a scale from 1 to 5. A random-effects model with a within-group design was used to calculate the ES. One-way analysis of variance of independent groups or Pearson’s correlation coefficients were used to examine moderators.

Results: 6207 articles published before Nov. 2016 were found, of which 10 studies representing 60 ES’s and totaling 806 participants (males and females, 9.9±4.8 yrs) were included in the analysis. The mean quality for the studies was 4.4±.7. An overall ES of .85 was found (p<.001; CI95%: .47 to 1.24; z=4.35; Q=419.50; I^2=94.28%), suggesting a positive high effect of the EX to enhance WM. Age (r=-.34, p=.048), number of sessions (r=-.42; p=.03), and sex (F威男=3.6; p=.04), significantly moderated the effect. Neither a) quality of the studies (r=-.24, p=.17), b) min session (r=-.28, p=.15), c) weeks of intervention (r=.24, p=.17), nor d) type of exercise (i.e., aerobic, anaerobic, neuromotor; r=-.41; p=.53) were significant moderators. No bias was found according to Egger’s regression analysis (p=.39).

Conclusions: EX has a positive significant effect on children and adolescents’ WM compared with their control peers. Different types of exercise appeared to be equally effective strategies for improving WM in these cohorts.

Thurs., May 30, 2019
Orlando, Florida

Medical & Science in Sports & Exercise®
METHODS: Have been evaluated 493 subjects (males = 351, females = 148), RT (n = 365, 279 males, 86 females) and CrossFit (n = 128, 69 males, 59 females) completed the follow online questionnaire (EQ, Behavioral Risk, Exercise Questionnaire, Exercise Motivations Inventory-2, The Basic Psychological Needs in Exercise Scale.

RESULTS: The CrossFit participants presented higher levels of enjoyment, stress management, social recognition, affiliation, competition, and weight management. Conversely, RT participants reported higher motives for appearance. Intrinsic regulation to exercise was significantly higher in CrossFit, whereas RT clients scored higher controlled motivation. The CrossFit group reported higher levels of relatedness, while RT group presented more perception of autonomy. There was no significant difference between weekly exercise volume between groups; therefore, correlation and mediation analysis were conducted with pooled data. Autonomy and competence were significantly associated with more autonomous forms of motivation. Exercise frequency and weekly exercise volume were positively related to intrinsic motivation. When mediating model was evaluated, the social motives to exercise and intrinsic motivation were found to mediate the relationship between competence and weekly exercise volume (95% BCa CI of 2.47 to 11.91).

CONCLUSIONS: These findings suggest that CrossFit members attend the gym/ CrossFit box predominantly for intrinsic reasons and social motives as compared to RT participants. Exercise professionals may consider the development of programs to increase social motives and exercise-related identity (e.g., interest, affiliation, and enjoyment) to promote intrinsic regulation in individuals from fitness centers.

2046 Board #202 May 30 2:00 PM - 3:30 PM Neuroelectric Indices of Attentional Processing are Reduced During Low-Intensity Cycling

Kaitlyn E. Carmichael1, David J. Cleland2, Alyssa G. Vigil2, Megan E. Ruhl3, Ryan L. Olson1. 1University of Georgia, Athens; 2Purdue University, West Lafayette, IN; 3University of North Texas, Denton, TX. (No relevant relationships reported)

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 research that has been conducted in this area is mixed, demonstrating differential 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: Twentyseven (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 time, F(4,23) = 4.54, p = .008, ηp² = .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, ηp² = .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

Melissa J. McGranahan, Edward S. Green, Kevin K. McCully, FACSM, Nathan T. Jenkins, University of Georgia, Athens, GA. Email: mmcg91@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±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 exercise (EX) conditions (BL, EX, 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 mean percent change ± SD. RESULTS: Significant interaction effect of Condition x Time on mVO2 was observed F=6.3 p=0.025, ηp²=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 ± ± 10.2% (p=0.001). In EX, there was an increase in mVO2 from BL to after EX by 12.1%/ 16.0% (p<0.05) and from BL to after MS by 18.2% ± 64.1% (p=0.05). CONCLUSION: To our knowledge, 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-Rinaldi, Larry Collins, Candi Ashley, Marcus Kilpatrick, FACSM. University of South Florida, Tampa, FL. (Sponsor: Marcus Kilpatrick, FACSM) Email: afrleming@mail.usf.edu (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, protocalls, 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 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 high-intensity interval trials (HIIT) 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 portions 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 dependent t-tests. RPE-O, RPE-L, affect, enjoyment, and HR (all p-values > 0.05; all ES values < 0.50) were not significantly different for the WALK-HIIT and RUN-HIIT trials. CONCLUSIONS: Findings indicate that WALK-HIIT and RUN-HIIT trials produced 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)

PURPOSE: This study thus aims to the clinic efficacy of Qigong Badaujin (QBDJ) on cognition and mental status in patients with type 2 diabetes. METHODS: sixty-seven type 2 diabetic patients with mild cognitive impairment (MC1) (31 males and 36 females; aged 47-68 years; the educational background of all participants were above middle school) were screened and randomly divided into two groups: the QBDJ group (n=34), and the control group (n=33). Both groups were based on the routine treatment of diabetes. The QBDJ group received Baduanjin exercise forty minutes a time and five times per week for three months, whereas the control group without special exercise intervention. Montreal Cognitive Assessment (MoCA) and Hamilton Anxiety Scale (HAMA) were used to evaluate the cognitive and 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 QBDJ 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 QBDJ 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 McCA Subtests in Two Groups

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<th>Control group (n=30)</th>
<th>QBDJ group (n=30)</th>
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<tbody>
<tr>
<td></td>
<td>Before intervention</td>
<td>After intervention</td>
</tr>
<tr>
<td>Visuospatial/executive</td>
<td>2.01±0.74</td>
<td>1.95±0.77</td>
</tr>
<tr>
<td>Naming</td>
<td>2.51±0.60</td>
<td>2.48±0.59</td>
</tr>
<tr>
<td>Attention</td>
<td>4.4±0.75</td>
<td>4.4±0.73</td>
</tr>
<tr>
<td>Language</td>
<td>2.02±0.66</td>
<td>2.03±0.57</td>
</tr>
<tr>
<td>Abstraction</td>
<td>0.99±0.27</td>
<td>1.02±0.23</td>
</tr>
<tr>
<td>Delayed recall</td>
<td>1.52±0.60</td>
<td>1.51±0.58</td>
</tr>
<tr>
<td>Orientation</td>
<td>8.78±0.50</td>
<td>8.81±0.42</td>
</tr>
<tr>
<td>Total score</td>
<td>20.03±1.24</td>
<td>20.14±1.52</td>
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</tbody>
</table>

When data is significant (p<0.05), an F-ratio is matched with *F(QBDJ group vs. Control group) and (F(compared with before intervention in QBDJ group)*

### Table 2. Comparison of HAMA Score in Two Groups

<table>
<thead>
<tr>
<th></th>
<th>Control group (n=30)</th>
<th>QBDJ group (n=30)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Before intervention</td>
<td>After intervention</td>
</tr>
<tr>
<td>HAMA</td>
<td>15.44±5.08</td>
<td>16.29±6.43</td>
</tr>
</tbody>
</table>

When data is significant (p<0.05), the F-ratio is matched with *F(QBDJ group vs. Control group) and (F(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. **RESULTS analysis:** For the ratio 1.8 (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(9, 135) = 3.63, p<0.01) 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(2, 50), 42.815 = 0.001, n² = 0.741) and FMD (F(2, 50), 42.815 = 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 (NNX15AC16G). PM: Alano and Simpson

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 68) 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 fifteenth 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<0.007), SPPB score (p=-.65, p<0.001) and FMD (r=-.4, p=0.04). TMT-B was inversely correlated with 6MWD (r=-.39, p=0.04), but not with SPPB, or FMD. DSC was correlated with 6MWD (r=.47, p<0.01), but not with SPPB, or FMD. **CONCLUSION:** In patients with CKD, psychomotor speed is associated with indicators of physical function and fitness levels, and with vascular function. Executive control, visuomotor speed, and complex attention was associated with physical fitness levels. These results indicate a comorbiditity between higher levels of fitness, physical, and vascular function, and higher scores in psychomotor speed and executive control in patients with CKD. The clinical
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±0.9yrs) 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 school of vulnerability area at Brasilia - Brazil, undertook Stroop test before and after intervention. The participants had to match the color of the bar to the meaning of physical activity (PAL) at moderate intensity (154.6±17.2 bpm). ANOVA mixed was used to compare incongruent Go condition in both groups after intervention for boys (958.3±113.3ms) and girls (963.4±113.3ms) in the most difficult part of Stroop test. To support these results studies with a neuroeletric analysis (i.e. event related potential component) can be recommended.

**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 (938.3±113.3ms to 877.9±105.6ms; 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 neuroeletric analysis (i.e. event related potential component) can be recommended.

**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 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 follow-up for 31 years in 3-9-year intervals. PA was queried in all study phases. Cumulative PA was determined in childhood (age 6-12 years), adolescence (age 12-18 years), young adulthood (age 18-24 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.
Endurance 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=51±1 year and range=21-72y; 49 males, 2 females) completing a 161km event (mean=20°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 (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 (Posm), plasma copeptin (Pcop), and body mass change (BM)) were collected before the ride. Five hydration markers (urine color and specific gravity, plasma osmolality (Posm), plasma copeptin (Pcop), 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 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 regressions tested associations between hydration markers and eight predictor terms derived from nineteen nutrients merged into a reduced-dimensionality dataset through regressions tested associations between hydration markers and eight predictor terms derived from nineteen nutrients merged into a reduced-dimensionality dataset through regressions tested associations between hydration markers and eight predictor terms derived from nineteen nutrients merged into a reduced-dimensionality dataset through regressions tested associations between hydration markers and eight predictor terms derived from nineteen nutrients merged into a reduced-dimensionality dataset through regressions tested associations between hydration markers and eight predictor terms derived from nineteen nutrients merged into a 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2059  Board #215  May 30 2:00 PM - 3:30 PM  
Dehydration Has No Influence on Simulated Motor-race Performance Despite Greater Cardiovascular and Thermoregulatory Demand  
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Email: justin.holland@qut.edu.au  
(No relevant relationships reported)  
Purpose: Motor-racing drivers compete in hot, climate-appropriate environments imposing high physiological strain. Dehydration may impact a driver’s health, safety and race performance. This study examined the effects of dehydration-induced changes in performance on physiological outcomes during a simulated motor-race.  
Methods: Fifteen healthy men [age: 25.2±5.4 y; body mass: 84.8±10.7 kg; VO2max: 43.7±2.8 mL·kg·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 saliva exposure (wt: 28.8°C temperature (WBT): 43.6±2.8°C)] and ﬂuid trial [1.0±0.5% body mass gain via room temperature water consumption every 10 min during saliva exposure]. All participants completed ~60 min of simulated motor-racing in a heated (WBT: 33.7±0.7°C) laboratory with no ﬂuid provided to both trials which resulted in a 1.3±0.4% and 0.9±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 (Osmol) were measured. Body mass, and serum [sodium (Na), osmolality (Osmol), and plasma osmolality (PV)] samples were collected pre- and post- sauna and race.  
Results: Mean lap time was not different between trials (ﬂuid=134.98±1.24 s, no ﬂuid=134.71±2.47 s; p=0.293). The no ﬂuid trial resulted in signiﬁcantly higher (p<0.05) peak heart rate (129.16±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±304 vs. 500±104 mOsm·kg−1), Na (138.7±2.1 vs. 135.8±4.5 mmol·L−1), USG [median (interquartile range): 1.025 (1.024-1.027) vs 1.000 (1.004-1.013)], Uosm (942±879-1010) vs 221 (186-497) mOsm·kg−1), total body mass loss (2.7±0.3 vs. 0.9±0.4%) and change in PV (7.9±2.4 vs. -3.3±1.2%) 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 greater cardiovascular and thermoregulatory demand. Further research is warranted to assess the impact of greater cardiovascular and thermoregulatory demand from dehydration on the safety, health and well-being of drivers.  

2060  Board #216  May 30 2:00 PM - 3:30 PM  
Self-Reported Changes in Thirst and Alertness during Variable Prescribed Fluid Intake  
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Email: hillaryyoder@gmail.com  
(No relevant relationships reported)  
Purpose: To evaluate the relationship between self-reported thirst and alertness in people drinking variable amounts of prescribed water. METHODS: Subjects (n = 115, 59 males, 32 ± 10 y; 24 ± 4.4 kg·m−2) visited the lab 3 times over 10 days: V1, a baseline visit that prior participants were drinking ad libitum; V2, following 3 days of ﬂuid restriction (1 L·d−1), of which 250 mL was consumed in the morning prior to the visit; and V3, the morning following a prescribed increase in water intake. The increase in water intake at V3 varied by group assignment: a control group (CON) maintained 250 mL of morning water consumption, while LOW and HIGH intake groups (n = 45 each) consumed 496 ± 82 mL and 878 ± 125 mL, respectively. At each visit, which occurred after the morning water consumption period, subjects indicated on an open-ended visual analog scale (VAS) how thirsty and alert they felt. Two-way ANOVA for thirst and alertness between groups from V1 to V2 and V2 to V3 were completed. Repeated measures correlation procedure was completed for change in alertness and thirst from V1 to V2 and V2 to V3. RESULTS: Groups were similar at baseline (V1) for fluid intake, thirst and alertness (all p > 0.17). Fluid restriction (V2) resulted in a decrease in both thirst and alertness (both p < 0.01), with no main effect of group. On average, thirst increased (35 ± 35 mm) and alertness decreased (-19 ± 31 mm) from V1 to V2. The prescribed increase in water intake (V3) revealed a signiﬁcant interaction of time and group for both thirst and alertness (both p < 0.01). Independent-samples t-tests revealed that HIGH reduced thirst (-38 ± 37 mm) and increased alertness (-18 ± 25 mm) more than both LOW (thirst, -7 ± 37 mm; alertness -1 ± 24 mm) and CON (thirst, -6 ± 23 mm; alertness 0 ± 23 mm; all p < 0.01). There was no difference between LOW and CON (both p > 0.92). Repeated measures correlation analysis showed a negative relationship between change in alertness and thirst (R2 = 0.29, 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.
Exercise-induced diuresis was found to be dependent on hydration status. This finding is supported by the results of the current study, where athletes maintained short-term hydration levels and avoided excessive dehydration (>2%).

When used alone, both caffeine and sodium-induced hydration (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 effects of caffeine are 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, 87.4 ± 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 body mass−1. Trials were separated by 1 week. Urine collections (UE) for each trial were voided at the start of the trial, before caffeine ingestion (NaCaf0), and after 75 min (NaCaf75). Caffeine was ingested (as NaCaf75) 5 min before the start of the first UE. Urine samples were analyzed for: specific gravity, urea (UE), sodium (Na+), and potassium (K+). Urine osmolality was also measured. Participants were instructed to consume caffeine on an ad libitum basis, and to avoid alcohol for 24 h prior to each trial.

Results:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Sodium (mmol·L−1)</th>
<th>Sodium (mg·L−1)</th>
<th>Urea (mmol·L−1)</th>
<th>Urea (mg·L−1)</th>
<th>Sodium excretion (mmol·L−1)</th>
<th>Sodium excretion (mg·L−1)</th>
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</thead>
<tbody>
<tr>
<td>NaCaf0</td>
<td>11.0 ± 2.0</td>
<td>150 ± 10</td>
<td>15.0 ± 2.0</td>
<td>475 ± 25</td>
<td>22.5 ± 4.5</td>
<td>3225 ± 675</td>
</tr>
<tr>
<td>NaCaf75</td>
<td>10.5 ± 1.5</td>
<td>132 ± 15</td>
<td>18.0 ± 2.5</td>
<td>700 ± 30</td>
<td>18.0 ± 3.5</td>
<td>2700 ± 450</td>
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</table>

Conclusion: Caffeine increases diuresis, but the magnitude of the diuresis was not different between conditions. Caffeine ingested 5 min before exercise resulted in significantly greater diuresis for the first 30 min of the trial, waiting to consume caffeine until 75 min 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) 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 at p<0.05.

RESULTS: Uvol was significantly lower in BL (87.4±34.1 mL) compared to WH college students (93.2±34.5 mL, p=0.01). Conversely measures of Uosm, Usg, and Ucol were significantly greater in BL (716±263 mOsm·kg⁻¹, 1.02±0.007, and 4.1±1.4), respectively) compared to WH college students (473±194 mOsm·kg⁻¹, 1.01±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; 23.6±4.4 vs 21.8±3.1, p=0.017; and Ucol; 4.6 [-1.2, -0.1], p=0.001). 

CONCLUSIONS: Based on 24 h urinary hydration markers, college-aged non-Hispanic Black men and women were inadequately hydrated compared to their non-Hispanic 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.

D-65 Free Communication/Poster - Thermoregulation/Hyperthermia

Method:

Mean hydration knowledge was 9.3±1.5 (out of 15). Less than 30% of participants scored more than 70% (≥70.5 or 15). Adequate knowledge was defined as ≥ 70% of a maximal score of 15. Over 98% of participating students understood the importance of fluids on performance, however, only 65% of participants received hydration education. Knowledge scores were significantly higher (P < 0.05) in those receiving hydration education; however mean knowledge scores were still low (9.5±1.5). Mean knowledge scores increased by year in school but were still low. Post-exercise weight loss knowledge was varied between answers. Of those who felt their fluid intake during training or races was adequate, 70% had low knowledge scores. Girls reported they were less certain about being adequately hydrated than boys (Girls: 63%, Boys: 37%). Stopping in a race due to an excessive feeling of heat was significantly higher in boys (60%) than in girls (40%). 

CONCLUSION: Despite understanding the importance of keeping hydrated, mean knowledge scores indicated inadequate knowledge, while hydration behavior indicated inconsistency in translation of knowledge.
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, Shyretta Brown1, Adam J. Reimel1, Alexander J. Aranyosi2, Stephen P. Lee1, Jeffrey B. Model1, Roobeh Ghaffari1, Kelly A. Barnes1,1 Grattanvale Sports Science Institute, Barrington, IL
1Epicore Biosystems Inc, Cambridge, MA.

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Purpose: Skin tattoos have been shown to reduce sweat rate and increase sweat advance the practicality of sweat testing.

Methods: Twenty-two healthy individuals (25.1±4.8 y (Mean±SD), 14 males) with

Assessing regional sweat electrolyte concentrations using standard patch techniques to measure regional 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±1.6 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

Validity And Reliability Of Telemetric Pill During 50 H Of Reuse.


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Validating regional sweat electrolyte concentrations during physical activity is crucial for understanding thermoregulation and hydration status. However, current sweat patch methods often lack accuracy, reliability, and practicality. The Epifluidic patch, with its colorimetric readout, offers a promising solution for real-time sweat analysis.

In this investigation, we aimed to evaluate the accuracy and reliability of the Epifluidic patch compared to standard absorbent patches in measuring regional sweat [Cl-] during exercise. Twenty-two healthy individuals participated, engaging in 20 minutes of intermittent cycling (4 x 5 min) at 85% HRmax. Sweat was collected into absorbent patches (Absorbent) and Epifluidic patches. The samples were subsequently analyzed for [Cl-] by ion chromatography.

Results showed that sweat [Cl-] was not different between repeat trials for the Absorbent and Epifluidic patch, with mean biases of -0.14°C±0.17°C and -0.10°C±0.13°C, respectively. Test-retest CVs were 12% and 4%, indicating high reliability.

Conclusions: The Epifluidic patch is a promising tool for sweat [Cl-] analysis, offering accuracy and reliability comparable to standard absorbent patches. Future studies should further validate this new approach across various exercise intensities and conditions.
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, Equivital) worn by each participant. Vest temperatures 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±22 and 97±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: 38.1±0.1°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=0.51 - 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.

**Physiological Strain Index Of Female Wheelchair Basketball Players During Competition**

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(No relevant relationships reported)

Purpose: The purpose of this study was to assess the thermoregulatory responses and physiological strain of elite wheelchair (WC) basketball players during international competitions. Methods: Eleven female (n=11; 7 SCI and 4 Non-SCI) national team WC basketball players volunteered for the study. Testing occurred during a four-game series against the same international competitor (temp 22.1±1.2°C, RH 55.2±2%). Hydration habits were monitored and gastrointestinal temperature (TG), heart rate, and skin temperature (SKT) were recorded in real-time. Results (mean±SD): Athletes arrived hydrated for all games (urine specific gravity, 1.014±0.002). Players lost a mean of 0.5±0.1% body mass due to sweat loss and replaced –69% of fluid losses. SCI players played 21±4 min and Non-SCI athletes played 14±6 min. SCI athletes had a mean SKT throughout the game of 35.2±0.9°C and Non-SCI of 36.2±0.2°C. SCI SKT rose a mean of 6.3±1.1°C and Non-SCI 6.8±0.9°C. SCI TC rose a mean of 1.0±0.2°C and Non-SCI a mean of 0.9±0.4°C. 2/10 players reached a Tc>39°C. SCI athletes class 1, 39.4°C, Non-SCI class 4, 39.5°C. Mean physiological strain index (PSI) was 7.1±0.7° (range, 2.6-7.9). Athletes who played <50% of the game (n=4) had a mean PSI of 6.7±0.8° compared to athletes who played ≥50% of the game (n=6) who had a PSI of 3.9±0.7°, with the greatest contribution to PSI from core temperature. Conclusions: Monitoring TC and PSI during competition is encouraged to understand competition specific responses and identify athletes more at risk of heat-related fatigue due to injury level and high playing time.

**Effect of Passive Heating on Per fusive and Diffusive Microvascular Oxygen Delivery**

Kaylin D. Didier, Lillie M. Huckaby, Andrew M. Alexander, Shane M. Hammer, Camryn N. Webster, Thomas J. Barstow, FACSM. Kansas State University, Manhattan, KS.

(No relevant relationships reported)

Previous studies have demonstrated that passive heating has led to increases in endothelial function and vasodilation of the brachial artery. The increase in 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: Three participants (2 women, 23.0±1.0 yrs, 70.9±5.7 kg, 171.0±10.1 cm) participated in this study. Peak power was determined by an incremental two-hand handgrip 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 (OxipletS, 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=0.82). However, the Δ 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 reduced. 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 (WBGT < 27.8°C) to no outdoor practices (WBGT > 33.4°C). An ANOVA was used to determine differences in WBGT between schools and across the various months during football season. **Results:** There were no statistical differences in the WBGT measures between the 10 schools at the R1 (P = 0.655) and R2 (P = 0.446) timepoints. Nearly 39% (n=169) of all WBGT measures at R1 (>4PM) across the 10 schools were > 27.8°C and would not have required any practice modifications. Only 7.5% (n=33) of the measures for this same R1 timepoint were ≥ 33.4°C which would have resulted in cancellation of practice. Fifty-seven percent (n=208) of R2 WBGT measures were ≥ 27.8°C while only 1.1% (n=4) were ≥ 33.4°C. Also, the maximum WBGT measurement in August (33.1 ± 0.7°C) was significantly higher than in October (28.6 ± 0.7°C; P = 0.000) but similar to maximum WBGT in September (32.7 ± 0.9°C) and November (31.0 ± 1.9°C; P = 0.05). **Conclusion:** Our findings revealed that if existing regional heat guidelines would have been applied in Florida during our study, the policy would have resulted in the cancellation of outdoor practices on only a few days. It is also clear that the risk of dangerously elevated WBGT was not limited to preseason practices in August. Finally, delaying practices to later in the afternoon would likely decrease the risk of EHI and minimize the number of practices affected by a heat policy.

**RESULTS:** Cockpit temperature elicited a positive relationship, with each measured physiological strain index (PSI) measured continuously during over 38 driving sessions generally accepted as core temperature (Tcore) and heart rate (HR). Use of calculations that encompass both Tcore and HR, such as the physiological strain index (PSI), may also provide useful information to aid in return-to-duty decisions. The heat tolerance test (HTT) is used by the military to assist with return-to-duty decisions for heat-injured warfighters. Criteria for determining heat tolerance are generally accepted as core temperature (Tcore) < 38.6°C and heart rate (HR) < 160 bpm during 120 min of treadmill walking in a comfortable heat stress environment. Additional information for classifying heat tolerance may be gained by evaluating the final 60 min of an HTT, as Druyan et al. (2013) determined a limit of < 0.45°C Tcore (F60) for classifying heat tolerance and compare it with the ΔTcore (F60) threshold of 1.82 validated by comparing it to the ΔTcore (Druyan et al.) were then compared. Use of calculations that encompass both Tcore and HR, such as the physiological strain index (PSI), may also provide useful information to aid in return-to-duty decisions. **Purpose:** To examine the relationship between changes in body temperature, and time spent above critical temperatures with aerobic performance and drinking behavior. **Methods:** 12 recreationally active men (24.4 ± 3.1 yrs; 81.5 ± 8.0 kg; 47.2 ± 4.8 mL kg/min) completed five experimental visits: a VO2 max test, and a cycling trial in 23°C, 24.5°C, 26°C, 27°C, 30°C, 32°C, 34°C, 34°C, 34°C, 34°C, 34°C, 34°C. Each cycling trial, participants completed 60 minutes of cycling at 60% VO2max, a 15min rest and a time to exhaustion (TTE) at 90% VO2max. Water intake, and TTE performance was collected in each condition. During each exercise session, participants were monitored continuously for their rectal temperature (Trect), skin temperature at five locations: Chest, Triceps, Forearm, Thigh and calf, Total skin temperature (Tsk) and whole body temperature (Twb) were calculated using weighted averages. The Area Under the Curve with respect to increase from baseline (AUC) was then calculated for Tsk, Twb, and Tcore. Data were analyzed as Pearson Product Moment Correlations between AUC/ with water intake and TTE performance. Furthermore, the time spent above specific critical temperatures for Trect (37.5°C, 38.0°C, 38.5°C and 39.0°C) and Tsk (35.0°C, 36.0°C, 37.0°C and 38.0°C) were related to water intake at TTE performance using stepwise linear regression. **Results:** Significant correlations were observed between water intake with Tsk (r = 0.469; p = 0.003) and Twb (r = 0.511; p = 0.001), though no significant correlation was observed for Tcore (p = 0.059). Time spent with a Tsk above 35°C related to total water intake (r = 0.521; p = 0.001), though no critical Tcore was observed. TTE performance was significantly correlated with and Tsk (r = 0.338; p = 0.036), but not with Tcore (p = 0.179) or Twb (p = 0.058). Time spent with a Tsk above 37°C and Twb above 38.5°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 Tsk, and likely not influenced by TTE performance, however, is influenced by both Tsk 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.
Findings suggest that 1.82 ΔPSI_{F60} and 0.45°C ΔT_{core} thresholds to determine heat tolerance yield a similar number of misclassifications. Future work should aim to refine these techniques to reduce the number of HT/Hi misclassifications.

**Board #238 May 30 2:00 PM - 3:30 PM
Establishing a Physiological Strain Index Criterion During the Final Sixty Minutes of Heat Tolerance Testing**

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(No relevant relationships reported)

The heat tolerance test (HTT) assesses cardiorespiratory and thermoregulatory capacity during heat stress using heart rate (HR) and core temperature (Tc) as pass/fail criteria. Currently, there is minimal information available on the efficacy of various PSI interpretations, with respect to accurately identifying differences in physiological strain between those that have passed and failed an HTT. PURPOSE: To report different methods to evaluate physiological strain during HTT using PSI. METHODS: Eighty-two military personnel (age: 25 ± 5 yrs; height: 178.2 ± 7.2 cm; weight: 84.5 ± 9.9 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 established Tc and HR criteria. A ΔPSI_{F60} was calculated for each subject that passed and failed an HTT and compared using independent samples t-tests (p < 0.05). Results: ΔPSI_{F60} was significantly less in HT subjects than in HI subjects (0.54 ± 0.64 vs. 1.95 ± 0.72; p < 0.001). For HT subjects, a ΔPSI_{F60} maximal normal accepted value was determined to be 1.82. CONCLUSION: Findings indicate that ΔPSI_{F60} appropriately differentiated HT from HI subjects during an HTT in this population of military personnel. Therefore, we report that exceeding a ΔPSI_{F60} 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_{F60} is needed.

**Board #239 May 30 2:00 PM - 3:30 PM
Interpretations of Physiological Strain Index During Heat Tolerance Testing**

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(No relevant relationships reported)

The heat tolerance test (HTT) assesses cardiorespiratory and thermoregulatory capacity during heat stress using core temperature (Tc) and heart rate (HR) 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 Tc measurements. To our knowledge, the change in PSI during the final 60 min of an HTT (ΔPSI_{F60}) has not been evaluated as a potential criterion for classifying heat tolerance/intolerance during HTT. PURPOSE: The purpose of this study was to establish a criterion threshold for ΔPSI_{F60} and report on its ability to classify heat tolerance/intolerance during an HTT. METHODS: Seventy-seven US military men (age: 25 ± 5 yrs; height: 178.5 ± 7.1 cm; weight: 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 established Tc and HR criteria. A ΔPSI_{F60} was calculated for each subject that passed and failed an HTT and compared using independent samples t-tests (p < 0.05). ΔPSI_{F60} was significantly less in HT subjects than in HI subjects (0.54 ± 0.64 vs. 1.95 ± 0.72; p < 0.001). For HT subjects, a ΔPSI_{F60} maximal normal accepted value was determined to be 1.82. CONCLUSION: Findings indicate that ΔPSI_{F60} appropriately differentiated HT from HI subjects during an HTT in this population of military personnel. Therefore, we report that exceeding a ΔPSI_{F60} 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_{F60} is needed.

**Board #240 May 30 2:00 PM - 3:30 PM
Thermal Behavior Does Not Differ Between Sexes During and Following High Intensity Aerobic Exercise**

Randi L. Snopkowski¹, Nicole Vargas¹, Christopher Chapman¹, Blair Johnson¹, Rob Gathercole², Zachary Schladter, FACSM³. ¹University at Buffalo, Buffalo, NY. ²lululemon athletica inc., Vancouver, BC, Canada. (Sponsor: Zachary Schladter, FACSM) (No relevant relationships reported)

Females utilize thermal behavior more than males during low intensity aerobic exercise. Core temperature is elevated during high vs. low intensity aerobic exercise because of greater heat production. Thus, thermal behavior is greater during high intensity exercise because of the heightened stimuli to behave. It is unknown if sex modulates thermal behavior during low intensity exercise.

**Purpose:** Test the hypothesis that thermal behavior differs between males and females during high intensity exercise and recovery.

**Methods:** 10 males (M) and 10 females (F) (23±3y) underwent 30 min of cycling exercise at a power output that elicited 80±5% (F) and 78±4% (M) of VO2peak (P=0.28) followed by 120 min seated recovery in a 27.1±1°C, 21.2±1% relative humidity environment. Subjects were instructed to maintain a thermally comfortable neck temperature throughout using a custom-made neck device. Neck device temperature provided an index of thermal behavior. Mean skin (10 site) and core (intestinal) temperatures, mean skin wetness (8 site), neck device temperature, skin blood flow (laser Doppler) and local sweat rate (ventilated capsule) were measured continually.

**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 wetness, 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±0.3°C, P=0.99) or neck device (F: 12.11±10.6, M: 11.90±12.9°C, P=0.25) temperatures, mean skin wetness (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 wetness, 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.

**Board #241 May 30 2:00 PM - 3:30 PM
Exercise Intensity Independently Modulates Thermal Behavior During Exercise Recovery, But Not During Exercise**

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**Purpose:** 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±1% RH environment, 20 subjects (10 females) cycled for 30 min at MI (53±6% VO2peak) or HI (78±6% VO2peak), followed by 120 min seated recovery. Mean skin (10 site) and core (telemetry pill) temperatures, and mean skin wetness (8 site) were recorded continuously. Participants maintained a thermally comfortable neck temperature throughout using a custom-made device. Neck device temperature provided an index of thermal behavior. The weighted average of mean skin and core temperatures, and mean skin wetness provided an indication of the mean afferent stimulus to thermally behave.

**Results:** Mean skin (by +0.4±0.7°C, P<0.01) and core (by +0.4±0.3°C, P<0.01) temperatures were higher at end exercise in HI. Mean skin temperature was not different between trials by 10 min recovery (P=0.96). Core temperature was higher in HI until 90 min recovery (P<0.01). Mean skin wetness (by +0.04±0.06 a.u., P=0.03) and the mean afferent stimulus (by +2.5±3.5 a.u., P=0.01) were greater at 10 min of exercise in HI, and remained until 60 min into recovery (P<0.01). The decrease in neck device temperature was greater in HI during exercise (at 30 min: by -4.9±9.6°C, P=0.06), but did not differ after 10 min recovery (P=0.60). There were no sex differences between males and females for the mean afferent stimulus and neck device temperature for exercise (HI: r=0.91, MI: r=0.96, both P<0.01) and recovery (HI: r=0.98, MI: r=0.96, both P<0.01). During exercise, there were no differences in the slopes (HI: -0.93±0.31; MI: -0.87±0.14/a.u., P=0.49) or y-intercept (HI: 43.4±11.6 a.u., MI: 42.5±12.3 a.u., P=0.35).
Heat Acclimation Causes Profound Post-Exercise Hypotension and Favorable Improvements in Lipid and Immune Profiles

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P=0.004). Only from pre-to-post HA, total cholesterol (170±22 to 152±15; P=0.002) and triglycerides (130±63 to 93±27; P<0.003) were reduced. A trend for changes in glycemic control (%AC; 56±5 to 53±4; P=0.033) was also found. For neutrophils (52±5±5% to 52±5±5%; P=0.05), lymphocytes (37±5±5% to 32±9±5%; P=0.067), and hemoglobin (20±4±1 to 3±1±0.1; P=0.006) were found after HA.

CONCLUSIONS: These preliminary data indicate that HA causes a profound post-exercise hypotensive response and favorable metabolic, lipid, and immune profile changes. Further examination of heat acclimation on vascular, metabolic, and immune responses will offer insight for benefits in other heat exposures with vascular, metabolic and immune dysfunction.

Purpose: The purpose of this study was to examine the 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 ± 2.6yrs; 180.5 ± 5.8cm; 85.3 ± 10.8kg; 38 ± 4.2±4±mL/min) 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, ηp2 = 0.258). Post-hoc analysis indicated a main effect of time during MT (F = 8.097, p < 0.001, ηp2 = 0.503), but not HT condition (F = 2.433, p = 0.065, ηp2 = 0.213). Specifically, during the MT, VO2 was significantly lower at M15 (p < 0.001), M30 (p = 0.015), M45 (p = 0.005) and M60 (p < 0.001) compared to M3. Furthermore, VO2 was significantly lower during the HT compared to MT during M60 (p < 0.001). No significant interaction was observed for VE (F = 1.384, p = 0.261, ηp2 = 0.148). A significant main effect of time was observed (F = 11.818, p < 0.001, ηp2 = 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).
Results: Data suggest that rapid and uncompensable Tc acquisition causes an altered cerebral oxygenation and haemodynamic response in the left-side PFC. There were no changes in the cerebral oxygenation and haemodynamic response during CON. The left-side response during PPE could have implications for cognitive processes during and/or following exercise in the heat.

**CONCLUSION**

Body water loss due to thermoregulation during exercise in a hot environment may cause a significant decrease in body mass, affecting blood plasma volume and consequently parameters such as blood glucose (BG) concentration. It is not known if the decrease in Tc that occurs as a result of this change in Tc will cause a decrease in BG concentration. In preliminary testing, the FPGA system showed an overall lower power consumption 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 data acquisition system (DAQ) 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. Funded by USAMRMC; author views not official US Army or DOD policy.

Heat stress has been shown to effect cerebral oxygenation and haemodynamics. There is although limited research evaluating the effects of rapid and uncompensable core temperature (Tc) acquisition, as which occurs when one is wearing personal protective equipment (PPE), on cerebral oxygenation and haemodynamics. PURPOSE: To determine the effects of rapid and uncompensable Tc acquisition on cerebral oxygenation and haemodynamics. METHODS: Fourteen male subjects (33.6 ± 12.1 years) performed an incremental exercise test to a termination criterion in a control session (CON) and an experimental session (PPE). RESULTS: Rate of thermal acquisition was significantly different (p = 0.001) between CON (0.02±0.04 °C/min) and PPE (0.04±0.19 °C/min). Time to termination (TTT) was also significantly different between CON (77.3 ± 22.8 min) and PPE (50.3 ± 12.4 min) and subjects also showed a lower HR throughout both conditions (p < 0.05), except M30 (p = 0.001). CONCLUSION: Data suggests recovery is moderately impacted in a high temperature environment, and will be sufficiently robust for outdoor field studies.

**CONCLUSION**

Extreme heat stress.

**RESULTS:** Following nitrate supplementation, mean arterial pressure decreased from 88 ± 5 to 80 ± 7 mmHg (P = 0.02). Participants were exposed to 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow and vascular conductance, and forearm blood flow and vascular conductance were measured throughout the exposure. RESULTS: Following nitrate supplementation, mean arterial pressure decreased from 88 ± 5 to 80 ± 7 mmHg (P = 0.02) in thermoneutral conditions. During a subsequent experimental session, mean arterial pressure was significantly lower POST vs. PRE (treatment x time interaction: P < 0.01); however, this effect was limited to the first 30 min of the heat exposure. No effect of dietary nitrate supplementation was observed on core temperature, mean skin temperature, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress (P > 0.05). CONCLUSION: Our results indicate that in aged individuals, dietary beet root juice supplementation with concentrated beet root juice (140 ml twice daily), participants experienced a 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow and vascular conductance, and forearm blood flow and vascular conductance were measured throughout the exposure. RESULTS: Following nitrate supplementation, mean arterial pressure decreased from 88 ± 5 to 80 ± 7 mmHg (P = 0.02) in thermoneutral conditions. During a subsequent experimental session, mean arterial pressure was significantly lower POST vs. PRE (treatment x time interaction: P < 0.01); however, this effect was limited to the first 30 min of the heat exposure. No effect of dietary nitrate supplementation was observed on core temperature, mean skin temperature, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress (P > 0.05). CONCLUSION: Our results indicate that in aged individuals, dietary beet root juice supplementation with concentrated beet root juice (140 ml twice daily), participants experienced a 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress (P > 0.05). CONCLUSION: Our results indicate that in aged individuals, dietary beet root juice supplementation with concentrated beet root juice (140 ml twice daily), participants experienced a 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress (P > 0.05). CONCLUSION: Our results indicate that in aged individuals, dietary beet root juice supplementation with concentrated beet root juice (140 ml twice daily), participants experienced a 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress (P > 0.05). CONCLUSION: Our results indicate that in aged individuals, dietary beet root juice supplementation with concentrated beet root juice (140 ml twice daily), participants experienced a 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress (P > 0.05). CONCLUSION: Our results indicate that in aged individuals, dietary beet root juice supplementation with concentrated beet root juice (140 ml twice daily), participants experienced a 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress (P > 0.05). CONCLUSION: Our results indicate that in aged individuals, dietary beet root juice supplementation with concentrated beet root juice (140 ml twice daily), participants experienced a 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress (P > 0.05). CONCLUSION: Our results indicate that in aged individuals, dietary beet root juice supplementation with concentrated beet root juice (140 ml twice daily), participants experienced a 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress (P > 0.05). CONCLUSION: Our results indicate that in aged individuals, dietary beet root juice supplementation with concentrated beet root juice (140 ml twice daily), participants experienced a 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress (P > 0.05).
Participating in marathons in hot and humid weather may lead to fatigue, syncope, injuries 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 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 186.44 ± 10.59 cm, VO₂ max 52.88 ± 7.09 ml/kg/min) had their lower limb skin temperature measured using IRT (FLIR T450) after running a marathon (80 m.a.s.l.) in a hot (thermal index 28.34 ± 3.27 ºC) 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 analysis into fourteen different areas and mean temperature of each area was used for analysis. A one-way ANOVA was used to compare thermal images taken 15 days and before marathon and 24 hours and 6 days after marathon.

**Results:** We found significant differences in skin temperatures: knee (D LL: F3,36 = 9.079, p = 0.004); Vastus medialis (D LL: F3,36 = 8.195, p = 0.001); Rectus femoris (D LL: F3,36 = 7.521, p = 0.002); Vastus lateralis (D LL: F3,36 = 6.598, p = 0.002); Semitendinosus (D LL: F3,36 = 4.150, p = 0.001); Biceps femoris (D LL: F3,36 = 4.150, p = 0.001); Popliteal fossa (D LL: F3,36 = 5.476, p = 0.001). These differences are significant 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.
used to model and predict GH output over time. The LSTM was trained on the first 1–4 hr of each of the exercise and resting profiles using lagged GH and SampEn. Five iterations of each model were run and the root mean square of the error (RMSE) from each of these iterations were compared across conditions. RESULTS: The LSTM models trained on the exercise profiles provided significantly better fit compared to the resting condition (RMSE$_{rest} = 0.289.0.29; \text{RMSE}_{exercise} = 0.41.0.26; p < 0.02), resulting in more accurate prediction of the nighttime changes in GH than resting profiles. CONCLUSIONS: The ability of these models to learn the relationship and accurately predict GH output based on the patterned regulation of cardia control throughout the day represents a shared hierarchical regulation between the HP and cardiac axes. These methods capture the more rapid time-dependent relationships that are currently missed with common assessment techniques.

**2098 Board #254 May 30 3:30 PM - 5:00 PM The Effects of Acute Ultraviolet Light Exposure on Post-Resistance Exercise Serum Testosterone in Older Men**

Alec Wallace, Shuyan Emanjohmic, Luis Segura, Josh A. Cotter, PhD, Evan E. Schick, PhD. California State University, Long Beach, Long Beach, CA.

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±2.1 cm, body mass 83.7±9.3 kg., BMI 25.9±1.15 kg/m$^2$) participated in two identical resistance exercise sessions followed by a 30-minute recovery. Sessions were approximately one week apart and the exercise protocol consisted of 4 sets of 10 repetitions of leg press, leg curl, 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 Effects Of Exercise On The Expression Changes Of Kiss-1/gpr54 In Testis Of Rats In Growth Phase**

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**No relevant relationships reported**

PURPOSE: To investigate the localization and expression level of KISS-1/GPR54 in testes and effects of exercise during the growth period of male rats . METHODS: 21d old weanling rats were randomly divided into group C (n=60) and group D (n=65). CE group took 5-weeks trained (60-70% VO$_2$max, 1h/day, 5days/week). The rats of two groups were killed on the 21st D, 35th D, 43rd D, and 56th D of growth from 21st D to 56th D,. KISS-1 and GPR54, but induced the decrease of KISS-1 and GPR54 mRNA during exercise intervention. Exercise intervention had no effect on the localization of KISS-1 and GPR54 mRNA and protein peaked at 43D (p < 0.01), and then decreased without significantly difference. Exercise intervention, the expression of KISS-1 protein in rats testis in each time point had the same trend as group C, but the expression level were significantly lower than group C. Both in CE and FS groups, GnRH mRNA decreased significantly before 56th day, which had the trend of increse. Both in CE and HE groups, the mRNA of Kiss-1 and GPR54 got the maximum levels on 42nd day, which opposed with the lowest level of GnRH mRNA. CONCLUSIONS: The changed trend of kisspeptin/ GPR54 signaling pathway during the growth period were obvious increase in high-fat diet rats. Exercise could change the trend of kisspeptin/GPR54 signaling pathway induced by high-fat diet especially after puberty.

**Board #257 May 30 3:30 PM - 5:00 PM Salivary and Serum Cortisol Proportion Dynamics Are Impacted by High-Intensity Exercise**

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**No relevant relationships reported**

Salivary cortisol (C$_s$) represents the free cortisol concentration of serum cortisol (C$_s$). It has been suggested that C$_s$ is approximately 5-10% of total C$_s$, however, the impact of diurnal variation in C$_s$ and how this pattern affects the proportion of C$_s$ and C$_s$ (C$_s$/C$_s$), has yet to be explored. PURPOSE: Therefore, the purpose of this study was to assess the diurnal changes of C$_s$ and the extent to which a high-intensity exercise bout may impact this relationship. METHODS: Male (n = 7) college-aged students (26.3±2.8 yrs, 176.5±8.1 cm, 73.6±12.6 kg, 9.9±3.2 BF(%), VO$_2$ max: 68.9±9.5 ml.kg$^{-1}$min$^{-1}$) completed two 24-hour (rest and exercise) cortisol profiles. Subjects had a catheter inserted at 0600hr and blood and saliva samples were collected simultaneously every 120 mins. During the exercise condition, subjects performed 5x30s sprinting intervals on the cycle ergometer, at a resistance of 7.5% of body mass. Subjects were permitted 3-min of passive recovery between bouts. C$_s$ and C$_s$ were analyzed via competitive-binding assay. C$_s$ was calculated as proportion of C$_s$ relative to C$_s$ at each time point. Multilevel 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 C$_s$ was fixed across all individuals. RESULTS: The IQR of C$_s$, was 3.56-6.29%. The greatest C$_s$ values were consistently observed during nighttime sampling with the magnitude of C$_s$ being greatest at 2300hrs. The cubic growth models were determined to best-represent 24-hr changes in C$_s$. The final model showed a significant effect for exercise (β = −1.37, p = 0.036, AIC = 1030.781). CONCLUSION: The greatest C$_s$ at 2300hrs appears to be driven primarily by elevations in C$_s$. 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 C$_s$ dynamics, especially during late afternoon and nighttime hours. It is therefore recommended that cortisol profiles be constructed from both total and free C$_s$ 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 Aporptosis study. Women aged 47 to 55 were randomly selected from the Finnish National Registry of some diseases. The biologically active form of vitamin D is dihydroxyvitamin D metabolites is not dependent on HC use.

**RESULTS:** A significant decline in hand grip force (-2.9 % (95%CI -4.5, -1.3; 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 -3.24 % (95%CI -4.6, -1.7; d=0.02) were observed following the menopausal transition. Walking distance significantly increased for 1.9% (95%CI 1.2, 2.7, d=0.38) while in walking speed changes were 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 Sklodowska-Curie grant agreement No75003, and by the Academy of Finland (ERMA study grant agreement 27532).

**METHODS:**

Several studies have investigated markers for exercise-induced fatigue. Physical and mental fatigue induces a secretion of salivary cortisol, and this hormone affects immunomodulation such as reduction of salivary immunoglobulin A (IgA) secretion. However, it is unclear whether the secretions of salivary cortisol and IgA levels in response to different exercise volumes are related to subjective fatigue and exercise performance.

**PURPOSE:** The aim of this study was to investigate relationships among salivary cortisol and IgA levels, subjective fatigue, and exercise performance after acute endurance exercise.

**METHODS:**

In the 20-min and exhaustive sessions, subjective fatigue increased at immediately after exercise and decreased 60, 120 min and 24 hours after exercise. However, MVC showed no change throughout the all sessions. In the resting sessions, no significant differences in salivary cortisol levels before and after exercise were observed. In the 20-min and exhaustive sessions, salivary cortisol levels were significantly higher 30 min after exercise as compared with before exercise and after then gradually decreased until 120 min after exercise. (p<0.05). No significant differences in salivary IgA levels before and after exercise were observed in all sessions. Additionally, salivary cortisol and IgA levels were positively correlated with the subjective fatigue (cortisol; r=0.243, p<0.05; IgA; r=0.167, p<0.05), but were not correlated with the MVC.

**CONCLUSIONS:**

These findings suggest that the changes in salivary cortisol and IgA levels may be related to increase in acute exercise-induced subjective fatigue. Supported by Grants-in-Aid for Scientific Research (#17H01218 and #16K13059, M. Iemitsu).

**REFERENCES**

D-67 Free Communication/Poster - Genetics

**TUESDAY, MAY 30, 2016**

**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 Hasegawa2, Naoki Horii1, Makiko Yoshikawa1, Katsunori Tsuchii2, Masatake Uchida2, Keiko Iemitsu1, Takeshi Hashimoto1, Kiyoshi Sanada1, Masao Kanamori1, Kohei Watanabe2, Mototsuyki Iemitsu3, Yuiitsu Musen University, Kawasaki, Japan. 2National Cancer Center Research Institute, Tokyo, Japan. 3Chukyo University, Aichi, Japan.

**No relevant relationships reported**

**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.**

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**No relevant relationships reported**

**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) to the catabolic metabolite (24,25(OH)2D) determines biological activity. In women, higher 25(OH)D concentrations are reported in oral contraceptive pill (OCP) users, but the influence of OCP and other hormonal contraceptives (HC) on vitamin D metabolites is not dependent on HC use.**

**RESULTS:**

Data included sport type, age, sex, weight and height. Height was transformed to age-

**PURPOSE:**

There is a significant concern that competitive sports in children and adolescents might hinder growth. Currently available data are limited and conflicting. The purpose of this study was to examine the trajectories of body height in competitive pediatric athletes.

**METHODS:** Data on all child and adolescent athletes that underwent annual pre-participation examinations in a sports medicine center from 2007-2018 were extracted. Data included sport type, age, sex, weight and height. Height was transformed to age-
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 to 0.03, p = 0.51), see Figure. In subgroup analyses, no significant change in height SDS was seen among athletes aggregated from classic weight-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
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(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 Aecenway 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.

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-oriented events, while the D allele seems like to be the opposite with power-oriented events. Furthermore, 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.

RESULTS: The genotype frequency of the AA, TA, and TT genotypes in the MCT1 gene were 43%, 49% and 8% in the national level and 44%, 32%, and 24% in the regional level. TT genotype frequency was lower tendency in national level climbers (5%) compared with regional level athletes (24%) (p = 0.089). The genotype frequency of the DD, ID, and II genotypes in the ACE I/Dgene were 16%, 38% and 46% in the national level and 3%, 38%, and 59% in regional level. There was no significant differences of frequency of the DD, ID, and II genotypes in the ACE I/D. CONCLUSIONS: Previous studies have shown that MCT1 T1470A polymorphism may associated with athletic performance in climbing athletes. The MCT1 T1470A and ACE I/D genotypes can 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.

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
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(No relevant relationships reported)

The MCT1 T1470A and ACE I/D polymorphisms are believed to play an important role in physiological functions and physical exercise. Previous studies have shown that MCT1 T1470A polymorphism and blood lactate concentration during and after high-intensity intermittent exercise. In addition, the I allele seems associated with endurance-oriented events, while the D allele seems to be opposite with power-oriented events. Furthermore, 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.

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Association Between Mitochondrial DNA Sequence, Heteroplasm, 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 (CFR) with exposure to a given dose of aerobic training: some individuals are highly trainable and increase CFR, 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, heteroplasm, 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 (CFR response levels: high responders n=15; lower 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 (supplementary-loop) hypervariable region (HVR) 2 at positions 72, 152, 163, 183, 224, 286, 295, 346, 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 Heteroplasm 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 CFR 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.
Combined effects on DHEA patterns: -2CG + 5HTTLPR (interaction effect, F(7.3, 126.3) = 3.7, p < .001), -2CG + Bcll (group effect, F(3, 53) = 4.2, p = .01), and 5HTTLPR + Bcll (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 serotonergic 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 were identified the relationship between tendon or ligament injuries and collagen gene polymorphisms such as, rs1800012 in COL1A1, rs12722 and rs3196378 in COL5A1 gene. However, effect of tendon and ligament inflammations on collagen-related gene polymorphisms 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. SNPs of rs12722 and rs3196378 in COL5A1, rs1800255 in COL3A1 and rs35796750 in COL6A1 gene were determined by real-time PCR with Taqman probe.

RESULTS: All subjects had GG genotype of rs1800012 in COL1A1 gene. The onset number of tendon and ligament inflammations in the student period of the university was significantly higher in CC genotype of rs12722 in COL5A1 gene as compared with CT and TT genotype individuals (P=0.05) and was significantly higher in CC genotype of rs3196378 in COL5A1 gene as compared with CA and AA genotypes individuals (P<0.05). Moreover, the onset number of tendon and ligament inflammations in the AA and AG genotype of rs1800255 in COL3A1 gene was tended to be higher than that in GG genotype individuals (P=0.078). However, the rs35796750 in COL6A1 gene polymorphism had no impact on the differences of the onset number of tendon and ligament inflammations.

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 (17H02182 and 16K13039, 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 relationship 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.

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 relationship 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.

**Introduction** Circulating 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 demonstrated 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), 2 ml of plasma were separated into 16 fractions of 1 ml. cfDNA concentration in plasma and SEC fractions was measured by real-time quantitative PCR of the L1PA2-repeat sequence with or without prior treatment of the fractions with DNaseI. To take pre-analytical considerations into account, the analysis was performed on freshly prepared plasma in a technical duplicate, and frozen SEC fractions. Vascular 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 DNaseI digest. Further experiments are required to clarify if the DNA is inside of EVs or on the outside, protected from DNaseI.

**Abstracts were prepared by the authors and printed as submitted.**

**INTRODUCTION**

Circulating 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 demonstrated 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), 2 ml of plasma were separated into 16 fractions of 1 ml. cfDNA concentration in plasma and SEC fractions was measured by real-time quantitative PCR of the L1PA2-repeat sequence with or without prior treatment of the fractions with DNaseI. To take pre-analytical considerations into account, the analysis was performed on freshly prepared plasma in a technical duplicate, and frozen SEC fractions. Vascular 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 DNaseI digest. Further experiments are required to clarify if the DNA is inside of EVs or on the outside, protected from DNaseI.

**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 years; 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 or 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 in (n = 14/32 each): 1) amnesia/ trouble remembering, 2) trouble understanding/confusion, and 3) visual disturbances. Dizziness was the least common symptom identified as a need to remove 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 for their removal from play decisions. This is encouraging as it suggests that PDS’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
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(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). The participants (60.5%) out of five with a concussion completed the randomized SCAT order. There was no significant effect of prior concussion on likelihood of receiving the randomized SCAT order (p =0.05). 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: These findings do not support the null hypothesis that SCAT symptom presentation order 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 Pelt1, Alissa H. Wicklund2, Steven P. Broglio, FACSM1. University of Michigan, Ann Arbor, MI. Orthopaedic 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 perception of concussion risk in contact sports such as football. The purpose of this study was to evaluate the effect of adult profession 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 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 midwest university and associated medical center between 2017 to 2018 (n=5849, age=39.5±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=0.23). Between-group nominal logistic regression was non-significant (p=0.20) in examining the difference in the perception 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 #276  May 30 3:30 PM - 5:00 PM
Changes in Fixational Eye Movements following Concussion
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(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 22% 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.

2120  Board #276  May 30 3:30 PM - 5:00 PM
Examining Persistent Deficits in Gait Utilizing Inertial Measurement Units
Griffin J. Feinberg, Andrew P. Lapointe, Kathryn L. Van Pelt, Lauren A. Dougherty, Allyssa Memmni, Katherine M. Breedlove, Steven P. Broglio, FACSM. University of Michigan, Ann Arbor, MI. (Sponsor: Steve Broglio, FACSM)
(No relevant relationships reported)

Purpose: The effects of concussion on gait have been studied using three-dimensional motion capture technology. However, the equipment expense may not be feasible for all clinicians and researchers. Inertial Measurement Units (IMU) are inexpensive, portable, and have been used to evaluate gait. The purpose of this study is to utilize IMU’s to evaluate gait deficits in concussed participants (CON) (time ≥1 year since concussion incidence) compared to non-concussed participants (NC). Methods:

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 no 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, and duration, 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<0.01). Turn velocity was faster for the concussed participants (mean CON= 208.2°/sec; NC= 208.2°/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.
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 assessment tool (Concorida Quadrant Biosciences Inc; Syracuse, NY). All subjects completed test 1, on average, 5.45 ± 3.53 days prior to 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=16) 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 the two 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 2 (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 injury at initial testing with large changes in cognitive and balance performance at re-test.

PURPOSE: It is recommended athletes receive annual concussion baseline testing that includes an assessment of postural control. Research has found concussion history does not correlate to baseline Balance Error Scoring System (BESS) scores. However, the BESS is not as sensitive in detecting when postural control has changed between groups to force plate measurements. The Stability Evaluation Test (SET) on the VSR Sport™ by NeuroCom® is an instrumented BESS and measures sway velocity. The purpose of this study was to determine the reliability of baseline sway velocity measurements taken during consecutive annual baseline screenings in Division I lacrosse players.

METHODS: 44 healthy Division I Lacrosse Players (14 females, 30 males; age = 20.57 ± 0.99; height = 69.59± 3.38; weight = 169.73bs ± 31.24) from one university participated in the study. All players were medically cleared for full participation and did not have a history of a concussion in the last 12 months. At the start of each season, players performed the standard 3 stances of the BESS test (double leg, single-leg, tandem) on two surfaces, firm and foam, while standing on the VSR Sport™ force plate.

RESULTS: A Pearson correlation analysis of the 2017 and 2018 sway velocities during each stance of the Stability Evaluation Test, found that none of the stance trials met the a priori threshold of \( r \geq 0.70 \) to indicate good test-retest reliability.

CONCLUSIONS: There is not a strong correlation between baseline balance measurements taken at the start of consecutive seasons. To ensure the reliability of measurements, it is recommended annual baseline measurements be taken even in the absence of a concussion. An individualized approach is ideal in the management of a concussion injury and baseline accuracy should be considered a critical component.

### Mean Sway Velocity Scores & Stance Correlations

<table>
<thead>
<tr>
<th></th>
<th>Double Leg, Firm</th>
<th>Single Leg, Firm</th>
<th>Tandem, Firm</th>
<th>Double Leg, Foam</th>
<th>Single Leg, Foam</th>
<th>Tandem, Foam</th>
<th>Composite Score</th>
</tr>
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<tbody>
<tr>
<td>2017 Mean Sway Velocity</td>
<td>0.69</td>
<td>2.19</td>
<td>1.31</td>
<td>1.75</td>
<td>4.88</td>
<td>5.40</td>
<td>2.69</td>
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<tr>
<td>2018 Mean Sway Velocity</td>
<td>0.63</td>
<td>2.18</td>
<td>1.38</td>
<td>1.58</td>
<td>3.60</td>
<td>3.61</td>
<td>2.17</td>
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<td>Correlation (r)</td>
<td>0.49</td>
<td>0.40</td>
<td>0.01</td>
<td>0.41</td>
<td>0.18</td>
<td>0.30</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Obesity has increased exponentially within the last three decades and is now widely recognized as one of the leading health threats due to its association with such as type 2 diabetes, cardiovascular disease, and hypertension. In recent years, there have been advances in technology such as bioelectrical impedance analysis (BIA), dual-energy X-ray absorptiometry (DEXA), and air-displacement plethysmography that has been used to categorize individuals into percent fat categories. However, there are still concerns with the validity of these devices. PURPOSE: The purpose of this study was to analyze the validity of an 8-point electrode BIA, DEXA, and air-displacement plethysmography methods compared to hydrostatic weighing. METHODS: 32 male (mean age ± SD= 22.4 ± 2.5 years) and 30 female subjects (mean age ± SD= 21.9 ± 2.3 years) performed body composition testing using BIA, DEXA, air-displacement plethysmography, and hydrostatic weighing. All tests were conducted in one continuous two-hour session for each subject. Subjects were instructed prior to testing to refrain from eating for a minimum of five hours but no more than ten, to avoid consuming alcohol within twelve hours of testing, to avoid caffeine within three hours of testing, to avoid large amounts of liquid within four hours of testing, and to refrain from exercising within 8 hours of testing. RESULTS: The one-way ANOVA with repeated measures and follow-up paired samples t-tests indicated that percent body fat estimated from DEXA (mean ± SD = 31.0 ± 8.9%) resulted in significantly greater values than hydrostatic weighing (23.3 ± 9.2%), air-displacement plethysmography (23.3 ± 10.8%) and BIA (23.6 ± 10.5%). In addition, the constant error (CE) and total error (TE) values of predicting hydrostatic weighing percent body fat from DEXA (CE = -7.7%, TE = 8.2%) was significantly greater than those associated with...
Aortic stiffness and cardiorespiratory fitness (CRF) are independent predictors of cardiovascular disease (CVD), cardiovascular (CV) events, and early mortality. However, the relationship between arterial stiffness and CRF 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., VO2max). Aortic stiffness was measured via carotid-femoral pulse wave velocity (cfPWV). Data were checked for normality, and Pearson product-moment correlations were performed to determine the association between CRF and arterial stiffness. RESULTS: VO2max for the entire cohort was 32.8±12.0 ml/kg/min (range 11.4-66.4). The entire cohort had a cfPWV (m/s) of 7.3±1.6 (range 4.8-12.2). cfPWV was moderately associated with CRF (r = -0.585, p < 0.001).

CONCLUSION: Arterial stiffness is inversely related to CRF. These data suggest that the beneficial effects of CRF on cardiovascular-related outcomes may be mediated, at least partially, through arterial stiffening.

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 between MF and arterial stiffness remains unclear. PURPOSE: To examine the relationship between MF and SMM with arterial stiffness. METHODS: Participants (N=203, 97 males/106 females) were apparently healthy adults (Age 48.3 ± 20.2 years, BMI 26.8 ± 4.9 kg/m2; VO2max 32.8 ± 12.0 ml/kg/min). Arterial stiffness was assessed through carotid-femoral pulse wave velocity (cfPWV). SMM was assessed through dual-energy X-ray absorptiometry (DEXA), while handgrip strength was measured through carotid-femoral pulse wave velocity (cfPWV). SMM was assessed through air-displacement plethysmography (EMG) 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.

Reserve of repolarization of the heart (RoR) is a non-invasive method to monitor the heart's response to stress. RoR assess stability of cardiac membranes and when excitation becomes unstable. Previous studies reported RoR as a useful tool to determine cardiac risk in cardiac patients. In this study we compared two cohort groups at rest and after exercise. Plasma samples were analyzed for stress proteins. RESULTS: Resting HR was statistically higher in the PTSD group compared to AH group (77.2 ± 3.1; 67.7±2.6 bpm, p < 0.0001). Resting RoR between both groups was not significantly different (AH=81.7%, PTSD = 78.15%, P > 0.2). RoR at the final exercise stage in AH group had significantly greater reserve (RoR = 40.4% compared to PTSD = 32.6%, P = 0.02) despite greater workload. Brain natriuretic peptide (BNP) increased in PTSD (pre = 139.5±27.8, post = 233.4±32.7 pg/ml, P = 0.02) compared to AH group with no change (pre = 123.9±30.2, post = 138±42.2 pg/ml). Plasma TnT was not different between groups at rest (P > 0.3) but increased significantly (P < 0.03) only in PTSD group with no changes in blood creatine kinase between groups and across time. Conclusions: These data suggest that PTSD individuals have less RoR in response to graded exercise compared to AH individuals. In addition, PTSD group had increased plasma BNP, and TnI suggesting an increased risk of having a cardiac event. It is suggested that this procedure may be useful as a screening process to help identify individuals with a risk of a coronary event.
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 20-parametric tests with two-tailed p value set at 5 %. RESULTS: At rest, HR was [supine: 64±12.8 bpm - 64±7.1 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.

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 preliminary 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 GSDIIIa underwent an incremental study until exhaustion. The study received institutional and NHS ethics approval. To determine whether calf muscle oxygen saturation (StO2) and vascular biomarkers of inflammation and oxidative stress were associated with an 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.

Women become more likely to develop chronic diseases as their metabolic function decreases after menopause. Vascular disease is a major problem for elderly women. The problem of these elderly women is due to a decline in health status due to lack of physical activity. 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: All variables showed interaction effects and there was a significant difference in delta values between the two groups. WBC and CRP levels significantly decreased in the EX (p<0.05). But control group CRP (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 had significantly increased. However, there was no significant difference between PWA and PWV. Conclusion: Our findings indicate that regular aquatic and resistance exercise were effective in improving the serum vascular inflammatory makers and blood pressure of the elderly women with lower cardiovascular disease risk, which are all due to the decreased physical activities. Therefore, if senior citizens continuously improve their efficiency of exercise, they can get the benefit of improving anti-inflammation and delaying the aging process with aging so that they can improve their level of healthy life in the old age.

Variblea Follicular Lutea p

<table>
<thead>
<tr>
<th>Variables</th>
<th>Follicular</th>
<th>Lutea</th>
<th>p</th>
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<tbody>
<tr>
<td>HRINITIAL (bpm)</td>
<td>96 ± 3.3</td>
<td>95.18 ± 4.4</td>
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</tr>
<tr>
<td>HRMAX (bpm)</td>
<td>182.5 ± 3.2</td>
<td>182.1 ± 2.9</td>
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<tr>
<td>C.R. (bpm)</td>
<td>86.4 ± 2.2</td>
<td>86.9 ± 3.8</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Conclusion: Glycogen debranching enzyme (GDE) deficiency which primarily affects the liver, skeletal muscle and heart and results in muscle weakness and profound exercise limitation. In this descriptive study 5 patients (3 female) (39 ± 11 years) with GSDIIIa underwent an incremental study until exhaustion. To determine whether calf muscle oxygen saturation (StO2) and vascular biomarkers of inflammation and oxidative stress were associated with an 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 chronotype profile in a group of triathlon 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 26th Brazil Triathlon Trophy (26º Troféu Brasil de Triatlón) in the Olympic distance participated in this cross-sectional observational study. Participants were evaluated for anthropometric characteristics (body mass, height, and body composition through [DEXA]), 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 variables of interest. No significant differences in subjective measures were observed between NOV and EXP group (p = 0.6). The NOV group had no changes in jump potentiation in both morning and evening tests. Notably, jump potentiation only occurred in morning types and 22.2% (n = 4) were classified as evening types. CMJ height in the EXP group was significantly higher (p < 0.05) in morning types than in evening types (1.73 ± 0.18 m) and MAV was lower in morning (55.3 ± 3.7 km/h) than in evening types (59.0 ± 4.2 km/h), indicating that EXP group were more adapted to morning training and thus having better physiological adaptations. However, there are no data about chronotypes and physiological profile.

CONCLUSIONS: Chronotype profile is an important factor to determine the athlete's performance and training adaptation. However, there are no data about chronotypes and physiological profile.

The Effect of Time of Day on Jump Potentiation in Distance Runners


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The Effect of Time Restricted Feeding On Metabolism Depression And Circadian Rhythms


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 objective measures given to participants at testing sessions. 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 during non-TRF and TRF. Analysis revealed that resting RQ values experienced a significant increase (p = 0.002) between testing non-TRF and TRF testing periods (p = 0.034) and pre-test and TRF testing sessions (p = 0.008). Direct correlations were found between BADS, total sleep and resting RQ. 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 time and depression in the present study. Future research is needed to verify if increased utilization of carbohydrates at rest influences changes of circadian rhythms and depression occurrence.

Circadian Phase Is Associated With Self-reported Chronotype In Young, Sedentary Adults

J. Matthew Thomas, Julie S. Pendergast, W. Scott Black, Philip A. Kern, Jody L. Clasey, FACSM. University of Kentucky, Lexington, KY.

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 level 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 melanin 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 associations between DLMO and chronotype, as well as body composition, in a sample of young, sedentary adults. METHODS: Fifty-two adults (19 male, 25 ± 6.0 yrs; 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 ≥ 0.5 pg/ml) and dim light melatonin onset (DLMO). Chronotype was measured as the midpoint of DLMO and bedtime. RESULTS: A significant decrease in total sleep time and depression in the present study. Future research is needed to verify if increased utilization of carbohydrates at rest influences changes of circadian rhythms and depression occurrence.

Social Jetlag Is Associated With Higher Evenness Index

Stephanie Witzel Esteves Alves, Olivia Francisco Antunes, Marcos Mónico-Neto, Hanna Karen Moreira Antunes. Universidade Federal de São Paulo, São Paulo, Brazil.

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Currently, the social demands imposed by work, school and academic activities prevent young 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 (nº 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 (subscales: 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 finds suggest that the presence of SJL didn’t impact the volunteer’s humor profile and longer SJL is associated to higher evenness index.

Melatonin is a hormone which controls sleep, inflammation, and oxidative stress. 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. **PURPOSE:** This work evaluated the effects of aerobic physical exercise on melatonin under hypoxic conditions. **METHODS:** 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, 71.1 ± 4.1 kg); Exercise under Hypoxia (EH) - (26.1 ± 3.2 y, 71.1 ± 3.2 kg); and Exercise under Normoxia (EN) - (24.1 ± 3.1 y, 72.3 ± 2.1 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 in a room devoid of any intervention. The normobaric hypoxia condition was conducted on the 1st and 2nd days at 7:30 AM as well as on the 1st and 2nd nights at 10:30 PM. 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 (28.1 ± 2.1 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.
Elastic Band Resistance Training Effects on Strength and Sleep of Shift Workers

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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 mass, exercises repetition number and sleep (sleep duration, sleep latency, sleep efficiency and weak after sleep onset) were assessment pre and post-training. The sleep variables were determined by actigraphy technique for during seven days. The pre and post-test comparisons were made using paired t test. RESULTS: The arm muscle area, increased after training (7015.5±1859.3 vs. 7571.19±1723.625, p<0.05) as well as exercises repetition number (shouder 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±8.4; 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±36.6 vs. 375±49.3 min; Sleep Latency: 28.5±32.7 vs. 14.0±15.0 min; Sleep Efficiency: 86.5±7.7 vs 86.5±7.5%; Weak after sleep onset: 54.4±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, MAFRE, CAPES and CNPQ.

Impact Of Sleep Deprivation On Flexibility

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PURPOSE: The purpose of this study was to verify the impact of sleep deprivation in flexibility of young adults. METHODS: Ten sedentary male young adults (Mean age: 24.3 ± 3.8 years old, body mass index: 24.8 ± 2.5 kg/m²) wore wrist actigraph before and during the 36-h of sleep deprivation to measure sleep wake cycle, and Passive Maximal Range of Motion (PROMmax) was evaluated by the modified knee extension test with a fleximeter in 4 different moments: at onset of sleep deprivation (8:00 am, day 1 – baseline), and after 12h (8:00pm, day 1), 24h (8:00am, day 2) and 36h (8:00pm, day 2) of sleep deprivation. Volunteers lay back with the hip flexed at 90° and the initial knee ROM (º) was considered as 90º right knee flexion. PROMmax was measured 06 times, and mean values at the 03 lasts was analysed. Analyses of Paired-Samples Variance were used to compare the variables in four moments, and statistical significance set at p<0.05. RESULTS: PROMmax values showed significant difference (F1,38 = 51.148, p<0.001) after 12h (71.7 ± 0.27; CI95% = 66.2-77.2), 24h (71.0 ± 2.6; CI95% = 65.8-76.3) and 36h (69.8 ± 2.6; CI95% = 64.5-75.1) of sleep deprivation compared with baseline (73.0 ± 2.7; CI95% = 64.5-75.1) and 36h (69.8 ± 2.6; CI95% = 64.5-75.1) of sleep deprivation. Moreover, there was decrease of PROMmax (F1,38 = 17.951, p<0.001) from 12 h to 36 h and from 24 h to 36 h of sleep deprivation. CONCLUSION: Our findings suggest that sleep deprivation may have a negative impact on PROMmax. Furthermore, 12 h and 36 h after baseline moment showed reduction of the PROMmax even as the time of maximal circadian rhythm values (acrophase) have generally observed between 4:00pm and 8:00pm. The duration of sleep deprivation and the circadian time are important in determining the impairment in passive flexibility performance. Acknowledgment: CAPES, CNPq, FAPEMIG, CEMAS, CEPE.

The Effect of Acute Sleep Restriction on Running Mechanics during an Exhaustive Run

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Purpose: Inadequate sleep is a known risk factor for injury, but the mechanisms by which sleep restriction increases injury risk remain unknown. The purpose of this study was to determine if running mechanics during an exhaustive run, including average peak impact accelerations between the tibia and the forehead, would be altered following one night of sleep restriction. METHODS: Two male and seven female subjects (21 ±3 yrs, 55 ±110kg) completed an exhaustive treadmill run following either 8 hours (well-rested, WR) or 3 hours of sleep (sleep-restricted, SR) in a randomized crossover design, separated by at least one week. The exhaustive treadmill run was performed at an intensity equal to the subject’s ventilatory threshold until volitional fatigue. Wireless inertial measurement units (IMUs) were placed on the right tibia and forehead. Average right tibia peak impact accelerations (RtPk), average head peak impact accelerations (HdPk), and shock attenuation (ratio of RtPk to HdPk) were measured for 3 minutes during the first 2-5 minutes and final 3 minutes. Pair t-tests were used to compare each dependent variable (F0.05) (RtPk vs HdPk, HPR vs HDP). Results: Time to exhaustion during the exhaustive treadmill test was not significantly different between the WR and SR conditions respectively (38.5 ±15 minutes, 40.0 ±14.7 minutes, p = 0.69). There were no significant differences in shock attenuation between conditions during the first 2-5 minutes (WR: 5.19 ±0.72g, SR: 5.07±0.92g, p = 0.49, WR: 5.53±0.87g, SR: 5.29±0.96g, p = 0.64) and HDP (WR: 2.12±0.44g, SR: 2.11±0.37g, p = 0.79, WR: 2.22±0.45g, SR: 2.30±0.36g, p = 0.76) during the first 2-5 minutes and final 3 minutes respectively. Conclusion: Running mechanics were not altered following one night of sleep restriction. These data suggest that one night of inadequate sleep is not sufficient to alter running mechanics, however more research is needed to understand the possible effects of chronic sleep restriction and its potential influence on injury risk during running.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

2149 Board #305 May 30 3:30 PM - 5:00 PM
Evaluation of Shoulder Health of Collegiate Wheelchair Basketball Athletes
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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 ultrasonography 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 Analog 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 (USPRS) 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 comparing the WR to the SR condition during the drop-landing task. The difference was significant in the single-leg drop-landing task, as well as 5 trials on each leg of a single leg stop-jump task. Peak knee flexion angles (PkKF) were captured using 3D motion capture. Vertical ground reaction forces (VGRF) for each leg were captured with two force plate sets.

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 PkKF was found (Right WR: 68.7 ±32.7°, SR: 51.1 ±34.2°, p=0.35). When comparing the WR to the SR condition during the drop-landing task. The difference in VGRF during the single leg stop-jump task approached significance for the left leg (WR: 2.52±6.1, SR: 2.72±4.0, p=0.052). No other 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.

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.

Pain and functional outcomes following shoulder injuries are important to provide better context in injury treatment and prevention.

Supported by the Craig Neilsen Foundation.

2150 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 mechanisms and 35.7% chronic in nature. The acute injuries occurred during game competition (55.3%), practice (14.3%), and off-season (66.7%); 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 the top 3 anatomic locations of surgery were knee (35.5%), 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,
**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 was 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%) of the respondents are female. Most (85%) practice figure skating year-round; 85% of the skaters participate in competitions. Some skaters also participate in more than one discipline, including singles (n=68), pairs (n=3), ice dance (n=21), synchronized skating (n=29), and theatre on ice (n=17). More than a quarter (27%; n=24) of participants reported spine injuries/back pain. The most common diagnosis was musculoskeletal pain. Treatment was primarily guided by primary care (n=10), sports medicine (n=13), physical therapists (n=14) and athletic trainers (n=10). Half of those who reported back pain did not present to a health care provider (n=12, 45%; n=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) skaters did not present to a HCP for evaluation of their first concussion. All concussions occurred during practice and most (92%; n=22) were during on-ice activities. The most common mechanism of injury was a fall (62%; n=15). 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.

**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.

**PREPARTICIPATION PHYSICAL EVALUATION SYSTEM: A PILOT FEASIBILITY STUDY**

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**METHODS**: 56 participants completed the Hospital for Special Surgery Pediatric Functional Activity Brief Scale (HSS Pedi-FABS), the Psychovitality (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). Additional participants 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, (n=48) reported that they expected to return to sport within less than six months of surgery. A 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 an 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=0.28). 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 level or less strenuous sport. There was no significant association between perceived social support and confidence in returning to sport.

**A REVIEW OF THE INJURY PATTERN OF THE 2018 CHICAGO MARATHON**

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**RESULTS**: 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 taken at 21 course medical tents and 2 finish line tents and categorized as either musculoskeletal, medical, wound care, or other. The data was divided into quartiles: miles 0-10, 10-18, 18-26.2, and finish line. The rate of each diagnosis was then compared between the quartiles using a chi-square analysis.

**RESULTS**: 3.8% of the runners visited the medical tents. Visit volumes had a bimodal distribution in the 2nd and 4th quartiles. 41.6% of runners seeking medical help did so at the finish line compared to 8.6%, 32.8%, and 17.0% in the first three quartiles respectively. 50.6% of all complaints were musculoskeletal, followed by 15.2% medical, 17.9% wound care, and 15.1% other. The percentage runners with musculoskeletal complaints were 24%, 75%, 16%, and 51% in the first, second, third, and fourth quartile respectively. Conversely, the percentage of medical complaints peaked in the 4th quartile with percentages of 1.1%, 5.8%, 1.7%, and 31.0% respectively.
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 (BTI) 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 15 ng/mL with severe deficiency below 13 ng/mL. 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.

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. 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 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% 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 in RTP decisions. Physicians and ATCs weighted ImPACT changed 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, self-rank is less important to ATCs compared to physicians. Although age was considered important in self-rank it was not a significant contributor to RTP decision making.
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 remain aware of the high prevalence of ED/DE and consider screening for it across age levels, with significantly less symptoms being reported in the middle school athletes.

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 concussion 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.

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 3 mL of diluted yellow latex into the bursa using an in-plane, anterior-to-posterior-superior 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 infradrellar 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 tendinosis. 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.
**2164** Board #320 May 30 3:30 PM - 5:00 PM

**It's More Than A Headache**

Juan M. Guzman, Jr., Darin Rutherford, Dennys Maldonado. 

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(No relationships reported)

**HISTORY:**  

15yo male high school soccer player with headache and dizziness following injury 1 month prior.  

Event was soccer ball striking right temporal area with fall to the ground without secondary head trauma or loss of consciousness. On rising, patient was knocked down by the opponent. He removed himself from the game due to symptoms of headache, balance problems, dizziness, sensitivity to light and noise, irritability, feeling slowed down, feeling mentally foggy, difficulty concentrating, and having visual problems. He had associated neck pain, numbness and tingling in the left upper extremity and left lower extremity after the injury. No weakness in the upper or lower extremities. No retrograde or anterograde amnesia reported. He continued to play the game.  

Reported his symptoms to the coach and licensed athletic trainer (LAT) when the game finished.

**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.*  

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(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). A 15-year-old male was diagnosed with Osteoid Osteoma. **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.
**Case 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 thigh. 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 dyspnea GI: abdomen soft, non-tender Skin: no bruising Neuro: decreased sensation subjectively along the outer right thigh from hip to knee MSK: Pain to palpation along proximal hip flexors and AHS, no defect in muscle palpated, full AROM, PROM of hips, 4/5 right hip flexion secondary to pain, 3/5 on left 5/5 strength bilaterally with hip extension, adduction, abduction, as well as knee flexion and extension. No spinous process or SJJ tenderness to palpation, no step offs appreciated.

**Diagnosis:** 1. Avulsion fracture of AHS with associated nerve injury 2. Hip flexor strain with malagaria paresthetica 3. Hip flexor strain with direct nerve injury from ice 4. FAI with acute hip labral tear 5. Lumbar disc herniation

**Tests and Results:**

1. **Tests and Results**
   - **#1:** Patellar subluxation
   - **#2:** Femoral condyle fracture
   - **#3:** Lateral collateral ligament tear
   - **#4:** Meniscal tear
   - **#5:** Tibial bone contusion

**Treatment and Outcomes:**

1. Pain relief from ice and 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.

**Diagnosis:** 1. Tall 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.

**Diagnosis:**

1. Acute tear of right triceps, long head, grade 2b
2. Treatment & Outcomes: Platelet-rich plasma injection into triceps tear followed by compression and 2 days rest. Progressive, sport-specific, pain-free strengthening with ATC guidance. Athlete avoided weight bearing on hands and stretching of triceps. She tolerated dance and trampline work without issue. Upon reaching 80% speed/power without pain or functional limitation, 2 weeks after diagnosis, we performed serial US exams to evaluate tissue healing and guide progressive muscle loading. 2 week US demonstrated decreased fascial thickening, 2 cm fiber gap w/hyperemia persisted. Absent contraction at site of injury remained, abnormal contraction of surrounding fibers was improved. Continued rehab, but did not progress beyond 80% at this same time regardless of pain-free status. 4 week US revealed resolution of hematoma and fascial edema. Mild hyperemia remained at zone of injury. Some abnormal contraction at site of injury present, and normalized contraction of surrounding fibers. Athlete was released to gradually RTP under ATC guidance.

**Tests and Results:**

1. Positive patellar apprehension on left
2. Range of motion left knee: painful active and passive range of motion, 45 degrees of flexion active and passive, 0 degrees extension active and passive
3. Positive patellar apprehension on left
4. Lower extremity normal
5. Differential Diagnosis
   - Patellar subluxation
   - Femoral condyle fracture
   - Lateral collateral ligament tear
   - Meniscal tear
   - Tibial bone contusion

**Notes:**

- Pain relief from ice and therapy, with work modifications to limit weight bearing status.
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   - Patellar subluxation
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**Notes:**

- Pain relief from ice and therapy, with work modifications to limit weight bearing status.
- Ortho Foot and Ankle referral to address operative management in process.
- Referral to Rheumatology after case discussion given concern for inflammatory arthritis.
- 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 
May: 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 posteroarticular 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.

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**HURTING HUMERI IN A TEENAGE FENCER**

**Jacob Jones, William Meehan, III. Boston Children’s Hospital, Boston, MA.**

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**(No relationships reported)**

**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 dull, aching 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’s pain resolved and restarted upper extremity PT. At 2 months follow-up, he endorsed similar symptoms on his left upper extremity, despite not using the arm for any strenuous activities apart from PT


**TEST AND RESULTS:** Right humerus x-ray: Cortical thickening of the right mid humeral shaft, with subtle periosteal reaction. Mottled cortical thickening which could represent an atypical stress reaction location.

**DIFFERENTIAL DIAGNOSIS:** 1. Medial Epicondylitis 2. Cubital Tunnel Syndrome 3. Flexor Pronator Syndrome

**TEST AND OUTCOMES:** Surgically treated with release of anterior subcutaneous nerve transposition with a nerve protection wrap, neurolysis of the posterior medial antebraachial 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 for 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.

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**AN UNUSUAL PRESENTATION OF AN INCREASINGLY COMMON INFECTION**

**Erica Martin. The University of Michigan, Ann Arbor, MI.**

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**(No relationships reported)**

**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 and 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 empirically with Tums with follow up in 1-2 days. She presented to the emergency department that time she is also having resting pain. At this time she is also having resting pain.

**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 cervical discharge. STI testing done, in addition to urine pregnancy testing. Urinary 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.

A Narrow Wrestling Decision

Tyler K. Drewry1, Richard Okragly1, Jaideep Chunduri2.

1TriHealth, Cincinnati, OH; 2Beacon Orthopaedics, Cincinnati, OH. (Sponsor: Henry Stenic, MD, FACSM)

Email: ktdrewry88@gmail.com

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 crepitation noted. Bilateral upper and lower extremity strength, sensation, and reflexes testing were normal. No clonus and negative Babinski, Spurling’s, and Hoffman’s signs.

DIFFERENTIAL DIAGNOSIS:
1. Cervical paraspinal muscle strain
2. Cervical Cord Neuropathy
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 with associated Cervical Cord Neuropaxia and Cervical strain

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 transient spinal cord injury necessitating a visit to the ER. He was referred for a second opinion to a neurosurgeon regarding clearance for return to play.

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)

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. Mandible dislocation

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.

A Real Pain in the Neck: A Football Player with Atypical Post-Traumatic Neck Pain

James Suchy, Doug Keene, FACSM. OHSU, Portland, CA.

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(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; HIEENT: tender 5 x 3 cm subcutaneous mass on the antero-lateral neck, no bruits appreciable; MSK (Neck): tenderness to palpation along the entire right SCM, no spontaneous 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 heterogenous 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.
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:

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 boxto 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.

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**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 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 antibiotic 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 vital signs. There was a mildly tender palpable crepitus over the anterolateral 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:**

**TREATMENT AND OUTCOMES:**
1. Conjoined left peroneal tendon subluxation with tenosynovitis and absence of fibular groove.
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. Podiatry 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.

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**Board #335**
May 30 3:30 PM - 5:00 PM

**Shoulder Pain in a Weightlifter**

Kelly Joy Valignota, Terry Nicola, FACSM, Melody Hrubes. UIC Sports Medicine, Chicago, IL. (Sponsor: Dr. Terry Nicola, FACSM)

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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 Hawkins’, 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 extensors, 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.

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. DIFFERENTIAL DIAGNOSIS: 1. Medial tibial plateau stress reaction 2. Distal MCL sprain 3. Pes anserine bursitis

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 protuberance 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 protuberance, 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.
to completely extend knee. Denies acute trauma. Pain is improved with massage and stretching. Occasionally taken NSAIDS for pain management. Denies numbness, tingling, weakness, syncope, 2, redness, fever, or chills. XR and US performed in clinic. Subsequently, MRI of left knee was ordered.

PHYSICAL EXAMINATION: LEFT KNEE Symmetric, no quadriceps atrophy No effusion No TTO over quadriceps tendon, patella, patellar tendon, medial joint line, MCL or LCL Left: Active ROM: 5-135, PROM 0-135 Right: Active ROM: 5-135 Clark Exclusion: 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 meniscus click without pain Thessaly/Apley: neg Ober: very flexible at level of hip Short and hypertonc hamstring on left, w/o tenderness to palpation No tenderness along IT band Thomas: positive Straight leg 5/5: hip and knee flexion and extension Sensation intact to light touch

DIFFERENTIAL DIAGNOSIS: Hamstring hypertonicity, Mass/tumor, Reactive arthritis, Enteropathic arthritis, 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 physis US left knee: normal hamstring tendon and muscle no fluid appreciated along tendon sheath, no pes anserine bursitis, no IT band bursitis, no effusion, meniscus not visualized

MRI Left knee: discoid lateral meniscus with horizontal tear

TREATMENT AND OUTCOMES: Left discoid meniscus sancorization 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 Okuyama2.
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 girls runners (15/y.o, 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.

2198 Board #2 May 30 6:00 PM - 7:00 PM Pre-Race Risk Screening and Stratification Predicts Adverse Events - SAFER Study In 76654 Distance Runners
Martin Schwellnuss1, Sonja Swanewelder2, Esme Jordaan3.
1SEMEL, University of Pretoria, Pretoria, South Africa. 2South African Medical Research Council, Cape Town, South Africa.

No relevant relationships reported

PURPOSE: The purpose of this study was to determine if a pre-race medical screening and risk stratification program predicts adverse events (ability of a runner to finish the race, or develop a medical complication) during an endurance running event.

METHODS: This prospective study, conducted during the Two Oceans marathon races (21.1km and 50km) in South Africa over 4 years, involved 76654 consenting race entrants. Race entrants completed a pre-race medical screening questionnaire at registration (3-4 months before the race), and were risk stratified into four groups: very high risk (VHR; existing cardiovascular disease - CVD), high risk (HR; risk factors for CVD), intermediate risk (IR; existing other chronic disease, medication use or injury), and low risk (LR). All runners in the VHR and HR categories were provided with educational information to decrease the risk of medical complications, and were also advised to undergo a pre-race medical assessment. Runners were tracked from registration to starting and finishing the race, and medical encounters (ME) were documented. Main outcome variables were the did-not-start (DNS; % runners registering but not starting) and the adverse event rate (AE; defined as % starters that did not finish the race (DNF) or had an ME) in each risk-category.

RESULTS: The DNS rate (%: 95% CI) for runners was similar in all risk categories (VHR=19.5; 17.9-21.2, IR=18.8; 18.0-19.7, IR=18.4; 18.0-18.9, LR=18.6; 18.2-19.1)(p=0.604). The DNF rates in the VHR (2.2; 1.6-3.0)(p=0.005), IR (1.8; 1.5-2.1)(p=0.017), and IR (1.9; 1.8-2.1)(p<0.001) were significantly higher compared to the LR (1.4; 1.2-1.5). The overall AE rates for runners in the VHR (2.3; 1.8-3.0) (p<0.001), HR (1.8; 1.5-2.1)(p=0.0323), and IR (2.0; 1.9-2.9)(p<0.001) were significantly higher compared to the LR (1.5; 1.3-1.6).

CONCLUSIONS: A pre-race medical screening, risk stratification and educational intervention program did not change the DNS in the risk categories. However, runners in the higher risk categories, that chose to start the race, were more likely to suffer an adverse event (not finish the race or present with a medical encounter) compared with runners in the lowest risk category.

2199 Board #3 May 30 6:00 PM - 7:00 PM Impact of Silver Ion Laundry Treatment on Athletic Gear and Environmental Pathogens and Athlete Health
Priya Balachandran1, John J. Openshaw2.
1Applied Silver, Hayward, CA. 2Stanford University, Palo Alto, CA.

No relevant relationships reported

Community-acquired infections caused by *Staphylococcus* and MRSA can spread easily through sharing towels, gear and contaminated surfaces. The resulting skin infections can lead to athlete disqualifications, cancellations of competitions and potential impact on team performance. In this study, we evaluate a residual antimicrobial textile treatment as an environmental hygiene and infection control strategy through improved textile cleanliness and reduced athlete risk for infection.

PURPOSE: To determine the impact of silver-based residual antimicrobial textile treatment on *Staphylococcus* and MRSA levels on athletic gear, environmental surfaces, athlete infection rates and number of missed play days. METHODS: The study, conducted at a professional sports facility over a six-month period, included pre-season and regular season use. Residual antimicrobial silver ion laundry additive was injected onto textiles during the final rinse stage of the facility’s standard laundry process. Bioburden data for *Staphylococcus* and MRSA was collected approximately every 4 weeks using contact plates. Athletes’ shirts, shorts, jerseys, girdles and towels, and locker room surfaces including carpets, upholstery and other hard surfaces were sampled. Infection rates and number of days missed pre- and post-laundry treatment were also being recorded. Samples collected before initiating the silver ion textile treatment served as the control data set. RESULTS: Prior to silver-ion treatment implementation, significant levels of *Staphylococcus* were measured on athlete textiles (average 75 CFU/100 sq. cm.) and on environmental surfaces (average 16 CFU/100 sq. cm.). Silver ion treatment of the textiles resulted in dramatic decreases in *Staphylococcus* by 77% on textiles and by 37.5% on environmental surfaces. Similar trends were also observed with MRSA. The overall bioburden levels continue to trend downward during the period of treatment. CONCLUSIONS: The current results demonstrate that a normal laundry process augmented with an active antimicrobial treatment provide athletic gear and a locker room environment that are clean. Final data related to cleanliness, infection rates and player days will be tallied at the close of 2018.
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 sport 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 ≥1 other non-running high school sports); moderate specialization (only distance running sport(s) for ≤8 months/year, or participation in distance running sport(s) for ≥9 months/year and ≥1 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:** Overall, 21.9% of the runners were high sport specializers, and 37.5% and 40.6% were moderate and low sport specializers, respectively. Twenty-three (35.9%) runners had low BMD (Z-score < -1.0). After adjusting for gynecological age and BMI, high sport specializers were five times more likely (OR=5.4, 95% CI: 1.3-23.3; p=0.02) to have low BMD (Z-score < -1.0). After adjusting for gynecological age and BMI, high sport specializers were five times more likely (OR=5.4, 95% CI: 1.3-23.3; p=0.02) to have low BMD than low sport specializers.**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.

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**Excessive long-term training and extensive exertion during exercise can induce 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 the Korean Mistletoe extract supplement group (KME, n = 10) and the control group (CON, n = 10). 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 minutes 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-strengh exercise) among active individuals, indicating improved anti-inflammatory activity.

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**The Effects Of Subconcussive Impacts On The Neurocognitive Function Of Men's Collegiate Lacrosse Players From Pre-season To Post-season**

Caroline Varlotta (Sponsor: Dr. Gerard P Varlotta, FACSM), Joshua Giordano, Joseph Miceli, Brandon Bug, Hailee Zwiwel, Matthew VarlottaHeller. NYIT-COM, Old Westbury, NY.

There is an estimated 1.6 to 3.8 million sports-related mild traumatic brain injuries (mTBI) per year in the United States. Football is more commonly studied than other sports, even though men’s lacrosse has almost as great a risk of mTBI. Since many players of this age group are in schools of higher education, mTBI can inhibit their ability to learn in the classroom. **PURPOSE:** To examine the effects of total number of impacts, cumulative magnitude, and cumulative rotation, as measured by accelerometer, on neurocognition, as measured by time to complete the Trails A task in pre- and post-season. **METHODS:** We examined 10 male freshmen NCAA Division II collegiate lacrosse players in pre- and post-season (January and May). Subjects wore the Vector mouthguard, which contains accelerometers, during full contact practices and games. Vector mouthguard recorded impact number and magnitude. Subjects’ cognition was evaluated by C3iLogix Trails A test. **RESULTS:** The data was analyzed by comparing athletes’ mean scores of Trail A between pre- and post-season with paired samples t-test and correlating it with the total number of impacts, cumulative impact, and cumulative rotation with computation of Pearson correlation coefficients. **Conclusion:** There is a significant correlation between total number of impacts and cumulative impact (r=0.74, p<0.001), cumulative rotation (r=0.71, p=0.02). The athletes took longer to complete the Trails A task in post-season if they experienced an increased total number of impacts, cumulative impact, and cumulative rotation. These changes may indicate the number of impacts, cumulative impact, and cumulative rotation affects athletes’ cognitive abilities without clinical symptoms or reporting of mTBI. The results of this pilot study suggests further investigation is warranted.
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%) figure 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/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/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/N=22/24) were during on-ice activities. The most common mechanism of injury was a fall (62%; n/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.