Mid-Atlantic Regional Chapter of the American College of Sports Medicine (MARC-ACSM)

42th Annual Scientific Meeting - 2019

ABSTRACT BOOKLET

Friday, November 1st, 2019
and
Saturday, November 2nd, 2019

Sheraton Harrisburg-Hershey Hotel
Harrisburg, PA

Differences in Performance Decline Between Sex Under Simulated Military Operational Stress Differences In Performance Decline Between Sex Under Simulated Military Operational Stress

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PURPOSE: Physical exertion, cognitive overload, sleep deprivation and caloric restriction are factors of operational stress in the military. This study aimed to investigate how Simulated Military Operational Stress (SMOS) effects performance on Tactical Mobility Test (TMT) both in men and women. **METHODS:** As part of an ongoing study; Forty male soldiers (26±5 yrs, 174±8 cm, 78±14 kg) and eleven female soldiers (25±5 yrs, 175±13 cm, 88±21 kg) completed a SMOS protocol lasting 5 days (D) and nights (N). Days 3 & 4 (D3, D4), subjects consumed 50% of caloric demands. N1, 2, & 5 (D1, D2, and D5) subjects slept from 2300-0700. N3-4, subjects slept from 0100-0300 and 0500-0700. Familiarization was completed D1. During D2 & 5 participants underwent a Tactical Mobility Test (TMT), consisting of the following: 2-min water can carry (WCC) (20 kg each hand), fire & movement course, 20-m casualty drag (CD) (91kg), 300-m shuttle run unloaded (SRU) and loaded (SRL) (16 kg), 2-mi paced, and 2-mi best effort timed ruck march (RM) (15 kg). Two-way mixed ANOVAs with Bonferroni Post Hoc ($p<0.05$) were used to identify if the difference in TMT performance form D2-5 was different between men and women. **RESULTS:** Regardless of sex a main effect for SRUt across days was found. SRUt increased by 6% from D2 to D4 and D5 (D2: 99.16±18.75, D4:104.99±21.50, p=0.008; D5: 105.34±18.37, p=0.002); additionally, D5 increased by 5% from D3 (D5: 105.3384±18.37, D3: 100.91±18.89; p=0.008). Although insignificant, mean CD time for males from D1 to D4 decreased by 5% from 44±27 to 42±25 seconds, while in women D1 to D4 increased by 13% from 76±29 to 86±54 seconds. Sex differences in performance approached significance; however, there was a small sample size and limited power base on current data. **CONCLUSION:** Short-term exposure to military operational stress leads to a decline in anaerobic capacity regardless of gender. The preliminary findings suggest SMOS the affect women and men equally. Even though there was not a statistical difference in CD time; there were possible relevant differences related to operationally differences that should be considered. When pulling a fallen soldier to safety 10 second unexposed on the battlefield can increase susceptibility to fire for both the wounded and the rescuing solider. Future investigation with a larger sample size is needed.

This study was funded by the Department of Defense (Award # W81XWH-17-2-0070). The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

Habitual Alcohol Consumption and its Relationship to Physical Fitness in College-age Students

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Alcohol consumption is common among college-aged students and may influence an individual's physical activity levels and physical fitness performance. **PURPOSE:** To determine if alcohol consumption habits of college-aged students is correlated with aerobic and/or anaerobic fitness levels. **METHODS:** Twenty-six subjects (9 females, 17 males) participated in this study. They filled out a Physical Activity Readiness Questionnaire, alcohol consumption risk assessment measure, and a physical activity survey. We conducted four fitness tests on the subjects as performance variables: hand grip dynamometer to test hand grip strength, YMCA step-test to measure aerobic fitness, 1-min sit up test to test anaerobic fitness, and a maximum quantity push up test to also measure anaerobic fitness. **RESULTS:** We ran an independent t-test to determine if there were differences between males and females in alcohol risk ($t(24)=-0.814$) and physical activity ($t(24)=-0.342$, neither of which were significant ($p>.05$). Spearman's Rho correlations were used to correlate alcohol risk with the fitness measures, but none were significant ($p>.05$). Significant correlations did exist between fitness measures, such as between grip strength and sit-ups ($r=.65$, $p<.001$), grip strength and push-ups ($r=.66$, $p<.001$), and sit-ups and push-ups ($r=.67$, $p<.001$). There were no significant differences in the results of a one-way ANOVA assessing alcohol risk and physical activity ($F(2,23)=1.45$, $p>.05$). **CONCLUSION:** We determined that we cannot predict performance variables based on alcohol consumption. A reason for this could be that the experiment was short term and that side effects of drinking take longer to show. Another limitation was that all of the participants were physically active and not sedentary.

Effects of a Low Carbohydrate Diet Versus a High Carbohydrate Diet on 5-km Running Performance

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A common belief is that high intensity exercise (>60%VO_{2max}) is best sustained by high rates of carbohydrate oxidation. The belief is based, in part, on an idea developed by Krogh and Lindhard in 1920. In the 100 years since, few studies have tested its validity. **PURPOSE:** We tested the hypothesis that performance in competitive recreational athletes exercising at >80% VO_{2max}, during simulated 5-km running time trials (5KTT) would be impaired during a 6-week period of adaption to a low-carbohydrate, high-fat (LCHF) diet, compared to their performances when they ate a diet higher in carbohydrate and lower in fat (HCLF). **METHODS:** Seven male

athletes (age 35.6 ± 8.4 years, height 178.7 ± 4.1 cm, weight 68.6 ± 1.6 kg) completed two maximal exercise (VO_{2max}) tests (Day 1 and 39) and four 5KTT (Day 4, 14, 28, and 42) in a fasted state during two 6-week periods when they ate either a HCLF or a LCHF diet, in a randomized counterbalanced, crossover design. **RESULTS:** Exercise performance during the VO_{2max} tests was unchanged on either diet ($p = 0.251$). Performance in the initial 5KTT was significantly slower on the LCHF diet (M_{diff} = 49 sec; 95% CI, 15 to 82; $p = 0.011$, $p = .683$; Day 4). There were no diet-related performance differences in the remaining three 5KTT (M_{diff} = 32 sec; 95% CI, -26 to 91; $p = 0.224$, $p = .235$, Day 14; M_{diff} = -5 sec; 95% CI, -51 to 41; $p = 0.806$, $p = .011$, Day 28; M_{diff} = -12 sec; 95% CI, -108 to 85; $p = 0.777$, $p = .014$, Day 42). Subjects exercised at ~82%VO_{2max}. Carbohydrate oxidation provided 94% of energy on the HCLF diet, but only 65% on the LCHF diet. **CONCLUSION:** 5KTT performance at ~82%VO_{2max} was independent of the runners' habitual diet. The HCLF diet offered no advantage over a diet with a high-fat content. Since these athletes run faster than 88% of recreational distance runners in the United States (U.S.), this finding may have wide general application.

Supported by Grove City College Jewell, Moore, & McKenzie Fund

Inter-leg difference in blood pressure is related to the ankle-brachial index in healthy individuals

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Increased inter-arm difference (IAD) in systolic blood pressure (BP) is linked to cardiovascular and peripheral vascular disease, arterial stiffness, and premature mortality. Previous research has determined that exercise induces IAD (e.g., eIAD). Recent studies on inter-leg difference (ILD) in systolic BP and pulse wave velocity have added a new dimension to this concept. **PURPOSE:** To examine the relationship between resting inter-limb differences and eIAD. **METHODS:** Following informed consent, participants completed a ten-minute rest and IAD, ankle-brachial index (ABI), heart rate, central and peripheral pressure were attained using standardized procedures. Subsequently, each participant completed a 30-minute acute bout of aerobic exercise (50% VO_2peak) on a cycle ergometer and eIAD was measured. **RESULTS:** Fifty-nine individuals completed all of the requirements of the study. Resting IAD (5±4 mmHg) was lower than ILD and (10±9 mmHg; $P<0.05$) and eIAD (9±7 mmHg; $P<0.05$), respectively. ILD was positively correlated with right arm systolic and diastolic BP (.293 and .285, respectively; $P<0.05$), central diastolic BP (.259; $P<0.05$), left leg systolic BP (.323; $P<0.05$), heart rate (.355; $P<0.05$), and double product (.390; $P<0.05$). ILD was negatively correlated with right-sided and overall ABI (-.580 and -.631, respectively; $P<0.05$). An equivocal relationship existed between ILD and eIAD (.259; $P=0.055$). No relationship existed between ILD and IAD (.075; $P=0.569$). **CONCLUSION:** Inter-leg blood pressure difference may not be related to resting or exercise-mediated IAD. When non-invasively screening for peripheral arterial disease, inter-leg blood pressure difference may be a simple and relevant measurement for consideration. The clinical

value and implication of inter-leg blood pressure difference remains unclear, however, future studies are warranted particularly in light of new (i.e., four-limb simultaneous) technologies.

The Effect of Postprandial Lipemia Serum With or Without a Prior Bout of Acute Exercise on Endothelial Cell Function

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Postprandial lipemia (PPL) is a physiological state marked by increased circulating triglycerides, leading to vascular endothelial cell (EC) dysfunction, a precursor to cardiovascular disease. A single bout of acute exercise has been shown to reduce PPL. EC migration, proliferation, and tube formation are important physiological processes involved in maintenance of a healthy endothelium. The effects of PPL on EC migration, proliferation and angiogenic capacity remain largely understudied. Moreover, the influence of a prior bout of exercise and its effect on PPL-induced EC migration, proliferation, and migration remains largely unknown. **PURPOSE:** 1) To determine the effect of PPL serum on human umbilical vein cell (HUVEC) migration, proliferation, tube formation, and ROS production; and 2) to determine the effect of a prior bout of exercise on PPL-induced alterations in EC function. **METHODS:** 10 healthy men were recruited and performed a VO_{2max} test. In 2 separate trials 7 d apart (first trial randomly assigned), participants were given a high fat meal (HF) the morning after a bout of exercise (EX) or a 12 h fast. Exercise was performed on a stationary cycle at 70% VO_{2max} until the participants expended 2.5 MJ. Serum was collected immediately prior (0') and 4 h after (4') ingestion of HF and applied to HUVECs in the following experiments: migration/gap closure, proliferation, and angiogenesis tube formation assays. HUVEC intracellular ROS was measured during migration. Data were analyzed using one- (area under the curve (AUC) analyses), two- (HF x EX), or three-factor (HF x EX x time) ANOVAs. Statistical significance was accepted at $p<0.05$. **RESULTS:** There were no EX x HF interactions. PPL increased migration (AUC) by 14% (0', 1124±55; 4', 1281±76; $p<0.05$), and proliferation by 6.4% (0', 2.50±0.04; 4', 2.66±0.05; $p<0.05$). Of the 4 angiogenic indices examined, PPL reduced network integrity by increasing the number of extremities by 17% (0', 34.1±1.8; 4', 39.9±1.7; $p<0.05$). There was a main effect of exercise on intracellular ROS, as well, increasing levels by 5.5% (0', 197.9±4.7; 4', 209.3±5.0; $p<0.05$). **CONCLUSION:** PPL increased EC migration, proliferation, and reduced angiogenic network integrity compared to 0'. A bout of exercise does not alter these effects, but does increase intracellular ROS during migration.

Influence of Acute Resistance Training on Memory, Executive Function, and Mood

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Acute exercise has been shown to improve performance on several domains of cognitive function. The majority of research has focused on the benefits of aerobic exercise, but research on the cognitive and mood effects of acute heavy resistance training (RT) is limited. **PURPOSE*:*** To determine how an acute bout of RT affects cognitive function and mood. **METHODS*:*** This was a within-subject design. College-aged males (n=21) visited the laboratory on 3 days, separated by at least 1 week. During session 1, subjects were tested for their 5-repetition maximum (5RM) on the box squat, bench press, and lat pulldown. During sessions 2 and 3, participants completed a rest or RT condition in a counterbalanced order. Prior to both sessions, participants completed trials 1-6 of the Rey Auditory Verbal Learning Task (RAVLT). During the RT session, participants completed 3 sets of 8-12 repetitions at 70% of estimated 1RM on the box squat, bench press, and lat pulldown. Training took ~40 minutes (including warm-up and cool-down). After the RT or 40 min seated rest, participants completed the recall and recognition trials of the RAVLT and a cognitive test battery in the Automated Neuropsychological Assessment Metrics (ANAM) Test System. The test battery included 10 tests that assessed memory, processing speed, executive function, and mood. Comparisons in cognitive performance and mood were made using a paired t-test. **RESULTS:** Higher scores on the color subtest of the Stroop Task, a test of processing speed, were found after RT compared to rest (training=69.57±2.03; rest=65.43±2.01; p=0.01). Better performance was observed in the Matching-to-Sample task, a spatial working memory task, after rest compared to RT (training=41.33±2.77; rest=45.33±2.53; p=0.03). There were no other differences in cognitive performance between conditions (p>0.05). After RT, participants had higher anger (training=11.05±3.34; rest=5.62±1.81; p=0.04), depression (training=6.43±2.22; rest=2.57±1.08; p=0.02), restlessness (training=32.33±4.15; rest=14.58±3.18; p=0.0001), and vigor (training=55.62±3.63; rest=48.24±3.90; p=0.04). **CONCLUSION:** Acute RT has limited effects on cognitive function in college-aged males, but increases anger, depression, restlessness, and vigor when assessed after cognitive tasks.

Effects of Beetroot and Hawthorn Supplementation on Blood Pressure and Prevalence of AMS in Hypoxia

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Acute Mountain Sickness (AMS) is a debilitating condition affecting travelers to altitude, noted by gastrointestinal issues, headache, and difficulty sleeping. An association has been seen between high central blood pressure and incidence of AMS, suggesting a possible causal relationship. Beetroot juice and hawthorn extract have both been shown to lower blood pressure.

Beetroot can also improve endothelial function, as measured with flow mediated dilation (FMD). **PURPOSE:** To investigate the effects of two dietary supplements, beetroot juice and hawthorn extract, on blood pressure and AMS at simulated altitude. **METHODS:** 6 healthy volunteers (mean (SD): VO2max: 39.6 (7.0) ml·kg−1·min−1) participated in a double-blind, crossover study of three groups, 1) placebo (PP), 2) beetroot juice (BP), and beetroot and hawthorn (BH), with a 10-day washout between treatments. Subjects supplemented for 7 days before spending 4 hours at simulated altitude (~12% O2; ~4,500 m). Systolic blood pressure (SBP), FMD, and AMS using the Lake Louise Scoring system were assessed. **RESULTS:** Subjects had a lower incidence of AMS in the BP group (33%) compared control (50%, p=0.73), but this finding did not reach statistical significance. Compared to PP (123.0 (4.4) mmHg), SBP in BR was (126.5 (11.0) mmHg, p=0.62) and in BH was (125.3 (9.2) mmHg, p=0.70). FMD showed no difference in control (3.5 (2.1) %) compared to BP (3.7 (7.2) %, p=0.98) and BH (5.7 (7.6) %, p=0.72). **CONCLUSION:** Beetroot juice lowers blood pressure in normoxic conditions, but the present study failed to show this effect at simulated altitude, nor was there added benefit to hawthorn extract supplementation. The prevalence of AMS was lower in BP, an indication that this area needs more robust investigation. Dietary interventions are a viable method to stave off Acute Mountain Sickness, but future beetroot research needs to involve a larger sample size.

Simulated Military Operational Stress Negatively Impacts Psychomotor Vigilance and Neurocognitive Biomarkers in Men and Women

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Military success requires sustained alertness in the presence of physical fatigue, caloric deprivation, and sleep restriction, stressors that may affect men and women differently. **PURPOSE**: To identify differences in psychomotor vigilance and neurocognitive biomarkers based on sex during simulated military operational stress (SMOS). **METHODS**: Forty-five Soldiers (25±5 years, 175±9 cm, 79 ±14 kg, 20 ± 7 BF%, 9 women) completed a 5-day/night SMOS protocol. Subjects were given 50% of caloric demands on Days 3 and 4. Subjects completed physical and cognitive evaluations from 0900 to 2230. Nights 3 and 4 included restricted sleep from 0100-0300 and 0500-0700, with psychomotor evaluations between 0300-0500. Fasted blood was drawn each morning at 0800, followed by psychomotor vigilance test (PVT). Concentrations of IGF-1, α-Klotho, and BDNF were analyzed using standard immunoassays. PVT performance was based on accuracy and response time correlated to a percentile position within a normative distribution. Two-way mixed ANOVA with Bonferroni correction for multiple comparisons were used appropriately ($p<0.05$). Day 1 PVT was excluded from the analysis to account for learning effect. **RESULTS**: There were no sex*time interaction

effects for PVT (p = 0.855), BDNF (p = 0.285), IGF-I (p = 0.013), or α-Klotho (p = 0.091). Main effect of time was observed for PVT (p = 0.008), IGF-I (p <0.001), and α-Klotho (p <0.001). PVT performance decreased by 42.9% from D2 to D5, although pairwise comparisons were not significant (p = 0.084). IGF-I and α-Klotho decreased from D1 to D5 by 13.1% (p <0.001) and 12.0% (p <0.001), respectively. There was a main effect of sex for BDNF (p = 0.020). On average, BDNF concentrations were 4,368.5 pg/mL higher in women during SMOS. **CONCLUSION**: SMOS has a similar negative impact in men and women on psychomotor vigilance and neurocognitive biomarkers IGF-I and α-Klotho. However, women demonstrate higher concentrations of BDNF in the presence of SMOS.

Department of Defense (Award # W81XWH-17-2-0070). The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

The Influence of Caffeine and the c.1083T>C Polymorphism on Anaerobic Power and Anaerobic Capacity

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Individuals demonstrate varying sensitivities to caffeine which may be influenced by the different polymorphisms of the adenosine receptor (ADORA2A). Individuals with the TT genetic variant display increased sensitivity to caffeine compared to those with the TC/CC variant. **PURPOSE:** To examine the effects of caffeine and ADORA2A (rs5751876) genetic variants on anaerobic performance. **METHODS:** Ten subjects participated in 2 trials of the 30 second Wingate Test (WAnT30) using a Velotron cycle ergometer. The trials were separated by 2-7 days. Both anaerobic power and anaerobic capacity were determined by the Velotron software. 60 min before testing, either caffeine (5mg•kg^{-1} BW) or placebo (maltodextrin) was administered in a gelatin capsule using a randomized and counterbalanced design. A mouth rinse of 0.9% NaCl was used to obtain buccal epithelial cells, DNA was extracted using QiAmp Mini spin columns, and cells were lysed with proteinase K. ADORA2A was analyzed and identified using TaqMan® SNP Assay and 40 thermocycles for amplification with a One-Step qPCR (Life Technologies, Carlsbad, CA). The data was analyzed using a 2 (condition) x 3 (genotype) ANOVA with repeated measures, $p < 0.05$. **RESULTS**: Genetic analysis determined that the subject pool included, 2 TT, 5 TC and 3 CC genotypes in this study. The main effect of condition, CAF vs PLA, revealed that the ingestion of CAF did not produce ergogenic benefits for anaerobic power or anaerobic capacity, $p = 0.74$ and $p = 0.97$, respectively. The main effect of genotype revealed significant differences between anaerobic power and anaerobic capacity across the variants of ADORA2A. Anaerobic power means for the variants TT, TC and CC were 10.0 + 0.1, 9.2 + 1.4 and 12.3 + 0.5 W•kg^{-1}, respectively. Pairwise comparisons found that CC > TC with other comparisons non-significant. Likewise, the anaerobic capacity means for TT, TC and CC were 8.9 + 0.2, 7.3 + 1.3 and 9.7 + 0.6 W•kg^{-1}, respectively with only CC > TC. **CONCLUSION**: Although the statistical power for this initial study was low, the results suggest

that individual differences of ADORA2 receptors, located in many tissues throughout the body, may influence the bodies response to anaerobic exercise.

A Survey of Nutritional Knowledge in College-Aged Students

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The knowledge on nutrition of an individual often dictates their overall health. This lack of knowledge often leads to poor nutritional choices further leading to significant health concerns. Many factors in college can lead to one making poor nutritional choices, one of the biggest factors is a lack of nutrition education or implementation prior to college or even while enrolled in college. **PURPOSE:** The purpose of this research is to assess the knowledge of general nutrition in college students. **METHODS**: Following approval form the East Stroudsburg University (ESU) internal review board, subjects were recruited from the ESU library, cafeteria, and coffee shop at on various days and times. Following informed consent, subjects were presented with a questionnaire. The questionnaire included two sections: demographic information and ten true or false nutritional knowledge questions related to general nutrition, macronutrients, and weight management. Subject proficiency was established as having 70% correct responses. Paired sample t-tests were conducted to determine significant findings. Significance was set at $p<0.05$. **RESULTS**: One hundred subjects were tested. Overall, the results indicated only 41% of students demonstrated proficiency in nutritional knowledge. In the area of general knowledge (four questions), subjects did not provide more incorrect (288) than correct (114) responses ($p=0.10$). In the area of macronutrients (three questions), subjects had statistically more incorrect (176) than correct (124) responses ($p=0.03$). In the area of weight management (two questions), subjects had statistically more incorrect (104) than correct (96) responses ($p<0.001$). **CONCLUSION:** It can be concluded that students have a basic level of nutritional knowledge and should be more educated on eating a balanced diet along with how to properly maintain their weight. Future studies should consider utilizing more detailed questions regarding where individuals receive their nutritional, weight loss and fitness lifestyle information.

The Influence of Sleep on Blood Pressure in Healthy Children

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Loss of ideal cardiovascular health can begin in childhood with the development of cardiovascular disease (CVD) risk factors occurring on a continuum. Central blood pressure (BP) values may be more reflective of CVD risk than peripheral BP but are rarely measured in children. Additionally,

in adults, poor sleep quality is associated with higher BP and incidence of CVD, however these relations are not as well elucidated in children. **PURPOSE:** To evaluate the role of sleep duration, sleep quality, and sleep variability (SV) on resting central and peripheral BP in apparently healthy 7-12 yr old children. **METHODS:** Sleep duration, total time in bed (TTIB), sleep quality (assessed by sleep efficiency (SE) and wake after sleep onset (WASO)), and SV (assessed by sleep midpoint standard deviation (SMSD)) were recorded in 20 healthy children (10 ± 0.5 yrs, 10 boys, 10 girls) for 7 consecutive nights outside of the laboratory via wrist accelerometry (ActiGraph GT3X+). Pulse wave analysis (PWA) was performed following sleep monitoring to determine central BP from peripheral BP measures using a generalized transfer function. Peripheral pressures were also evaluated using PWA. Central and peripheral BP were measured and averaged over 3 trials. Pearson's *r* correlations were used to assess relations between sleep metrics and BP values. Independent samples t-tests were used to determine group differences. **RESULTS:** Sleep duration averaged 7.9 ± 0.2 hrs/night, while TTIB averaged 9.6 ± 0.1 hrs/night. SE was 82 ± 2%, WASO was 89 ± 9 mins, and SMSD was 48 ± 6 mins. Sleep duration, TTIB, SE, WASO, and SMSD were not significantly associated with central or peripheral BP values. When using an 85% cutoff for SE, central and peripheral BP and TTIB were not significantly different between groups, however sleep duration was significantly different (7.4 hrs <85% vs 8.4 hrs >85%, $p < 0.001$). **CONCLUSION**: Preliminary data suggest that children age 7-12 are not getting the recommended amount of sleep (9-11 hrs/night) despite adequate time in bed. Thus far, the effects of shortened and poor-quality sleep on BP in this age group may be too minute to detect differences, though further research is needed.

Supported by NIH grant P20GM113125

Changes in Vertical Jump and Sprint Momentum at the NFL Scouting Combine since 2000

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PURPOSE: To assess the changes by position in vertical jump and sprint momentum at the NFL Scouting Combine since the year 2000. **METHODS:** Data for 2388 athletes who participated in the NFL Scouting Combine from the years 2000-2003 (00-03; n=1169) and years 2016-2019 (16-19; n=1219) were obtained. Athletes were grouped according to their position at the NFL Scouting Combine into offensive line (OL), defensive line (DL), running back (RB), tight end (TE), linebacker (LB), wide receiver (WR), and defensive back (DB). Athletes not included in one of these categories were excluded from the analysis. Velocity during the vertical jump and 40-yard dash tests was calculated from jump height and sprint time, respectively. Velocity measures were multiplied by the athletes recorded body mass to determine linear momentum during the vertical jump (VJM) and 40-yard dash (40M). Athletes who did not participate in the vertical jump or sprint were excluded from each analysis. Yearly differences in momentum across each position were assess via 2×7 between-subject ANOVA with Bonferroni-adjusted post hoc tests. The alpha level was set a $p \leq 0.05$, and all data are presented as mean±standard

deviation. **RESULTS:** Significant year×position interactions were observed for VJM (p=0.023) and 40M (p=0.003). Post hoc tests revealed a significantly lower VJM in 16-19 when compared to 00-03 for the OL (p=0.003, 521.4±28.7 kgm/s vs 535.1±52.7 kgm/s) and RB (p=0.005, 401.6±29.9 kgm/s vs 414.8±37.8 kgm/s). Furthermore, a similar trend (p=0.056) was noted for TE, who had a lower VJM in 16-19 (454.4±64.1 kgm/s) than 00-03 (470.9±25.9 kgm/s). For 40M, WR (p=0.001) had significantly greater 40M in 16-19 (746.4±49.4 kgm/s) when compared to 00-03 (727.8±53.2 kgm/s). Furthermore, trends for greater 40M in 16-19 were noted for DL (p=0.071) and OL (p=0.090). Also, RB (p=0.043) had significantly lower 40M in 16-19 (785.2±48.5 kgm/s) when compared to 00-03 (799.3±62.7 kgm/s). No other yearly differences were noted for VJM or 40M. **CONCLUSION:** Momentum during the vertical jump and sprint at the NFL Scouting Combine have changed for some positions in the last 20 years. RB have experienced a decrease in both VJM and 40M; while WR, OL, and DL may have increased 40M. Changes in momentum may be indicative of the changing demands of each position in the sport of American football.

The Effect of Video Distraction on High-Intensity Exercise Performance

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PURPOSE This study examined the physiological and psychological effects of external distraction during high-intensity cycling. **METHODS** Ten healthy young adults participated in two ten-minute sessions of cycling. Sessions included a distraction condition (D) during which subjects pedaled while watching an adventure documentary, and a control condition (C) in the lab. Subjects were blinded to any exercise or biofeedback during both sessions. Subjects were instructed to cycle hard and try to cover as much distance as possible in both sessions. Total distance, oxygen consumption, heart rate, rating of perceived exertion, and energy expenditure were assessed during both sessions, and post-test mood state was reported following each session. **RESULTS** There were significant, progressive increases in VO_2, HR, and RPE throughout both rides, but mean VO_2 (31.43 $\pm$ 8.09 vs 30.82 $\pm$ 7.92 ml/min/kg), HR (151.37 $\pm$ 15.73 vs 152.17 $\pm$ 19.20 bpm), and RPE (13.56 $\pm$ 1.33 vs 13.24 $\pm$ 2.14) were similar between D and C conditions respectively. However, video distraction resulted in greater total cycling distance than the control condition, (2.75 $\pm$ 0.43 vs 2.63 $\pm$ 0.47 mi, respectively), and a higher 10-minute RER (1.06 $\pm$ 0.09 vs 0.99 $\pm$ 0.02, for D and C respectively). There was a non-significant 15% increase in self-reported mood following the distraction session compared to the control session (2.90 $\pm$ 0.74 vs 3.40 $\pm$ 1.07, respectively). **CONCLUSION** Mental distraction during high-intensity cycling exercise increases total distance covered during a high-intensity cycling session.

Effects of a Novel Ground-Based Movement Training Program on Functional Movement, Flexibility, Strength and Endurance

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Ground-based movement training (GMBT) is a unique form of bodyweight training that incorporates various animal poses, transitions, and crawling patterns to reportedly improve fitness and performance. GBMT is growing in popularity and being used in numerous settings including general fitness, strength and conditioning for sport, and physical rehabilitation. Unfortunately, little evidence exists to validate claims made by commercial GBMT programs and to guide practitioners in the best use of GBMT. **PURPOSE:** To assess the impact of 8 weeks of a commercially available GBMT program on functional movement, dynamic balance, active joint range of motion, and upper body muscular strength and endurance. **METHODS:** Forty-two (males = 19; females 23) physically active college-age (19.76 ± 2.10 years) subjects were randomly assigned to a GBMT or control (CON) group. The GBMT group performed 60-minutes of GBMT twice a week for 8 weeks in addition to their normal physical activity, while the CON group maintained their normal physical activity throughout the intervention period. Two-way mixed ANOVA with repeated measures was used to assess differences between groups. **RESULTS:** The GBMT group showed significantly greater improvements than the CON group in overall functional movement screen composite score (mean ± SD:1.62 ± 1.53 vs. 0.33 ± 1.15 points, p = 0.004), functional movement patterns (0.81 ± 0.87 vs. 0.00 ± 0.71 points, p = 0.002) and fundamental stability patterns scores (0.57 ± 0.75 vs. 0.05 ± 0.50 points, p = 0.011). Additionally, the GBMT group showed significantly greater improvements than the CON group for hip flexion (right 9.10 ± 4.46 vs. 2.88 ± 7.27 degrees, p = 0.002; left 7.06 ± 5.91 vs. 1.10 ± 6.51 degrees, p = 0.004), hip lateral rotation (right 6.27 ± 7.28 vs. -0.10 ± 5.24 degrees, p = 0.002; left 5.09 ± 7.25 vs. -0.31 ± 6.97 degrees, p = 0.018) and shoulder extension (right 4.16 ± 9.10 vs. -4.23 ± 8.72 degrees, p = 0.004; left 7.08 ± 11.37 vs. -2.12 ± 9.89 degrees, p = 0.008). **CONCLUSION:** Our results indicate that GBMT can improve functional movement patterns and various active joint ranges of motion.

Supported by Grove City College Jewell, Moore, & McKenzie Fund

Impact of Operational Stress on Motor Evoked Potentials in Military Personnel

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Sleep deprivation is a prevalent operational stressor that may degrade neurophysiological performance in military personnel. Transcranial magnetic stimulation (TMS) is an established

non-invasive brain stimulation technique capable of assessing corticospinal excitability that is not extensively investigated in military populations. **PURPOSE:** To examine the influence of operational stress (i.e., sleep deprivation) on corticospinal excitability in military personnel. **METHODS:** Thirty-two male and seven female service members (25.1±4.9yr) performed two series of stimulus response curves (SRCs) at 15% maximum voluntary muscle contraction for five consecutive days (D0-D4) using single-pulse TMS and a figure-of-eight coil. A familiarization day served as D0 with baseline testing on D1. Participants were allowed eight hours to sleep on D0, D1 and D4. On D2 and D3, participants had their sleep restricted for two 2-hour segments. For the SRC, stimulator outputs were randomly administered from 5-100% in 5% increments. Motor evoked potentials of the first dorsal interosseous muscle were quantified as the peak-to-peak electromyography amplitude of the 50ms post TMS stimulus. Corticospinal excitability was assessed by fitting MEP responses to a Boltzmann sigmoidal curve (BSC) via nonlinear regression and determining BSC_{MAX} and BSC_{V50} (i.e., stimulator output at the mid-point between BSC_{MIN} and BSC_{MAX}). Repeated-measures one-way ANOVAs with Tukey post-hoc tests were used to compare BSC properties over time. **RESULTS:** ANOVAs revealed a main effect of time for both BSC_{MAX} and BSC_{V50} ($F(3.31, 122.40)=2.71$, $p=0.04$ and $F(2.96, 109.50)=3.26$, $p=0.02$, respectively). No significant pairwise comparisons were detected for BSC_{V50}. BSC_{MAX} revealed to be significantly greater on D3 compared to D0 (5.21 vs 4.56 mV, $p=0.02$) and D1 (5.21 vs 4.44 mV, $p=0.02$) but similar to D2 and D4 ($p>0.05$).**CONCLUSION:** Our findings highlight the ability of TMS to capture subtle but significant increases in corticospinal excitability after exposure to simulated operational stress. Furthermore, BSC_{MAX} remained elevated on D4, suggesting one day is inadequate recovery time after operational stress.

Supported by the Department of Defense W81XWH-16-PHTBIRP-CR3A.

Lower Extremity Power and its Relationship to Qualitative and Quantitative Measures of Landing Performance

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Lower extremity injuries are common in athletic activities. Anterior cruciate ligament (ACL) injuries are a particular concern. Developing effective screening tests to identify high risk individuals is a priority. Movement mechanics, high forces, high rates of loading, and fatigue are factors which may contribute to the occurrence of a lower extremity injury. Improving strength, power, agility, balance, and muscle activation may potentially decrease overall risk. **PURPOSE**: To investigate the relationship between landing mechanics and lower extremity power after fatigue. **METHODS**: 12 male subjects performed 3 trials of the Landing Error Scoring System (LESS) test and vertical jump test before and after a fatigue protocol. The fatigue protocol consisted of body weight squats to 90° knee flexion at 60 Hz until they could not maintain the pace. Vertical ground reaction forces (vGRF) were measured by force plates. Pearson Correlation Coefficients are used to assess the relationship between LESS, peak power, and

vGRF, and dependent *t*-tests to identify changes due to fatigue. **RESULTS:** Vertical jump height decreased 63.6±18% ($p<0.001$) after fatigue. Peak power was not related to LESS score before ($r=-0.21$, $p=0.52$) or after ($r=-0.19$, $p=0.56$) fatigue or to peak vGRF before ($r=-0.36$, $p = 0.25$) or after ($r=-0.26$, $p = 0.42$) fatigue. LESS score is related to normalized vGRF ($r=0.61$, $p>0.05$) but not after fatigue ($r=0.22$, $p = 0.5$). Fatigue did not significantly change LESS score (4.7±2.7 vs 5.4±2.6, $p=0.08$), peak vGRF (55.8±18.3 vs 50.3±13.9N/kg, $p=0.25$), or time to peak vGRF (89±28 vs 95±24ms, $p=0.52$). **CONCLUSION**: Fatigue did not significantly alter any dependent variable, consistent with previous observations. Lower extremity power did correlate with either qualitative or quantitative measures of landing performance. Improving power and strength alone may not be sufficient to reduce the risk of ACL or lower extremity injury.

Neuromuscular Function in Individuals One Year after Medical Clearance Following Anterior Cruciate Ligament Reconstruction

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When an anterior cruciate ligament (ACL) tears, it becomes dysfunctional and cannot heal on its own, requiring ACL reconstruction (ACLR) and subsequent physical therapy if the person wishes to remain active. While several studies have examined strength and neuromuscular control after ACLR, noting differences between the limbs persisting after the surgery, strength and neuromuscular function have yet to be thoroughly examined one-year following rehabilitation and a physician's clearance to resume all activities. **PURPOSE:** To examine strength and neuromuscular control of both the ACL reconstructed limb (ACLRL) and uninvolved limb (UL) at more than one year post-clearance in order to examine long-term function. **METHODS:** Both men and women (n=11; 20.4±1.7 years), who had undergone ACLR and have been cleared, for at least a year, by their physician to resume full activity, served as participants in this study, as well as height and weight-matched controls (n=11; 19.6±1.3 years). The Star Excursion Balance Test (SEBT), thigh circumference, quadriceps muscle thickness via an ultrasound (US), ACL laxity via the KT-2000 test, and maximal strength during both knee flexion and extension via a handheld dynamometer were all used in determining neuromuscular function for both the ACLRL and UL. **RESULTS:** Participants had significantly smaller thigh circumference in their ACLRL (52.7±2.5 cm) compared to their UL (54.0±2.9 cm; p=0.048), significantly less muscle thickness in their ACLRL (3.4±0.6 cm) compared to their UL (3.7±0.5 cm; p= 0.005), and significantly weaker strength during flexion in their ACLRL (216.0±64.2 N) compared to their UL (235.8±54.5 N; p=0.017). However, there were no significant differences between the ACLRL and UL in the SEBT (ACLRL= 246.3±37.1 vs. UL= 252.3±33.2; p=0.105), the KT-2000 test (ACLRL= 3.7±2.5 mm vs. UL= 2.7±2.3 mm; p=0.070), or the extension strength test (ACLRL= 342.4±155.0 N vs. UL= 362.9±137.4 N; p=0.531). There were no significant differences between the legs of controls for any of the tests (p>0.05) **CONCLUSION:** The ACLRL was shown to be smaller and weaker compared to the UL when

tested more than one-year after rehabilitation and a physician's clearance to resume activity without restrictions.

The Effects of Accentuated Eccentric Loading on Velocity and Muscle Activation in the Bench Press

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Accentuated eccentric loading (AEL) is a resistance training method that has been proposed to positively influence adaptations during tasks utilizing the stretch shortening cycle. However, it remains unclear if optimal concentric loading schemes exist for AEL protocols. **PURPOSE:** To evaluate the effects of AEL on concentric velocity and muscle activation using low (30% 1-repetition maximum [1RM]) and high (80% 1RM) concentric loads with AEL in comparison to traditional loading (T) in the bench press exercise. **METHODS:** Twelve resistance-trained men (age: 26 ± 6 yrs; 1RM: 134 ± 33 kg) performed two repetitions with full recovery for the loading conditions of 30T (30% 1RM during the concentric and eccentric phases), 30AEL (100% 1RM during the eccentric phase, 30% 1RM during the concentric phase), 80T (80% 1RM during the concentric and eccentric phases), and 80AEL (100% 1RM during the eccentric phase, 80% 1RM during the concentric phase). The differing loads during the concentric and eccentric phases of the AEL conditions were applied using mechanical weight releasers. Concentric barbell velocity was measured using a linear position transducer and the EMG activity of the pectoralis major and triceps brachii muscles during the concentric phase of the lifts were recorded. **RESULTS:** The mean concentric velocity was statistically greater in the high concentric loading conditions (mean difference: 0.57 m/s, 95% confidence interval [CI]: 0.47 – 0.67 m/s, $p<.0001$). AEL resulted in a reduction in velocity compared to traditional loading (mean difference: 0.04 m/s, 95% CI: 0.01 – 0.08 m/s, $p<.0001$). Muscle activity in the high concentric load conditions was statistically greater than the low concentric load conditions (mean difference: 143 uV, 95%CI: 84 – 202 uV, $p<.0001$). There were no other statistically significant main effects or interactions ($p>0.05$). **CONCLUSION:** AEL resulted in a small decrease in mean concentric velocity but did not affect concentric muscle activation during repetitions of the bench press performed with either low or high concentric loads.

Arterial Wave Reflection Increases 60 Minutes Post Ultramarathon but Returns to Baseline at 24 Hours

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Ultra-endurance bouts of exercise may elevate risk for cardiovascular disease, even though habitual aerobic exercise induces cardiovascular benefits. Despite the increase in popularity of ultramarathon running in the last few decades, the acute blood pressure changes and vascular effects of prolonged exercise bouts have not been completely elucidated. **PURPOSE**: The purpose of this study was to examine blood pressure and wave reflection changes before, 60 minutes post- and 24 hours post a 50-kilometer race. **METHODS:** Ten ultramarathon runners (male = 7, age = 40±2 years) underwent cuff-based measures of blood pressure and wave reflection (augmentation index (AIx) and AIx normalized to a heart rate of 75 beats per minute (AIx75)) in the brachial artery. Central blood pressure measures were generated based on the brachial artery pressures. Changes (delta) in blood pressures and wave reflection were calculated as the differences from baseline to 60 minutes post-race and baseline to 24 hours post-race. Paired t-tests were used to compare measurements 60 minutes post-race – baseline vs. 24 hours post-race – baseline. **RESULTS:** Comparing delta values, there were no significant differences in brachial systolic blood pressure (-2.7±3.5 vs. -4.2±2.5 mmHg, p=0.62), brachial diastolic blood pressure (-1.4±2.8 vs. -6.8±2.0 mmHg, p=0.07), or aortic systolic blood pressure (-4±2.9 vs. -4.7±2.0 mmHg, p=0.76). Delta aortic diastolic blood pressure (-1.1±3.0 vs. -7.1±1.7 mmHg, p=0.04) and delta mean arterial pressure (-0.7±2.8 vs. -6.4±1.6 mmHg, p=0.03) responses were significantly lower 24 hours post-race as compared to 60 minutes post. Additionally, the change in AIx75 from baseline was significantly higher 60 minutes post, but returned to baseline by 24 hours post-race (5.6 ± 3.0 vs. 0 ± 1.9 %, p=0.02). **CONCLUSION:** The AIx75 increase within the 60 minutes post-race aligns with previous literature that found increases in arterial stiffness after a bout of ultra-endurance exercise. These data suggest that despite changes in wave reflection following an ultramarathon, vascular effects are ameliorated by 24 hours post-race. Additionally, there may be beneficial effects from blood pressure responses in the 24 hours following race completion.

Renal and Segmental Artery Hemodynamic Response to Mild Hypercapnia

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The risk of kidney disease is elevated in conditions associated with sustained or transient elevations in the partial pressure of carbon dioxide, such as chronic obstructive pulmonary disease or sleep apnea. Indirect evidence indicates that hypercapnia induces renal vasoconstriction, a response that differs from the vasodilatory response that occurs in most other vascular beds. Thus, one mechanism underlying an increased risk of kidney disease is that repeated hypercapnia-induced episodes of renal vasoconstriction reduce oxygen delivery and compromise renal oxygenation. However, it is unknown if hypercapnia elevates vascular resistance in vessels going to or within the kidneys. **PURPOSE**: To test the hypothesis that

breathing a hypercapnic gas mixture increases vascular resistance in the renal and segmental arteries. **METHODS:** After 45 min of supine rest, renal hemodynamics were assessed in seven healthy adults (26 ± 4 years, 4 females) immediately prior to (AIR) and while breathing a 3% CO_2, 21% O_2, 76% N_2 gas mixture for 5 min (CO_2). The partial pressure of end-tidal CO_2 ($PETCO_2$, capnography) and mean arterial pressure (MAP, finger photoplethysmography) were measured continually. Blood velocity (BV) in the distal segment of the right renal artery (Renal) and the middle portion of the same segmental artery within a given subject (Segmental) was assessed using the coronal approach via Doppler ultrasound. Vascular resistance (VR) was calculated as MAP/BV. **RESULTS:** CO_2 increased $PETCO_2$ (44 ± 2 vs 46 ± 1 mmHg, P=0.01). MAP did not differ after CO_2 (AIR: 95 ± 8, CO_2: 96 ± 9 mmHg, P=0.41). In the renal artery, CO_2 reduced BV (31.5 ± 8.7 vs. 28.5 ± 7.5 cm/s, P<0.01), and elevated VR (3.3 ± 1.3 vs. 3.6 ± 1.5 mmHg/cm/s, P=0.03). Similarly, in the segmental artery, CO_2 reduced BV (23.1 ± 5.2 vs. 21.0 ± 5.6 cm/s, P=0.03) and increased VR (4.4 ± 1.3 vs. 4.9 ± 1.7 mmHg/cm/s, P=0.09). **CONCLUSION:** These preliminary findings suggest that mild hypercapnia elevates vascular resistance in the renal and segmental arteries.

Energy Balance during Postpartum Period is Associated with Metabolic Adaptation

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Previous studies have demonstrated that perturbations in body weight result in modified resting metabolic rate (i.e. metabolic adaption) that attempts to return the body to its customary weight (i.e. the set-point theory). How body weight changes during pregnancy impacts resting metabolic rate (RMR) and subsequently affects the ability to return to pre-pregnancy weight postpartum has not been investigated. **PURPOSE:** To examine if metabolic adaptation occurs during the postpartum period. **METHODS:** RMR and body composition were measured after an overnight fast in 26 women (mean age 34, range 26-40; mean BMI 28.1±6.0 kg/m^2) at 3, 6, 9 and 12 months postpartum. Energy balance over the postpartum period was calculated as the sum of the change in both fat mass (FM) and fat-free mass (FFM) multiplied by their respective energy densities. The ratio of RMR to FFM was used to assess the degree of metabolic adaptation. The degree of linearity between weight change and energy balance with metabolic adaptation was assessed using Pearson correlation. **RESULTS:** Weight loss (mean weight loss: -3.4±3.6 kg) was positively associated (= 0.4, p = 0.03) with metabolic adaptation (mean RMR/FFM: 31.8±2.8 kcal/d/kg). Total energy balance (mean energy balance: -28719± 29546 kcal) was positively associated (= 0.5, p = 0.01) with metabolic adaptation, indicating that a greater negative energy balance is associated with a lower resting metabolic rate relative to metabolically active fat-free mass (i.e. a greater metabolic efficiency). This relationship was independent of whether or not women had returned to their pre-pregnancy (i.e. set-point) body weight. **CONCLUSION:** The acute perturbation in body weight away from the set-point as a result of pregnancy contributes to the presence of metabolic adaptation during the postpartum period. The increase in metabolic efficiency in relation to greater weight loss during this time may contribute to difficulty in continuing to lose weight, or maintaining lost weight, after childbirth.

Brain Natriuretic Peptide and Inflammation in Non-Dialysis Chronic Kidney Disease

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Cardiovascular disease (CVD) is common in chronic kidney disease (CKD) patients, often resulting in patient death before progression to end stage renal disease. Early identification of patients for cardiovascular disease and heart failure (HF) prevention is vital in this cohort. Brain natriuretic peptide (BNP) is a well-established marker of HF released from the left ventricular myocardium in response to increases in volume and pressure and is elevated in CKD patients. Recent evidence suggests BNP may be related to the presence of underlying coronary artery disease as well. Inflammation and oxidative stress are characteristic in CKD and may play a role in the elevated BNP and increased cardiovascular risk in CKD. BNP may be a useful marker in identifying CKD patients with a higher risk of developing cardiac disease and HF. **Purpose:** To evaluate the association between BNP and markers of inflammation and oxidative stress in non-dialysis CKD. **Methods:** 27 participants (21 male, 6 female; 60±10 years) with non-dialysis CKD (eGFR 46±14 ml/min/1/73m^2) who had a negative graded exercise test on a cycle ergometer were studied ($VO2_{peak}$ 17.8±5.9 ml/kg/min). A blood sample was drawn for evaluation of inflammatory markers IL-6, IL-10, & TNF-α using a Bead-Based Multiplex Assay (Millipore Sigma). Urinary F2-isoprostane and isofurans were measured by LCMS. Pearson correlation coefficients were calculated to assess the relationship between BNP and $VO2_{peak}$, inflammation and oxidative stress. Significance was set at $p<0.05$ and data are presented as mean±SD. **Results:** Despite the absence of overt CVD, BNP was elevated relative to diagnostic guidelines (300±235 pg/ml). BNP was positively correlated with IL-10 (*r=0.39, p=0.04)* and TNF-α (*r=0.47, p=0.015)* but not significantly correlated with IL-6 (*r=0.19, p=0.37*). BNP was not related to VO2peak or markers of oxidative stress. **Conclusions:** In conclusion, BNP is associated with inflammatory markers suggesting that systemic inflammation may play a role in the increased cardiac risk in non-dialysis CKD patients.

Supported by NIH Grant HL113514

Differential Responses in the Growth Hormone-Insulin-Like Growth Factor-1 Axis Following Simulated Military Operational Stress

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PURPOSE: The growth hormone-insulin-like growth factor-1 axis plays a critical role in physical performance and recovery. Circulating concentrations of these hormones have been found to increase following physical exertion and decrease following sleep and food restriction such as that common in military operations. It is unknown if the magnitude of change (i.e., pre- to post-exercise difference) varies over time. We aimed to determine the effects of simulated military operational stress (SMOS) on GH and IGF-1 patterns. **METHODS:** Thirty-four males (176.7±1.3cm, 83.4±2.5kg, 20.0±1.2%BF) and ten female (166.0±3.7cm, 64.0±2.2kg, 24.8±2.0%BF) service members (26.1±0.80yrs) completed a 5-day/night SMOS protocol. During days 3 (D3) and 4 (D4), subjects were given 50% of caloric demands. On nights 1, 2, and 5 subjects slept from 2300-0700. During nights 3 and 4, subjects slept from 0100-0300 and 0500-0700. Participants underwent a Tactical Mobility Test (TMT) on D2-5: 2-minute water can carry (20-kg each hand), fire and movement course, 20-meter casualty drag (91-kg), 300-meter unloaded and loaded (16-kg) shuttle runs, and 2-mile paced then 2-mile best effort timed ruck march (15-kg). One-way repeated measures ANOVAs were used to assess the "magnitude" of hormone response following the TMT (change scores from pre- to post-TMT), as well as pre- and post-TMT concentrations on D2, D4, and D5. Paired-sample t-tests were used to compare absolute changes in pre- to post-concentrations. **RESULTS:** There was no difference in magnitude of change at any time point for GH (p=0.814) or IGF-1 (p=0.723). However, there was a significant increase in both GH and IGF-1 following physical exertion each day. Pre-TMT IGF-1 concentrations (D2: 40.22±12.47, D4: 37.45±12.56, D5: 34.75±11.82 ng/mL, p<0.001) but not GH (p=0.784) declined significantly. Post-TMT IGF-1 was significantly (p=0.001) lower at D4 (37.96±11.67) vs. D2 (41.96±12.26) and did not recover by D5 (36.91±12.11), and GH was not different (p=0.582). **CONCLUSION:** Circulating concentrations of IGF-1 but not GH declined following SMOS. While GH and IGF-1 increased significantly following TMT, the magnitude of response was not different over time. Future studies should investigate the relevance of declining levels with no change in the magnitude following physical exertion.

This study was funded by the Department of Defense (Award # W81XWH-17-2-0070). The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

Effects of Acute Nitrate Intake on Exhaled Nitric Oxide and Vascular Endothelial Function in Hypoxia

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Nitric oxide (NO) can be produced within the body via NO synthases (NOS) or from dietary nitrate and utilized to regulate blood flow and oxygen delivery through dilation of the vascular endothelium. In chronic hypoxia, highlanders exhibit adaptive increases in NO production to maintain adequate oxygen delivery. Non-adapted individuals, however, exhibit reductions in NO levels which is predicts susceptibility to pulmonary edema and acute mountain sickness. Nitrate supplementation in normoxia increases exhaled NO suggesting an increase in NO levels, and

increases brachial artery flow-mediated dilation (FMD). **PURPOSE:** Investigate the effects of acute nitrate supplementation on FMD and exhaled NO in hypoxia. **METHODS:** In a double-blind and randomized study, 8 men (mean age 24±4 years; BMI 24±3 kg/m^2) consumed 70 mL of either 0.45 g of nitrate (NT) or an inert placebo (PL). Brachial artery flow mediated dilation (FMD) and exhaled and salivary nitrate levels were measured before and after 120 minutes of hypoxia (11.5±0.2% O_2) exposure. Brachial artery FMD was assessed with Doppler ultrasound during reactive hyperemia following a standard 5-min ischemia protocol. To determine exhaled nitric oxide levels, participants were asked to exhale at a target force into a hand-held electrochemical device. Salivary nitrate was determined using salivary test strips. **RESULTS:** NT increased salivary nitrate levels (0.1±0.2 to 2.8±1.0 aU, $p<0.05$) while PL had no effect (0.1±0.3 to 0.3±0.4 aU, $p>0.05$). A condition effect was detected for brachial FMD ($p<0.05$). FMD was reduced similarly with hypoxia for the both the NT (8.7±2.7 to 5.9±3.4%) and PL (7.9±2.1 to 5.5±2.8%) conditions. A condition-by-time interaction was detected for exhaled NO ($p<0.001$). Exhaled NO increased during hypoxia with NT (18±5 to 28±10 nmHg) but remained unchanged with PL (19±5 to 20±5 nmHg). **CONCLUSION:** Nitrate supplementation increased exhaled NO during acute hypoxia but had no effect on reductions in brachial FMD. These findings suggest that acute nitrate may increase NO availability in the pulmonary vasculature without having an impact on the peripheral vasculature.

Upper Body Kinetics has No Difference for Mound and Flat Ground Throwing

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Baseball pitchers are required to have appropriate arm strength and pitching mechanics to perform well. There have been numerous studies on training programs in order to maximize their performance, yet no conclusions have been made for what would be ideal for these athletes. Many pitchers have been trained on flat ground without knowing benefits transfer to the mound or of possible detriments. **PURPOSE:** To determine if there are upper extremity kinetic differences of long tossing from a mound versus flat ground in experienced throwers. **METHODS:** Six healthy and experienced participants (20 Y ±1.26) were asked to make 5 throws from a mound (MO) and 5 throws from flat ground (FG). Thirty-eight markers were placed on the subjects at various anatomical locations to quantify the upper extremity kinetics using the infrared cameras of the motion capture system. The target was a distance of 67 meters, which was calculated using throwing angles and ball velocities. The dependent variables of elbow flexion torque, shoulder external rotation torque, shoulder abduction torque, and shoulder horizontal abduction torque were calculated and analyzed in PitchTrak. The data was then run through multiple dependent T-tests to compare the conditions of mound and flat ground pitching. **RESULTS:** There were no significant difference in mean was found among any of the variables: elbow flexion torque (FG=11.90±0.69 deg/sec vs MO=13.80±1.30 deg/sec), shoulder external rotation torque (FG=8.56±0.33 deg/sec vs MO=8.63±0.36 deg/sec), shoulder abduction torque

(FG=16.16±1.22 deg/sec vs MO=20.8±2.72 deg/sec), shoulder horizontal abduction torque (FG=11.50±1.42 deg/sec vs MO=12.76±1.37 deg/sec). **CONCLUSION:** Upper body kinetics are similar in when throwing long toss from a mound and from flat ground. This indicates that there is no performance benefit of training from a mound compared to flat ground. This study provides some practical implications for coaching and training programs for baseball pitchers, allowing pitchers to have more flexibility when training to maximize performance.

Supported by Research as a High Impact Practice Grant 841024

The Effect of Caffeine on Motor Task Performance

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PURPOSE: The purpose of this study was to determine the influence of caffeine during task performance tests that require fine motor skills. **METHODS:** Thirty-two subjects volunteered for the study, gave informed consent and practiced the motor performance tests during a familiarization session and completed two experimental trials. The subjects reported to the lab one hour prior to the experimental trials and ingested a gelatin capsule containing 5mg•kg^{-1} BW of caffeine anhydrous (CAF) or a placebo (PLA) containing maltodextrin administered in a random and counterbalanced order. Following the hour absorption period, fine motor abilities were assessed using the Purdue Pegboard Test (PPT) and the Minnesota Dexterity Test (MDT). The PPT required participants to manipulate pegs, collars, and washers in a systematic order, and the scores were calculated by the number of pegs the subject placed within a certain time frame. Four different tests and subscores were obtained or calculated during 30 and 60 second trials. The tests of the PPT included a right-hand, a left-hand, a two-hand, and an assembly test. The MDT required participants to place and manipulate small discs systematically into holes on a large board, and scores were calculated according the time it took participants to complete the tests for both a placing and turning trial. Paired t-tests were used to identify significant difference between the CAF and PLA trials for each score, $p < 0.05$. **RESULTS:** No significant difference in motor task for any subscores of the PPT. Scores for CAF vs PLA were: right hand (17.0 $\pm$ 1.9 vs 16.7 $\pm$ 1.9s, p=0.61), left hand (16.5 $\pm$ 5.9 vs 45.1 $\pm$ 1.6s, p=0.56), two-hand (13.5 $\pm$ 1.7 vs 13.6 $\pm$ 1.3s, p=0.18) and assembly (46.5 $\pm$ 1.9 vs 16.7 $\pm$ 9.4s, p=0.61). In addition, there was no significant difference between trials of CAF and PLA for MDT tasks of placing (57.2.0 $\pm$ 6.6 vs 56.5 $\pm$ 5.4s, p=0.75) or turning (41.7 $\pm$ 5.4s vs 40.3 $\pm$ 1.9s). **DISCUSSION:** Ingesting CAF prior to task performance activities did not affect motor performance; however, some individuals increased performance 3-15% under the CAF condition. Future studies will consider variables that help dictate individual responses.

Potential Racial Disparity in Vascular Function Across the Menstrual Cycle

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African American women (AAW) have the highest rates of cardiovascular disease (CVD) compared to all other races, with the largest racial dispaity existing between AAW and Caucasian women (CW). Premenopausal women are generally viewed as being protected against CVD, owed to the endogenous effects of the female sex hormone estrogen. Paradoxically, AAW tend to have higher concentrations of estrogen compared to CW. Studies have associated fluctuations in vascular function across the menstrual cycle (MC) with the changing levels of estrogen, but this relation has never been explored in the context of race. **PURPOSE:** To compare nitric oxide-mediated vascular function across 3 phases of the MC between AAW and CW using passive leg movement (PLM). **METHODS:** PLM was performed on premenopausal, healthy, female participants not using hormonal contraceptives; 5 AAW (22±1 years) and 11 CW (23±1 years). Phases of the MC were identified as early follicular (EF) (1-5 days post onset of menstruation; low estrogen), ovulation (OV) (within 1-3 days of luteinizing hormone surge determined by an ovulation test; high estrogen), and mid-luteal (ML) (8-10 days post ovulation; moderate estrogen). Blood flow velocity and diameter of the femoral artery were calculated using doppler ultrasound. A 2x3 repeated measures ANOVA was used to identify differences in vascular function between AAW and CW across 3 phases of the MC. **RESULTS:** The hyperemic response to PLM, calculated as area under the curve (mL), was trending lower in AAW compared to CW at each phase of the MC. EF (AAW: 66.0±19.2, CW: 137.2±42.8), OV (AAW: 76.3±30.6, CW: 155.0±42.7) and ML (AAW: 80.1±29.8, CW: 133.6±28.9) (p=0.12). **CONCLUSION:** Although not significant, AAW seem to experience attenuated vascular function compared to CW across all 3 menstrual phases. These preliminary data suggest the potential for race-derived disparities in vascular function across the MC, but additional data are needed.

The Association between Ambulatory Blood Pressure Monitoring, Cerebrovascular Pulsatility, and Cognitive Performance in Young Adults

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Ambulatory blood pressure monitoring (ABPM) is the gold standard for blood pressure (BP) assessment. In older adults, ambulatory pulse pressure (PP), mean arterial pressure (MAP), and BP dipping have been associated with altered cerebrovascular blood flow, increased cerebrovascular disease, and cognitive decline. As rates of hypertension increase in young adults, cerebrovascular pulsatility may damage neuronal tissues and accelerate cerebral aging. **PURPOSE:** Determine if ABPM is associated with middle cerebral artery (MCA) pulsatility and cognitive performance in a group of young adults. **METHODS:** 68 young adults (age: 21±4 yrs; body fat: 26.6±8.0%; n = 53 women) underwent 24-hr ABPM. BP was measured every 20 min during the day (0700 – 2200 hr) and every 30 min at night (2200 – 0700 hr). Following a 12-hr fast, transcranial Doppler of the MCA was used to measure pulsatility at rest and during 3 min of

a cognitive stress (Stroop task). One-tailed Pearson correlations were run between PP, PP variability, MAP, BP dipping, BP variability ratio (BPVR = standard deviation of systolic/standard deviation of diastolic pressure), and the ambulatory arterial stiffness index (AASI = 1 – regression slope of systolic and diastolic BP) with MCA pulsatility and cognitive performance (Stroop task accuracy). **RESULTS:** There was a trend for systolic and diastolic nighttime dipping to be inversely associated with resting MCA pulsatility ($r = -0.21$, $p = 0.057$ and $r = -0.20$, $p = 0.059$, respectively). No other measures from ABPM displayed a relationship with resting MCA pulsatility. Significant associations were noted between MCA pulsatility during the cognitive stress task and average daily PP ($r = 0.25$, $p = 0.027$) and systolic dipping ($r = -0.25$, $p = 0.028$). Accuracy during the cognitive stress task was not associated with any measure of BP variability (PP, PP variability, or BPVR), MAP, or AASI ($p \geq 0.174$). **CONCLUSION:** These data suggest that nighttime BP dipping may be related to reduced cerebrovascular pulsatility at rest and that greater reductions in systolic BP during sleep may relate to MCA pulsatility during cognitive stress. Additionally, greater daily PP may be associated with increased MCA pulsatility during cognitive stress. ABPM is associated with cerebral pulsatility but not cognitive performance in healthy, young adults.

Supported by NIH Grant 1R03MD011306-01A1

Information Processing is not Affected by Multiple Concussions in College Age Students

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A concussion may result in several long-term effects including mild cognitive impairment, mental and physical ailments, cognitive decline, and/or increase risk of depression/anxiety. Information processing is an important aspect of executive function, cognition, and movement adaptation. The components of information processing can be assessed using multiple types of reaction time (RT). Considering the lack of differences found in multiple concussed 17-22 yr old athletes compared to non-concussed athletes on ImPACT testing, more specific information processing testing is needed. **PURPOSE**: To determine the effects of multiple concussions on information processing. **METHODS**: 41 subjects (23 female;18 male; 20.5$\pm$1.6 yrs), took part in this study. 16 participants had no diagnosed concussions (NONE), 12 had 1-2 diagnosed concussions (FEW), and 13 had 3 or more (MANY, mean: 4, range 2-8) diagnosed concussions. Simple reaction time (SRT, stimulus detection), disjunctive reaction time (DRT, stimulus identification), and choice reaction time (CRT, response selection) tests were utilized to assess information processing. Reaction time tests were compiled and downloaded from Psychtoolkit.com to run offline. Average times for each test along with error scores for DRT and CRT for each participant were recorded for later analysis. A 3x3 between-within factorial ANOVA was used to determine interaction between groups and RTs. One-way ANOVA were used to determine the effects of RT on each group separately. **RESULTS**: Mean reaction times (milliseconds, ms) (sd) for each group are as follows: **NONE**; SRT: 322.1ms (± 22.2), DRT: 425.5ms (±83.2),CRT:456.1ms (±38.3);

FEW; SRT: 328.1ms (±35.3), DRT: 432.5ms (±65.5), CRT:470.1ms (±75.1) ; **MANY**: SRT: 335.0ms (±41.4), DRT: 448.4ms (±77.8), CRT: 498.3ms (±80.7). . Factorial ANOVA revealed no significant interaction between the number of diagnosed concussions and reaction times [F (4, 760) = 0.294, p=0.881]. All three groups had significant RT differences (all F>75.0, all p<0.001). Post hoc analysis shows SRT significantly quicker than both DRT and CRT for all groups (all p≤0.001). **CONCLUSION**: Information processing is not affected by one or multiple concussions when looking at college aged students.

The Role of Reactive Oxygen Species in Neurovascular Coupling in Healthy Young and Older Adults

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Advancing age is associated with an increase in reactive oxygen species (ROS) relative to endogenous antioxidant defenses. ROS impair neurovascular function in animals, but their effect on human neurovascular coupling (NVC) is not well understood. **PURPOSE:** To assess the influence of an acute, supraphysiological infusion of an antioxidant (ascorbic acid; AA) on NVC in healthy young (Y) vs. middle-aged/older (MA/O) adults. **METHODS:** 8 Y (4 males / 4 females, age: 25 ± 1 years; BMI: 22.9 ± 2.6 kg/m^2; blood pressure (BP): 105 ± 13 / 64 ± 8 mmHg) and 9 MA/O (3 males / 6 females, age: 66 ± 8 years; BMI: 29.3 ± 4.7 kg/m^2; BP: 115 ± 11 / 72 ± 9 mmHg) participated in this randomized, double-blind placebo-controlled crossover intervention. Participants received a 20-minute bolus infusion of either saline (SAL) or 0.06 g AA / kg fat-free mass (FFM), followed by a drip-infusion of either SAL or 0.02 g AA / kg FFM. NVC was assessed as the percent change (from baseline) in middle cerebral artery (MCA) velocity normalized to beat-by-beat changes in mean arterial pressure to calculate cerebrovascular conductance (MCA_{CVC}) during the N-back test of executive function. Unpaired T-tests were used to assess age-group differences at baseline in MCA_{CVC} and performance on the N-back test. The efficacy of AA for improving NVC was assessed as the raw change (Δ) in MCA_{CVC} before and after infusion using a 2X2 repeated measures ANOVA with age (Y vs. MA/O) and treatment (SA vs. AA) as factors. Data are presented as mean ± SD in Y vs. MA/O. **RESULTS:** Compared with Y adults, MA/O adults produced lower correct responses (CR) on the N-back test (17 ± 1 vs. 16 ± 2 #CR; P = 0.074) yet exhibited a greater NVC response (MCA_{CVC}: 4.03 ± 2.59 vs. 7.18 ± 2.92 %, P = 0.033). AA did not significantly affect NVC or improve executive function in Y or MA/O adults; however, the mean change in MVA_{CVC} appeared to be lower in both groups after AA infusion compared with saline [SAL MCA_{CVC}: 2.43 ± 4.99 vs. 2.05 ± 5.88 %; AA MCA_{CVC}: 0.67 ± 3.04 vs. 0.91 ± 3.19 %, Treatment effect: P = 0.438, F (1, 13) = 0.639]. **CONCLUSION:** NVC is augmented in MA/O adults and is likely driven by an increased neuronal demand as a result of lower executive function. AA does not ameliorate NVC or executive function in MA/O adults.

Supported by P20GM113125.

A New Paradigm for Bodyweight Classification from the 2001-2006 National Health and Nutrition Examination Survey

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Obesity is a major public health issue in the United States (US) that affects an estimated 78 million US adults each year. Since the 1970's, obesity rates have more than tripled and have been associated with a higher prevalence of developing cardiometabolic and renal disease. However, body mass index (BMI) alone may be an imprecise measurement of body weight classification as it does not account for either visceral or total body fat. Furthermore, the current fitness categories for body composition are not standardized to the World Health Organization's (WHO) general population guidelines, and therefore, limit their use in clinical practice. **PURPOSE.** To perform a large-scale population-based cross-sectional analysis from the (2001-2006) National Health Assessment and Nutrition Examination Survey (NHANES). **METHODS.** Our population included 20,676 men and women who self-reported their age and sex, and who had complete anthropometric and body composition data from NHANES. Body composition variables included BMI, waist circumference, and total body fat percentage, measured with dual-energy x-ray absorptiometry (DXA). All study participants provided written informed consent prior to enrollment. Descriptive statistics, frequency distributions and percentiles were computed for the total population, and by age, sex and BMI. **RESULTS.** Of the included population, 49.1% were men and 50.9% were women. Those with a BMI between 18.0-24.9 kg/m^2 (normal weight) had a total body fat between 19.6%-30.4% and a waist circumference between 67.2 -85.9 cm (10^{th} - 45^{th} percentile). Those with a BMI $\geq$ 25.0 - 29.9 kg/m^2 (overweight) had a total body fat between 31.6% - 39.0% and a waist circumference between 88.5-101.5 cm (50^{th} and 75^{th} percentile). Those with a BMI $\geq$ 30 kg/m^2 (obese) had a total body fat $\geq$ 40.7% and a waist circumference $\geq$ 104.6 cm (80^{th} – 99^{th} percentile). **CONCLUSIONS.** We performed a large-scale population-based cross-sectional analysis from NHANES to standardize metrics of waist circumference and body fat percentage to the WHO's general population guidelines for body weight classification. Our findings may provide clinicians and healthcare practitioners with a more comprehensive assessment of body composition and serve as a supplemental resource to BMI when determining body weight status for Americans.

The Effect of Static and Dynamic Stretching on Power Output in Dancers

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Flexibility and power output are two critical components of dance performance; however, recent research suggests that acute bouts of stretching may decrease muscular power. **PURPOSE:** The

purpose of this study was to compare the effects of dynamic stretching (DS) and static stretching (SS) on muscular power in dancers. **METHODS:** 12 female, collegiate dance majors volunteered for this study. The subjects attended a familiarization session, gave informed consent, and were oriented to all testing procedures. Three different experimental sessions were conducted in randomized order for each stretching condition: DS, SS, and no stretching (NS), with a minimum of 48 hours between testing days. Each session began with a warm-up (5 min walk) followed by a guided stretching protocol, specific to dancers, for each condition. Muscular power (peak torque, Watts) was obtained for the plantar/dorsiflexors with an isokinetic dynamometer (60º/s and 180º/s) and vertical power (W/kg BW) was obtained using both a squat (SJ) and countermovement jump (CMJ). One-way ANOVA with repeated measures with Tukey HSD post-hoc tests were conducted to determine significance ($p \leq 0.05$) for each variable. **RESULTS:** The results indicated that there were no significant differences for the power output of dancers after incorporating DS, SS, or NS as part of a warm-up. Isokinetic muscular power isolating the plantar flexors demonstrated no significant difference at 60º/s (DS, 57.1 $\pm$ 22.7 W; SS, 57.8 $\pm$ 28.4 W; NS, 62.7 $\pm$ 19.3 W, $p = 0.82$) or at 180º/s (DS, 28.3 $\pm$ 9.50 W; SS, 30.5 $\pm$ 14.7 W; NS, 32.2 $\pm$ 16.2 W, $p = 0.76$). In addition, measurements of power incorporating whole body power demonstrated no significant difference in jump height for the SJ (DS, 21.05 $\pm$ 3.36 cm; SS, 20.83 $\pm$ 3.55 cm; NS, 20.9 $\pm$ 3.14 cm, $p = 0.893$) or the CMJ (DS, 23.8 $\pm$ 3.9 cm; SS, 23.7 $\pm$ 5.7 cm; NS, 24.7 $\pm$ 6.8 cm, $p = 0.98$). **CONCLUSION:** Although some research suggests that varying form of stretching may decrease muscular power, this study suggests that neither acute static stretching nor dynamic stretching will elicit a significant change in muscular power in dancers.

Microvascular Endothelial Dysfunction is Not Evident in Adults with 2017 AHA/ACC-Defined Stage 1 Hypertension

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In 2017, the American Heart Association (AHA) and American College of Cardiology (ACC) re-defined stage 1 hypertension (HTN1) to systolic blood pressure (BP) 130-139 mmHg or diastolic BP 80-89 mmHg. These new guidelines lowered the BP threshold classification for hypertension (HTN) and substantially increased the prevalence of HTN among US adults. Microvascular endothelial dysfunction, an early manifestation of the atherosclerotic disease that precedes clinically apparent target organ damage, is a hallmark of HTN. The degree to which endothelial dysfunction is evident in the microcirculation of adults in AHA/ACC defined HTN1 classification remains equivocal. **PURPOSE**: We tested the hypotheses that microvascular endothelial dysfunction would be present in adults with HTN1 compared to normotensive adults (NTN; BP <120/<80 mmHg), but would be less severe compared to adults with stage 2 hypertension (HTN2; systolic BP ≥140 mmHg or diastolic BP ≥90 mmHg), and that these

impairments would be mediated by reductions in nitric oxide (NO)-dependent dilation. **METHODS**: This retrospective analysis included 20 NTN (5 men; 45-64 yrs; BP 94-114/60-70 mmHg), 24 HTN1 (13 men; 40-74 yrs; BP 110-134/70-88 mmHg), and 47 HTN2 (30 men; 40-74 yrs; BP 128-180/80-110 mmHg). Both seated and 24hr ambulatory monitoring was used to measure BP. Red cell flux (laser Doppler) was measured during intradermal microdialysis perfusion of acetylcholine (ACh; 10^{-10}-10^{-1} M) alone and during co-perfusion with the NO synthase inhibitor L-NAME (15 mM). **RESULTS**: Baseline conductance (flux/BP) was not different between groups (NTN: 0.16±0.02, HTN1: 0.16±0.03, HTN2: 0.15±0.1, P=0.74). ACh-induced dilation was impaired in HTN2 (P<0.01), but not in HTN1 (P=0.59), compared to NTN. Further, reductions in the NO-dependent component of ACh-induced dilation were evident only in HTN2 (P<0.01). Further, endothelium-dependent dilation was blunted in adults lacking a nighttime dip of at least 10% in BP (P=0.01). **CONCLUSION**: Although functional impairments in NO-mediated endothelium-dependent dilation were not evident in HTN1, consistent with the 2017 AHA/ACC recommendations for the clinical management of HTN, stage 1 hypertension is an optimal point to initiate lifestyle interventions to prevent the progression of overt microvascular dysfunction.

Funding: CTSI TL1 (GAD), NIH HL093238 (LMA), and National Dairy Council

Wheel Running Partially Compensates for the Effects of Estrogen Receptor-α Knockout on Cortical Bone

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Loss of estrogen activity negatively impacts bone mass and strength, whereas exercise is osteogenic. **PURPOSE:** To determine whether voluntary wheel running could compensate for the negative effects of estrogen receptor-α (ERα) loss by evaluating tibial cortical geometry and biomechanical properties and trabecular microarchitecture in global ERα-knockout (KO) and wild-type (WT) male mice. **METHODS:** At 12 weeks of age, mice were allowed *ad lib* access to a high-fat diet, and KO and WT mice were randomized to exercise (EX) treatment or sedentary (SED) control, resulting in four groups: WT-SED, WT-EX, KO-SED, and KO-EX (n=8-10 per group). After 10 weeks, body composition was assessed via EchoMRI, animals were sacrificed, and hind limbs collected. **RESULTS:** Cortical geometry of the mid-diaphysis and trabecular microarchitecture of the proximal right tibia were assessed via micro-computed tomography. Biomechanical properties of the tibia were assessed via three-point bending at the distal end of the tibial crest. Two-way ANCOVA, with body mass as a covariate, was used to test the main and interactive effects of KO and EX on cortical geometry and biomechanical properties; two-way ANOVA was used to test the effects of KO and EX on all other outcomes. EX decreased body mass (p=0.01) and body fat percentage (p=0.01), regardless of genotype. KO had lower total bone area (p=0.01), marrow area (p=0.05), and cortical thickness (p=0.02) of the tibia mid-diaphysis versus WT. There was a significant genotype-by-exercise interaction

(p=0.05) for cortical area; EX increased cortical area in the KO animals, such that KO-EX was not different from WT animals. EX increased cortical thickness (p=0.03), regardless of genotype. There were no differences in biomechanical properties of the mid-tibia (distal end of the tibial crest) among groups. KO improved measures of trabecular microarchitecture compared to WT. **CONCLUSION:** Loss of ERα negatively impacts cortical bone geometry in young, sedentary, male mice, but exercise started after skeletal maturity can partially compensate for the loss of ERα activity.

This study was supported in part by grants from National Institutes of Health (NIH) K01 HL-125503 (to JP) and American Egg Board #00050021 (NCW).

The Effects of 50k Ultramarathon Running on Quadriceps Torque and Circulating Inflammatory Calprotectin.

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Ultramarathon running has increased in popularity over the past decade. However, the effects of prolonged running on novel circulating inflammatory factors, such as calprotectin, and their relationship to muscle strength are not completely understood. **Purpose**: Determine the effects of prolonged running on quadriceps strength and plasma calprotectin levels and examine the relationship between these two factors. **Methods**: Trained men and women (n=11) age 39 ± 7 years participated in a 50-kilometer(k) trail run consisting of five 10k laps. Seated knee extensor force was measured before the race, after each lap, immediately post-race and 24h post-race using a hand-held dynamometer. Quadriceps torque (N.m.) was calculated by multiplying tibial length by force. Blood was drawn 30 minutes after participants finished eating their pre-race meal, after the first lap (10k), within 60 minutes of finishing the race and 24h post-race. Plasma calprotectin was measured using an enzyme-linked immunosorbent assay (ELISA). **Results**: Quadriceps torque did not significantly change from pre-race to lap 1 (P=0.64), but significantly declined post-race (-10%; P=0.047) and returned to pre-race values by 24h post-race (P=0.1). Compared with lap 1, quadriceps torque declined significantly by lap 2 (-9%; P=0.024) but remained unchanged from lap 2 through post-race (between -10 and -8% from lap 2 through post-race; P>0.05 for each timepoint). Plasma calprotectin increased 63% at lap 1 (P=0.003), 83% post-race (P=0.001), and returned to pre-race values 24h post-race (P=0.66). Pre-race calprotectin levels directly correlated with quadriceps torque at lap 1 (r=0.627, P=0.023), post-race (r=0.771, P=0.005) and 24h post-race (r=0.767, P=0.006). Plasma calprotectin levels 24h post-race directly correlated with 24h post-race quadriceps torque (r=0.604; P=0.04). **Conclusion**: Athletes participating in a 50k ultramarathon experienced an acute decline in quadriceps torque that coincided with an acute increase in plasma calprotectin concentrations.

Both torque and plasma calprotectin returned to pre-race values after 24h. The relationships between calprotectin levels and muscle torque before, during, and after the race suggest a potential novel role for calprotectin in muscle recovery from an ultramarathon.

Supported by Bridges to the Baccalaureate Program 5 R25 GM058264 16, the University of Maryland College Park, and the Baltimore Veterans Affairs Medical Center

Gut Microbiota Contribute to Exercise Capacity and Metabolic Profile in a Wildtype and Longevity Model Mouse

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The gut microbiota can be influenced by many factors including host genotype, diet and exercise training. Previously, we have shown host genotype and behavior (i.e. exercise) can influence the selection of individual species and strains of microbes in the mouse gut. **PURPOSE:** The purpose of this study was to examine the role of gut microbes and their impact on exercise tolerance, metabolic outcomes and short chain fatty acids (SFCA) profiles in two strains of mice, a wild type (WT, n=15) and disruption of adenylyl cyclase type 5 knock out (AC5KO, n=17), a well-established model of longevity, healthy aging and enhanced exercise capacity. **METHODS:** Mice (n=32) were randomly assigned to either sedentary (PRE) or exercise (POST) conditions. Exercise training consisted of forced treadmill running (FTR) at 60-70% of maximal running capacity 5 days/week for five weeks. Following training, a subset of animals (n=3, each) were given an oral antibiotic (ABX) treatment for one week to eliminate gut microbes. **RESULTS:** Exercise tolerance was reduced in WT-ABX (233.0 m vs. 524.1 m, $p=0.0161$) and AC5KO-ABX (248 m vs. 951 m, $p<0.0001$) mice compared to POST. WT-POST mice showed a significant reduction in glucose tolerance testing (GTT) area under the curve ([AUC]) (4,607,903.5 $\pm$ 247,340.1 vs. 3,640,733.3 $\pm$ 160,536.2 arbitrary units [AU], $p=0.009$) indicating enhanced glucose uptake compared to PRE. AC5KO-ABX mice displayed a significant reduction in GTT AUC (3,322,485.0 $\pm$ 308,117.1 AU vs. 2,249,800.0 $\pm$ 266,022.9 AU, $p=0.01$) which coincided with a significant decrease in insulin tolerance testing (ITT) area above the curve (269,197.5 $\pm$ 42,952.5 vs. 560,307.5 $\pm$ 48,065.4, $p=0.006$), demonstrating increased insulin sensitivity. SCFA profiles were altered in both WT-ABX and AC5KO-ABX mice from PRE to POST, with significant increases in acetic acid (24% vs. 87%, $p=0.003$) and (19% vs. 89%, $p=0.031$) which was associated with proportional decreases in butyric acid (58.3% vs. 1.9%, $p=0.003$) and (66.1% vs. 0.7, $p=0.009$), respectively. **CONCLUSION:** Our results suggest that depletion of the gut microbiome significantly reduces exercise tolerance, regardless of genotype; changes glucose and insulin sensitivity; and alters SCFA concentrations by reducing butyric acid in favor of acetic acid.

The Addition of Naltrexone Alters Cerebral Glucose Uptake Following Acute Exercise

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Rodent studies have demonstrated that exercise (EX) can be used to replace the rewarding effects of opioid self-administration**.** Despite this knowledge we do not have a clear understanding of how exercise is as rewarding as opioid use. **PURPOSE:** To investigate the role of the endogenous opioid (EO) system on brain glucose uptake following a bout of EX with and without administration of naltrexone (NTX). **METHODS:** Mice were fasted overnight and scanned using positron emission tomography (PET) in one of four conditions: control (CON), EX, NTX or EX +NTX injection. Mice were delivered a dose of 18F-fluorodeoxyglucose (FDG-18; 70 uCi) 1 hour prior to scanning. Mice that underwent EX performed 50 minutes of forced swimming following a week of familiarization. NTX was given via intraperitoneal injection (4 mg/kg) 15 minutes prior to EX or FDG administration. Data was imaged using VivoQuant software and analyzed using PMOD (PNEURO) software by a technician blinded to the experimental conditions. Data was calculated as average standardized uptake values (SUV) for 19 regions of interest (ROI) and made relative to the SUV of the whole brain. **RESULTS:** EX increased food consumption ($p<0.05$) two hours following EX but was abolished by NXT ($p<0.05$). EX increased glucose uptake in the region of the cerebellum and the combination of EX + NTX increased uptake in several other regions of the brain including the hypothalamus, basal forebrain and septum, and amygdala. EX increased FDG-18 uptake by 36.1 ± 7% in the cerebellum relative to CON ($p< 0.05$). There were no changes in FDG-18 uptake following EX or NTX in the hypothalamus. The combination of EX + NTX significantly increased uptake by 53 ± 12% relative to control and compared to EX and NTX (39.3 ± 10%; 35.2 ± 9%; $p<0.05$), respectively in the hypothalamus. The same trend followed in the region of the basal forebrain and septum EX+NTX increased ($p<0.05$) FDG-18 uptake relative to all other conditions (CON = 52.4 ± 8%, EX = 82.2 ± 21%, EX + NTX =40.4 ± 8%). Lastly, there were significant increases in uptake in the right and left amygdala under the EX + NTX conditions relative to CON (74.6 ± 8%; 57.5 ± 4.8%; $p<0.05$), respectively. **CONCLUSION:** These data demonstrate how EX changes brain glucose metabolism which may be specific to the EO system and therefore EX may have potential as an adjunct therapy for addiction.

Endothelial Function is Preserved in Ultra-Marathon Runners Following a 50 km Race

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Ultramarathon runners may be at a heightened risk for adverse cardiovascular events, especially in the time period immediately following a prolonged bout of endurance exercise. The heightened cardiovascular risk may, in part, be attributed to endothelial dysfunction. **PURPOSE:** To evaluate endothelial function, as measured by % flow-mediated dilation (FMD), before and after completion of a 50 km ultramarathon race. **METHODS:** Baseline diameter of the brachial artery and % FMD of eleven participants (male=8; age=40 ± 2) were measured pre-race, 60 minutes post-race and 24 hours post-race completion. A repeated measures ANOVA was used to compare baseline diameters and % FMD among timepoints. **RESULTS:** Pre-race baseline diameter (3.83mm ± 0.16) and % FMD (6.45% ± 0.89) were not significantly different at 60 minutes post- (3.89mm ± 0.16 and 6.75% ± 1.33) or 24-hours post-race completion (3.92mm ± 0.18 and 7.46% ± 0.76). **CONCLUSION:** Data from the current study suggest that no impairment of endothelial function occurs within 24 hours following a 50 km ultra-marathon race. These data suggest that ultramarathon runners may not be at a heightened cardiovascular risk as measured by brachial artery reactivity following a 50 km race.

Effects of Oral Saline Consumption on Heart Rate Variability Measurements During Postural Change

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Acute large doses of sodium increase serum sodium levels, which may increase sympathetic activity. Conversely, the increase in plasma volume due to volume loading may suppress sympathetic drive and increase parasympathetic activity. Changing from supine to upright posture requires shifts in autonomic activity to combat against the blood pooling effects of gravity. Saline administration has been shown to be effective in combatting symptoms in subjects with orthostatic intolerance. However, it is unclear what saline administration will do in normal healthy subjects. **PURPOSE:** To examine the effect of oral saline consumption on autonomic function in healthy adults in the supine and upright seated postures. **METHODS:** Healthy subjects participated in two randomized data collection visits. During the experimental visit participants orally consumed 423mL of normal saline (NS) and waited 90min before data was recorded. During the control visit (CON) no saline was consumed. Beat-by-beat blood pressure and an electrocardiogram were recorded during 5 minutes of supine (SUP) rest followed by 5 minutes of upright sitting (SIT). Heart rate variability was analyzed to assess resting autonomic function between conditions and postures using a repeated measures two-way ANOVA. **RESULTS:** Sixteen healthy participants (age 21.1 ± 1.0 years; body mass index 25.0 ± 1 kg/m^2,) were studied. Main effects showed that heart rate (HR) decreased slightly ($p < 0.05$) during the saline condition (CON: 65.8 ± 7.96 bpm, NS: 64.24 ± 8.55 bpm). There was a significant interaction effect for low frequency power (LF), high frequency power (HF). Post hoc

tests provided evidence that LF was increased in the SUP compared to SIT in both the control (SUP: 33.24 ± 17.78 nu, SIT: 50.04 ± 22.60 nu) and NS (SUP: 40.70 ± 21.62 nu, SIT: 55.0 ± 23.67 nu), while HF decreased in the control (SUP: 64.24 ± 17.10 nu, SIT: 48.95 ± 22.20) and NS (SUP: 57.69 ± 20.82 nu, SIT: 44.27 ± 23.17. **CONCLUSION:** The results of this study suggest that heart rate was suppressed by saline consumption. However, this preliminary data suggest that there is no evidence that saline consumption had an effect on heart rate variability during either SUP to SIT postures.

Effects of Precooling on Recreationally Active Individuals During Loaded Carriage Foot Marches in Heated Conditions

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Over the last 20 years, literature has demonstrated that military members are prone to exertional heat illness (EHI) due to engaging in physical activity while carrying necessary military equipment. Solutions such as cold-water immersion or convective cooling vests help ease this physiological strain, however, these methods require time, space, equipment, and/or costs that may make them impractical for broad implementation. Precooling (Pc) is when an individual either applies an external cooling method or ingests a cold substance to preemptively lower core temperature before an activity. **PURPOSE:** The aim of this study was to investigate the effects of a Pc protocol employing ice slurry (0±1°C) vs. cold water (4°C) on core body temperature (CT) and time to exhaustion (TTE, minutes) during a simulated military full combat gear foot march in males aged 18 to 35 years. **METHODS:** Six college aged males, (23.5±1.0 y/o, 91.0±9.3 kg, 183.3±8.1 cm), engaged in two separate simulated army ruck march trials in heated conditions (33±2°C). The researchers used a Pc protocol of 7.5g/kg of bodyweight of both water (control) and ice-slurry (experimental) administered over a 30-minute period prior to activity. Following the Pc protocol, the participants self-selected a pace from 3.0-4.0 MPH and walked for up to 90 minutes or until volitional fatigue inside a heat tent while wearing full Army combat gear. CT, heart rate (HR) and RPE were collected every 5 minutes. Blood pressure was collected pre and post exercise. A t-test was run for TTE, and two separate ANOVA's were conducted on both HR and CT. **RESULTS:** There was no significant difference in TTE (control = 26.3±8.2 min vs. Pc = 28.2±11 min; p = 0.227), HR (control = 133.6±13.4 bpm vs. Pc = 135.7±16.2 bpm; p = 0.763) or CT (control = 37.4±0.4°C vs. Pc = 37.4±0.4°C; p = 0.876) between conditions. **CONCLUSION:** The Pc protocol was ineffective at lowering CT vs. control and thus did not increase TTE. Additional research on ice slurry Pc with military equipment is needed to further elucidate the potential benefits of Pc on exercise performance and decreasing the risk of EHI.

Beetroot Juice and Cerebrovascular Hemodynamics in Young Adults with a History of Concussion: Preliminary Findings

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Concussions have become more prevalent with the recent increase of youth participation in sports with head involvement. Repeated concussions have been associated with decreased cerebral blood flow (CBF) and cognitive function. High levels of dietary nitrates in beetroot juice may favorably improve cerebrovascular blood flow. **PURPOSE**: Examine changes in middle cerebral artery (MCA) hemodynamics and cognitive function after consumption of beetroot juice in young adults with a history of concussions. **METHODS**: Cerebral blood flow and cognitive function were measured in 5 young men (age: 21 ± 1 yrs) with at least two diagnosed concussions in the past 5 years (number of concussions: 3 ± 2) as part of a double blind study design. Participants completed 2 study visits on separate days consuming two, 16.9 fl oz bottles of either beetroot juice (BEET) or purple carrot juice (CAR). One bottle was consumed prior to sleep the night before the visit, and the other bottle was consumed within two hours of their visit. A 48-hour washout period was implemented between study visits, and BEET and CAR were counterbalanced. MCA blood flow (mean velocity, Vm, and pulsatility index, PI) was measured using transcranial Doppler. Cognitive function was determined using an incongruent Stroop test as accuracy and reaction time (RT). **RESULTS:** Vm did not differ following BEET versus CAR (57.3 ± 19.2 vs 53.3 ± 17.7cm/s, respectively; $p=0.219$, $\eta^2= 0.35$). Similarly, PI following BEET (0.92 ± 0.19) did not differ from CAR (0.88 ± 0.04, $p=0.596$, $\eta^2= 0.08$). Accuracy did not differ between the two conditions (BEET: 65.1 ± 9.6%; CAR: 62.6 ± 10.7%, $p=0.719$, $\eta^2= 0.04$). Reaction time did not differ between BEET and CAR (1.05 ± 0.08 vs 1.08 ± 0.18sec, respectively; $p=0.623$, $\eta^2= 0.06$). **CONCLUSION:** Our preliminary findings suggest that beetroot juice does not influence CBF or cognitive function in young adults with a history of concussion.

Changes in Health-Related Fitness of College Females During a One-Semester Activity Course

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Young adulthood is a prime time to establish healthy physical activity behaviors. Female physical activity is low, and chronic diseases due to the lack of exercise are evident among women in college. College physical activity courses offer opportunities for students to learn how to exercise to make a positive impact on health-related fitness. **PURPOSE:** To evaluate baseline and follow-up health-related fitness outcomes among female college students as seen through their participation in a semester-long, tri-weekly activity course. **METHODS:** 10 women enrolled in a physical activity course participated in a pilot study evaluating changes in health-related fitness. Participants underwent assessments that included resting heart rate, body mass

index, push-ups, and sit-and-reach. Baseline data were collected at the beginning of the semester and follow-up data were collected six weeks later. A paired t-test was used to evaluate changes in resting heart rate, body mass index, number of push-ups, and flexibility. **RESULTS:** Resting heart rate (87.0 bpm $\pm$ 9.4 vs. 82.8 bpm $\pm$ 7.4, $p > .05$), number of push-ups (12.6 $\pm$7.4 vs. 17.3 $\pm$ 8.5, $p > .05$), and flexibility (41.3 cm $\pm$ 5.2 vs. 43.4 cm $\pm$ 4.5, $p > .05$) improved, but were not significant. Although body mass index increased (21.5 kg/m^2 $\pm$ 2.9 vs. 21.8 kg/m^2 $\pm$ 2.5, $p > .05$), it was also non-significant. **CONCLUSION:** The results of this study illustrate small improvements in health-related fitness, however, differences were non-significant. Participation in an organized, semester-long activity course three days a week may improve certain aspects of health-related fitness in college females, but further investigation on the quality of activities is needed to determine course effectiveness in improving student fitness.

The Effect of Seated Posture on Thoracolumbar Fascia, thus Influencing Balance

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Excessive flexion or extension of the lumbar spine, otherwise known as poor posture, can result in mechanical alterations of the fascia and surrounding tissues. This excessive or prolonged loading can result in micro- and macro-changes to fascial systems. These changes put stress on the thoracolumbar fascia (TLF) and exert additional pressure on the paraspinal muscle compartment (PMC), which may result in proprioceptive deficits, negatively impacting balance. **PURPOSE**: The purpose of this study was to determine if acute insults to the TLF were capable of affecting measures of balance. **METHODS**: Healthy young individuals (n=16; M= 8, F= 8; ages 19-21) were chosen for this experiment. Participants were not involved in varsity sports, not taking oral contraceptives, and had no history of back injury. During baseline testing (BL), hip angle was measured while seated in a comfortable position. In the following two sessions, participants sat in different forced postures, erect (EP; upright with a hip angle of 90°) and slouched (SP; hip angle of < 90°). Posture was maintained for 20-minutes while watching media on a laptop in a quiet laboratory. Immediately following each posture, participants performed a sensory organization test (SOT) on a Neurocom EquiTest. The six SOT conditions isolate the sensory systems that affect balance. For each session, SOT conditions were randomized. Participants were required to wait at least 24 hours prior to the next session. Dependent t-tests were conducted using SPSS and analyzed BL vs. EP, BL vs. SP, and EP vs. SP. **RESULTS**: During BL vs. EP, increased equilibrium scores were observed in Condition 3 ($BL_3 – EP_3$ = -1.354 ± 2.664; $p = 0.025$), Condition 5 ($BL_5 – EP_5$ = -5.288 ± 8.859; $p = 0.031$), and Condition 6 ($BL_6 – EP_6$ = -10.369 ± 12.446; $p = 0.005$). During SP, participants performed better in Condition 3 ($BL_3 – SP_3$ = -2.606 ± 3.321; $p = 0.007$) and Condition 6 ($BL_6 – SP_6$ = -14.739 ± 14.194; $p = 0.001$) compared to BL. No significance was found for EP vs. SP. **CONCLUSION:** The acute insult to the TLF was not influential enough to affect all balance sensory systems, but there is evidence that some systems were. This is beneficial for future research where longer

durations of insult to the TLF may elicit significance due to increased stress on the PMC as well as more prominent micro- changes to the fascia and surrounding tissues.

Comparison of Lipoprotein Based Insulin Resistance Score and Traditional Risk Factors in Adolescents with Obesity

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Changes in lipoprotein profiles occur prior to overt hyperglycemia or type 2 diabetes mellitus and in association with insulin resistance. The Lipoprotein Insulin Resistance Score (LP-IR) is a weighted score of lipid particles and concentrations to quantify the multifactorial role of lipids in insulin resistance. Previously LPIR scores greater than 25 increased disease risk in adults. Identifying metabolic perturbation via LPIR in adolescents with obesity may identify at-risk individuals prior to traditional risk factors. **Purpose:** The aim of this study was to compare LP-IR scores to traditional risk factors (BMI, Total Cholesterol, LDL, HDL, TGs) in a cohort of adolescents with obesity. **Methods:** We assessed n = 69 (Age, Median (IQR) = 17 (2), Female = 51, Male = 18) adolescents with obesity (BMI = 46.5 (11.1)) for plasma lipoprotein particle concentration and diameters via automated nuclear magnetic resonance. LP-IR scores were determined as weighted calculations of LDL, VLDL, and HDL particle sizes and concentrations. Subjects were classified into quartiles based on LPIR. ANOVA was used to assess differences among quartiles for BMI, Total Cholesterol, LDL, HDL, and TGs. **Results:** LP-IR among quartile groups were Q1: 19.5 ± 7.1, Q2: 37.7 ± 4.6, Q3: 51.9 ± 2.5, Q4: 72 ± 11.7. There was no difference among quartiles for BMI ($p = 0.60$), LDL ($p = 0.77$), or total cholesterol ($p = 0.66$). Significant differences were identified for Q4 (most insulin resistant) in comparison to all other quartiles for TAG (90 ± 32 mg/dl vs. (Q1) 43 ± 18, (Q2) 51 ± 19, (Q3) 57 ± 17) and HDL (37 ± 7 mg/dl vs. 51 ± 9, 43 ± 10, 38 ± 7). **Conclusion:** Differences in risk factors (HDL and TGs) were identified in the most insulin resistant (Q4) subjects in comparison to all other groups as would be expected in MetSyn. However, subjects in Q2 and Q3 did not show significant changes in traditional risk factors in comparison to Q1 (least insulin resistant) despite LP-IR scores above 25, which has previously been associated with increased disease risk. Thus, LP-IR may be useful in identifying early pathological metabolic alterations in adolescent obesity in conjunction with identification of traditional risk factors. However larger studies are needed to better understand the LP-IR score in pediatric patients with obesity.

Validation of a Wrist-Mounted Photoplethysmography Device During Graded Exercise Testing

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The electrocardiogram (ECG) serves as the gold standard of heart rate (HR) monitoring but is rarely used outside of a clinical environment. Newly developed wearable technology is more usable outside of a clinical setting, but has not been validated against this gold standard. Increased ease of use as well as increased portability will allow for more flexible study design. **PURPOSE**: The purpose of this study is to determine the validity of a wrist mounted photoplethysmography (PPM) device used for measuring HR during incremental treadmill exercise using ECG as the criterion HR measurement. **METHODS**: Twenty-two subjects (13 men, 9 women; 35.8 ± 6.3 yr, 14.6 ± 7.5 % body fat, VO_2max: 55.5 ± 0.49 ml·kg^{-1}·min^{-1}) performed a Bruce treadmill protocol graded exercise test. HR was recorded at rest and at the end of each minute with the Mio Alpha PPM device and ECG simultaneously. HR was compared between methods across the entire testing session (rest and exercise values) and separately for each exercise test stage using paired-samples *t*-tests. Validity coefficients were determined using the Pearson correlation. **RESULTS**: HR across the entire intensity range (rest to maximal exercise) exhibited a significant correlation between methods (r = 0.97, p < 0.001). However, HR was significantly different (overall mean HR: ECG = 124 ± 39 b·min^{-1}, Mio = 123 ± 37 b·min^{-1}, t_{359} = -2.504, p = 0.013). Significant correlations were observed at rest and each exercise test stage, with r values ranging from 0.67 to 0.96 (all p < 0.001). HR was significantly different between methods at rest (ECG = 66 ± 13 b·min^{-1}, Mio = 68 ± 16 b·min^{-1}), stage 3 (ECG = 144 ± 13 b·min^{-1}, Mio = 143 ± 13 b·min^{-1}, p = 0.014), stage 4 (ECG = 168 ± 13 b·min^{-1}, Mio = 164 ± 14 b·min^{-1}, p = 0.004), and stage 5 (ECG = 178 ± 12 b·min^{-1}, Mio = 173 ± 18 b·min^{-1}, p = 0.039). **CONCLUSION**: Correlational analyses indicated a strong agreement between HR methods overall, as well as individually at rest and during each exercise test stage. However, mean comparisons observed significant differences between methods. From a practical standpoint, the mean difference between methods did not exceed 3 b·min^{-1} except for stage 5. Therefore, a PPM device may not provide accurate HR monitoring at maximal exercise intensities.

60 Min Daily Vs Average of 60 Min/Day, Are There Differences in Health Status?

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The physical activity (PA) guidelines for Americans 2nd Ed. recommend children and adolescents (6-17 years old) to engage in at least 60 min/day of moderate-to-vigorous PA (MVPA). However, it is common to report that participants meet guidelines when they average 60 min/day of MVPA instead of 60 min daily as recommended. **PURPOSE:** To determine if there were differences in health status (high-density lipoprotein cholesterol (HDL), total cholesterol (TC), triglyceride (TRG), BMI, and diastolic and systolic blood pressure (DBP, SBP)) between children and adolescents that engage in MVPA for an average of 60 min/day

(group 1) or 60 min daily (group 2). **METHODS:** Data from 724 (Group 1 =371, Group 2 = 353) children and adolescents (aged 6–17 yrs) that had 6+ valid days of accelerometer data from the 2003-2006 National Health and Nutrition Examination Survey (NHANES) were included in this analysis. One-Way ANOVA was used to compare mean values between the 2 groups for all measures and ANCOVA was used to control for covariates. **RESULTS**: Mean MVPA (82±20 and 128±37 min/day), age (10±3 and 8±2 years) and BMI (19±4 and 17±3 Kg/m^2) were significantly different between groups ($p<.001$). However, HDL (57±12 and 59±13 mg/dL, p=.10), TC (165±30 and 162±29 mg/dL, p=.23), TRG (77±38 and 78±47 mg/dL, p=.89), SBP (103±10 and 101±10 mmHg, p=.08), and DBP (53±14 and 53±14 mmHg, p=.70) were not different. When variables were adjusted for age and gender, no significant mean differences were found for BMI (p=.21), and other health measures. **CONCLUSION**: Although there were mean differences in MVPA between children and adolescents that engage in MVPA an average of 60 min/day or 60 min daily, there were no significant health differences. More studies are needed to confirm these initial findings leading to a possible change in the wording of the guidelines.

The Effects of Music on Perceived Intensity of Exercise During a Submaximal Treadmill Test

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Previous studies suggest that music has a positive effect in the perception of exercise intensity and with music subject experience less fatigue (RamezanPour, 2011). **PURPOSE**: To study the effects of music on the perception of intensity during submaximal treadmill exercise among recreationally active college students. **METHODS:** A total of 12 participants (Males = 7, and Females =5; 21.8 years ± 8 years) healthy physically active (as per ACSM guidelines) participants from Cabrini University and Valley Forge Military College volunteered for the study. Each subject completed a 20-minute treadmill exercise either "with music" or "no music" on two separate days. After the exercise, the overall rating of perceived exertion (RPE-O) was estimated using the Adult OMNI-Walk/ Run Scale. A paired t-test was used to determine differences between RPE-O for two conditions. **RESULTS:** There was no significant differences (p= 0.26) for RPE-O between the music (4.75±1.35) and no music (5.08±0.9) conditions. The heart rates measured at 20 minutes were not significantly different either (p=0.2, HRmusic=157.8±29 beats.min-1, HRnomusic=152.3±30beats.min-1). **CONCLUSION:** During submaximal treadmill exercise, music has no effect on the perception of exercise intensity among recreationally trained college students. Future studies should explore the effect of music during varied submaximal intensity exercise, intermittent exercise duration, and fitness levels.

The Effects of Acute Creatine Supplementation on Arterial Stiffness

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PURPOSE: To determine the effects of acute creatine monohydrate supplementation on arterial stiffness (AS). There is a void in our knowledge on the impact of exercise supplements, in particular creatine monohydrate supplementation, on AS in the major elastic arteries. As of this writing, there is one experiment that examined the relationship between creatine supplementation and arterial stiffness. However, the previous study used arterial stiffness indices that were dependent on several factors including blood pressure, thus subjected to interpretation. This study attempted to clarify some of these discrepancies through our proposed model. **METHODS**: 20 male, physically active participants were randomized in a double-blind fashion to placebo (PL) (n=10, 22.9±3.1 yrs) or creatine (CM) (n=10 21.3±1.8yrs) groups. Subjects received 0.3 g/kg/day creatine monohydrate or placebo in gelatin capsules for 7 days. Each subject underwent a series of anthropometric assessments, ultrasonography of the carotid artery, applanation tonometry, and seated and supine blood pressure measurements at baseline and on day 7 of the study period. **RESULTS**: There were baseline differences in central systolic blood pressure (cSBP) (mean difference, 109; 95% confidence interval (CI) 105 to 113, vs. mean difference, 130; 95% CI 114 to 146, $p < 0.05$) between the PLA and CM groups, respectively. Following the intervention, there were no significant differences between PL and CM in arterial stiffness indices between the groups. Percent fat free mass (FFM) was significantly increased (mean, 68.5±7.5%; 95% CI 62.1% to 72.9%, to mean 69.3±7.5% 95% CI 62.9% to 73.6%, $P<0.05$) in the CM group only. There were no other significant changes in anthropometric measurements. **CONSLUSIONS**: Using a randomly controlled, double-blind trial with validated measurements of AS; acute creatine supplementation does not appear to impact vascular compliance in young, otherwise healthy males.

Funding Source: None

Vascular and Autonomic Correlates of Cerebral Pulsatility in Young Women

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Cerebral pulsatility is associated with increased stress on the microvascular of the brain resulting in cerebral damage. Age-related increases in arterial stiffness dampen the buffer-effect of large artery elasticity, augmenting cerebral pulsatility in older women. In addition to large artery stiffness, autonomic nervous system function may affect cerebral pulsatility by altering vascular tone. However, correlates of cerebral pulsatility in young women have not been thoroughly explored. **PURPOSE**: To determine the relationship between aortic stiffness and autonomic function with cerebral pulsatility index (PI) in young women. **METHODS**: Eighty-two women

(21±4 years) underwent resting cerebral hemodynamic assessment. Cerebral PI was assessed using transcranial Doppler of the middle cerebral artery. Aortic stiffness was measured via carotid-femoral pulse wave velocity (PWV) using applanation tonometry. Autonomic function was assessed via heart rate variability (HRV). Log transformations were performed to remove heteroscedasticity of the autonomic measures [low frequency (LF), high frequency (HF)]. lnLF was used as a measure for sympathetic activity, while lnHF was used as a measure of parasympathetic activity. Pearson-moment correlations (two-tailed) were used to analyze the relationships between PWV and HRV with PI. **RESULTS**: PI was not significantly correlated with PWV (r=-0.029, p=0.822) or lnHF (r=0.251, p=0.057). There was a significant, though weak, positive association between lnLF and PI (r=0.393, p=0.002). **CONCLUSION**: Sympathetic activity is a more prominent correlate of cerebral pulsatility than large artery stiffness in young women. Sympathetic tone may increase vasoconstriction of the cerebral vasculature resulting in augmentation of cerebral pulsatility. Additional research using other measures of sympathetic activity are needed to corroborate these findings.

Supported by NIH Grant 1R03MD011306-01A1

Does Weight Status Influence Cardiovascular Response to Sitting Versus Standing While Performing Computer Work?

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The long-term health benefits and efficacy of standing desks are unknown. Recently it was shown that blood pressure (BP) and cardiovascular stain may be higher while standing. These factors may also be affected by weight status. **PURPOSE:** To evaluate the cardiovascular differences between sitting and standing in normal versus overweight individuals. **METHODS:** A total of 34 individuals, 19 normal (N) and 15 overweight (OW), completed the study. Subjects participated in two 15-minute trials, sitting (SIT) and standing (STD), during which they completed simple mouse driven computer tasks. Trials were completed back-to-back in random order. Throughout the test a continuous blood pressure system monitored heart rate (HR), mean arterial pressure (MAP), stroke volume (SV), cardiac output (Q) and total peripheral difference (TPR). Data from the last five minutes of each condition was averaged. All finger BP measurements were calculated as change scores from the first 5 minutes of the seated work free baseline period. A 2x2 ANOVA was used to determine differences between weight status (N vs. OW) and condition (SIT vs. STD). **RESULTS:** The HR was lower ($p \leq 0.001$) when SIT (N 67 ± 2 bpm, OW 64 ± 2 bpm) compared to STD (N 81 ± 2 bpm, OW 74 ± 2 bpm), but not different between groups ($p = 0.118$). There were no differences in ΔMAP between conditions ($p = 0.807$) or groups ($p = 0.374$). The ΔSV was different between conditions ($p < 0.001$) and groups ($p = 0.010$). ΔSV was higher ($p = 0.010$) when N were SIT (N 6.7 ± 2.0 L/min) compared to all other groups and conditions (N: STD -9.2 ± 2.6 L/min; OW: SIT -6.3 ± 2.1 L/min, STD OW -11.0 ± 2.8 L/min). The ΔQ was not different between conditions ($p = 0.228$) or groups ($p = 0.162$), but

did have a significant interaction (p = 0.015) with N SIT being higher than all other conditions (SIT: N 0.4 ± 0.1 L/min, OW -0.2 ± 0.1 L/min; STD: N -0.1 ± 0.2 L/min, OW -0.1 ± 0.2 L/min). The ΔTPR was not different between condition (p = 0.233) or groups (p = 0.219), but also had a significant interaction (p = 0.039) with N SIT being higher than all other conditions (SIT: N -0.2 ± 0.1 PRU, OW 0.1 ± 0.1 PRU; STD: N 0.1 ± 0.1 L/min, OW 0.0 ± 0.1 PRU). **CONCLUSION:** Results suggest that the cardiovascular response to siting versus standing may be influenced by the interaction of body position and weight status.

Vascular function in Female Vegetarians and Omnivores

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The benefits of a vegetarian diet on health are well studied and documented. When compared to omnivores, vegetarians have lower body weight, blood pressure (BP) and cardiovascular disease risk. Although the exact underlying mechanisms remain unclear, it is hypothesized that the vegetarian diet may protect the vascular endothelium, whose optimal function is necessary to prevent pathogenesis of atherosclerosis. **PURPOSE**: To assess if women who have been following a vegetarian diet have greater endothelial function compared to those consuming a non-vegetarian diet containing red meat. **METHODS**: Young healthy normotensive females between the ages of 18-45 years were recruited. Vegetarianism (V) was defined as following a plant-based diet that could include eggs and dairy for at least 5 years and omnivores (O) were defined as consuming red meat at least twice a week. Diet history was assessed via a food frequency questionnaire. Assessment of vascular function involved brachial artery flow-mediated dilation (FMD), a method to assess endothelial function primarily mediated by nitric oxide, carotid-to-femoral pulse wave velocity (PWV), a measure of arterial stiffness and, aortic augmentation index, an index of wave reflection, normalized for heart rate at 75 beats per minute (AIx75). **RESULTS:** Thirty-eight (17O/21V) normotensive female subjects (O: 24 ± 1 yr; BMI 23 ± 1 kg/m^2; 113 ± 2/69 ± 2 mmHg; V: 25 ± 6 yr; BMI 22 ± 1 kg/m^2; 111 ± 2/70 ± 1 mmHg) completed the study. Vegetarians consumed more carbohydrate and fiber, less fat, and protein than O, even when normalized to energy intake ($P<0.05$). There were no differences in baseline diameter between the two groups ($P>0.05$) nor peak diameters ($P>0.05$). % change in FMD was similar between groups (O: 6.85 ± 0.9 %, V: 6.56 ± 0.6 %). Arterial stiffness as assessed by PWV (O: 5.1 ± 0.2 m/s, V: 5.3 ± 0.2 m/s) and AIx75 (O: 0.4 ± 4%, V: 3.8 ± 3%) were also not different between groups ($P>0.05$). Finally, total hours of physical activity performed were not different between V and O ($P>0.05$). **CONCLUSION**: Contrary to our hypothesis, these data in young healthy females suggest that a vegetarian diet may not offer any additional benefits to resting hemodynamics or vascular function parameters compared to a diet containing red meat.

Supported by NIH NIGMS P20GM113125

The Effect of Urea and Laminar Shear Stress on Endothelial L-arginine Transport

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Shear stress (SS) stimulates vascular endothelial cells (ECs) to produce nitric oxide (NO) from L-arginine (L-arg) that is transported through the cationic amino acid transporter 1 (CAT-1). In the presence of excess urea, common with kidney disease, L-arg transport through CAT-1 is reduced, contributing to endothelial dysfunction. Aerobic exercise increases SS to ECs and this SS may increase L-arg transport in the presence of excess urea. **PURPOSE:** To examine the effect of SS and urea on L-arg transport and the production of NO metabolites (NOx) in ECs. **METHODS:** Human umbilical vein ECs were treated with growth medium supplemented with 25 mM of either urea or mannitol for 48 hours. Cells were sheared for 12 minutes at 0, 10, 15, or 20 dyn/cm^2 at 37°C (Flexcell International). ECs were treated with 25 μCi L-[^{3}H]arginine for 1 min immediately or 6 hours (6H) following SS in PBS. Cells were dried and harvested in a NaOH/SDS buffer. Liquid scintillation counting and BCA assay were used to measure, radioactivity (DPMI) and protein content respectively. Growth media was collected to measure NO_X via commercially available kit (Cayman Chemical). A 2x4-way ANOVA was used to assess differences in groups. **RESULTS:** L-arg transport was increased immediately after SS in both mannitol and urea groups *(mannitol [m], urea [u] treated 0dyn: m 100±17, u 86±9 , 10dyn: m 268±26, u 158±27, 15dyn: m 325±83, u 270±92, 20dyn: m 400±105, u 342±108 % of control; n=4-5, main effect of shear stress p=0.005, treatment effect for urea p=0.258)* . L-arg transport remained elevated 6H after SS, but the urea treated group was reduced (*6 hours; 0dyn: m 100±3, u 48±4, 10dyn: m 250±47, u 113±17, 15dyn: m 317±14, u 155 ±34, 20dyn: m 296±61, u 207±24 % of control; n=4-5, SS main effect p<0.001, urea treatment effect p<0.001*). NO_X produced per hour was not different between groups prior to shear stress (group effect urea: p=0.475, main effect SS: p=0.424). 6H after SS NOx increased in all groups (main effect SS: p=0.028, urea treatment effect: p=0.843). Although there was not an overall treatment effect, the 0 dyn urea was decreased compared to 0 dyn mannitol (p=0.023). **CONCLUSIONS:** These results indicate that SS increased L-arg transport however this effect is blunted by urea. Despite the reduced L-arg transport NO production appeared to be maintained in the presence of urea following SS.

Comparison of Velocity between an Accelerometer and a Linear Position Transducer during Barbell Back Squat

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PURPOSE: To compare the barbell velocity measurements between two different devices at a variety of loads during the barbell back squat. **METHODS**: 11 men and 7 women completed a

body composition assessment followed by a 1-repetition maximum (1RM) test on the barbell back squat. After 48 hours, subjects completed 7 sets of barbell back squat at submaximal loads in a randomized order. Subjects completed 5 repetitions per set at every 10% of 1RM from 30-80% of 1RM, and 3 repetitions at 90% of 1RM. A rest period of 3-5 minutes was provided between each set. Average velocity (AV) was assessed during each repetition using an accelerometer (ACC) and linear position transducer (LPT) attached to the barbell. Average AV was calculated for each set and device. All barbell back squat testing was performed on a power rack with calibrated weight plates and was overseen by a Certified Strength and Conditioning Specialist to ensure safety and proper form. Subjects were instructed to complete each repetition "as fast as possible". The differences in velocity between the ACC and LPT at each of the 7 loads were assessed using a 2×7 repeated measures ANOVA with Bonferroni-adjusted post hoc tests. Alpha level was set a $p \leq 0.05$, and all data are presented as mean±standard deviation. **RESULTS**: There was a significant device×load interaction ($p=0.005$) when comparing average velocity between the ACC and LPT. The LPT recorded significantly greater average velocities than the ACC at 40% ($p=0.023$, 0.81±0.16 m/s vs 0.78±0.14 m/s), 50% ($p=0.027$, 0.74±0.15 m/s vs 0.71±0.15 m/s), and 60% ($p=0.036$, 0.68±0.14 m/s vs 0.65±0.13 m/s) of 1RM. Furthermore, there was a trend ($p=0.059$) for the LPT (0.87±0.20 m/s) to record a faster average velocity then the ACC (0.83±0.19 m/s) at 30% of 1RM. However, at 70%, 80%, and 90% of 1RM the AV recorded by the ACC and LPT were statistically similar. **CONCLUSION**: At lower loads, the velocity of the two devices were significantly different. From 30-60% of 1RM, the LPT recorded a higher AV than ACC. However, from 70-90% of 1RM two devices recorded statistically similar AV. If conducting velocity-based training at loads greater than 70%, either the ACC or LPT can be used as there is no difference in recorded AV; however, at lighter loads there will be differences between the devices.

Supported by Bloomsburg University Research and Scholarship Mini Grant (001071).

Development of a Time Efficient Protocol for Cross-Limb Comparisons of Muscle Mitochondrial Capacity Using NIRS

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The non-invasive determination of muscle oxidative capacity via Near Infrared Spectroscopy (NIRS) typically involves voluntary contraction of a single limb and requires as many as 22 brief ischemic occlusions per measurement. This limits the number of oxidative capacity measurements that can be completed in a given test session and also makes cross-limb muscle comparisons challenging. **PURPOSE:** To establish the efficacy of a recently developed protocol that utilizes fewer (i.e. 6) ischemic occlusions combined with surface electrical stimulation (E-stim) in both limbs simultaneously. **METHODS:** The test employs 2 upper thigh cuffs and 2 NIRS sensors

placed directly over the vastus lateralis (VL) muscles (supine position) or the semi-tendinosis (ST) muscles (prone position). Metabolic rate is temporarily increased via E-stim pads placed above and below each NIRS sensor. A standard 6Hz frequency is employed using a pre-modulation setting, with the intensity (mV) increased sufficient to raise metabolic rate ($\geq$ 3 fold), but within the tolerance of each participant. The mitochondrial capacity protocol involves 4 separate sets of 30 sec of E-stim followed by 6 x 5 sec cuff inflation/5 sec cuff deflation cycles. Analysis consists of calculating oxygenation recovery rate constants (Tc) for each muscle (i.e., 4 repeated measurements per muscle, per limb) using a customized software program. **RESULTS:** In preliminary tests of moderately active younger adults, Tc ranged from 24 to 44 sec in the VL and 32 to 53 sec in the ST. Variability of repeated tests (CV%) averaged <10% (range 6.2-17.2%) in both muscles. Metabolic rate increased from pre- (slope = -0.011) to post- (slope = -0.018) stimulation. **CONCLUSION:** This bilateral E-stim protocol is time efficient and should facilitate cross-limb comparisons of muscle mitochondrial capacity.

Self-paced aerobic exercise performance is attenuated following four hours cold water immersion.

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It is common for special warfare operators to complete land-based missions following prolonged transport dives. Time to exhaustion during high intensity aerobic exercise is attenuated following cold water submersion, which can be exacerbated when breathing oxygen (O_2). However, the high intensity time to exhaustion model may not be operationally relevant. **PURPOSE:** We tested the hypothesis that self-paced exercise performance following four hours cold water immersion is reduced compared to a non-immersed control, and that performance would be further reduced when breathing O_2 during immersion. **METHODS:** Six subjects (age: 24±2y; $\dot{V}O_{2max}$: 46±5 mL/kg/min) completed a baseline (CON) performance and two, 4 hour cold water immersion visits (20°C) breathing air or 100% O_2. During CON visit and following immersion, subjects completed a 60 minute loaded-march with 20% body mass (data not shown) followed by a self-paced 5 km run on a motorized treadmill. Core temperature, heart rate, and rating of perceived exertion (RPE) were recorded every 500 m during the run. **RESULTS:** 5 km run time was reduced following immersion while breathing 100% O_2 ($p=0.01$) and air ($p=0.03$) compared to the CON (33±7 min vs. 32±6 min vs. 29±5 min, respectively). However, there was no difference between air and O_2 ($p=0.66$). Core temperature increased during the 5 km run ($p<0.001$), but was not different between conditions ($p=0.41$). Heart rate increased during the 5 km run ($p <0.001$), but was not different between conditions ($p=0.22$). Finally, RPE increased during the run ($p<0.001$), but was not different between conditions ($p=0.69$). **CONCLUSION:** This interim analysis suggests that prolonged cold water immersion attenuates self-paced aerobic endurance performance, but does not appear to be further affected by breathing gas type (i.e., air

vs. O_2). The mechanisms for this attenuated post-immersion performance remain largely unknown.

Partial support from the Marc Diamond Research Fund (Grant # FA-18-07)

The Effects of Cocoa Flavanol Supplementation on Endothelial Function and Exercise Performance

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Cocoa flavanols have gained attention for potential beneficial effects on endothelial function and exercise performance, especially in clinical populations. However, few studies have utilized healthy college-aged individuals. **PURPOSE:** To evaluate the use of cocoa flavanols as a supplement to improve endothelial function and exercise performance in healthy individuals. **METHODS:** Twenty-eight college-aged males (N=19) and females (N=9) completed this randomized, double-blind study. Participants took either cocoa flavanols (375 mg) or placebo (0 mg cocoa flavanols) each day for 14 days. Flow-mediated dilation (FMD%), resting heart rate, resting blood pressure, and exercise performance (anaerobic and aerobic) were measured at pre- and post-supplementation. **RESULTS:** There were no significant interactions between groups and time or any main effects for dependent variables. There was no meaningful change (p = .24) in FMD% between pre- and post-supplementation for the treatment (15.23 ± 1.57% to 14.16 ± 1.70%) or placebo (16.70 ± 1.79 to 11.06 ± 1.94%) group, respectively. **CONCLUSION**: Cocoa flavanol supplementation does not appear to significantly improve endothelial function or exercise performance in healthy, young college students. Future studies could use either higher doses or different subject populations in order to see if cocoa flavanols might elicit a significant improvement.

Supported by the Baylor University Department of Health, Human Performance, and Recreation Thesis Research Grant

Relationship of Health-Related Quality of Life to Functional Fitness in Rural Cancer Survivors

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Health-related quality of life (HRQoL) is of high interest in exercise oncology due to decreases in HRQoL during and following cancer treatments. Functional fitness assessments (FFA) are also commonly assessed in this population due to the treatment-related side effects that may impact the patient's ability to perform activities of daily living (ADLs). However, the

relationship between these variables has not been previously explored. **Purpose:** To examine the relationship between HRQoL and FFA in a group of rural cancer survivors. **Methods:** Fifteen (Females, n=8; Males, n=7) subjects with a previous diagnosis of cancer aged 62.0 ± 8.5 years and BMI of 21.8 ± 7.9 kg/m^2 were assessed in several areas of FFA including waist circumference, body fat percentage, fat free mass (FFM), timed up and go (TUG), and 30 second chair stand (30CS). They were also given the Functional Assessment of Chronic Illness-Fatigue (FACIT-F) with subscales in physical well-being (PWB), social/family well-being (SWB), emotional well-being (EWB), functional well-being (FWB), and fatigue. The types of cancer and staging were diverse. Treatment types included chemotherapy, radiation, and surgery. FFA were completed and the FACIT-F completed at home and returned at the following session. **Results:** Pearson Correlations were significant between SWB and TUG (r = -0.844, p = 0.000), SWB and 30CS (r = 0.715, p = 0.003), and between fatigue and FFM (r = 0.668, p = 0.006). A correlation trending toward significance was seen between FWB and TUG (r = -0.504, p = 0.055). No other significant correlations were found. **Conclusion:** Moderate-to-strong relationships were observed between SWB, TUG time, and 30CS. This shows cancer survivors who are more mobile may have a greater ability to engage in social tasks and ADLs. In addition, higher amounts of FFM were moderately correlated with having less fatigue meaning cancer survivors with more FFM may have less fatigue.

Effects of Acute Aerobic vs. Resistance Exercise on Glycemic Control

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Acute exercise has commonly been found to transiently enhance glycemic control during recovery from the exercise. This effect has more commonly been observed following aerobic exercise. **PURPOSE:** This study was designed to contrast the effects of resistance exercise (RT) vs. aerobic interval exercise (AER) on post-exercise blood glucose (BG) control during an oral glucose tolerance test (OGTT). **METHODS:** Ten volunteers completed all testing. All subjects completed a resting control trial (CON) consisting of a 75-min OGTT following consumption of a 25% glucose solution dosed at 1 g/kg body mass. On separate days (minimum 48hrs. between), subjects completed the RT and the AER protocols. For RT, subjects completed a 30-min circuit protocol (6-7 sets) of 6 reps/set using 10-RM load for squat, bench press, knee extension and preacher's curl. For AER, subjects alternated between treadmill exercise (3 min) and arm crank ergometry (2-min) over a 30-min period. BG was assessed via fingertip sampling prior to exercise, mid-exercise, post-exercise and during the 75 min OGTT. Blood lactate was collected at rest, mid-exercise, post-exercise and 15 min post-exercise. **RESULTS:** Both exercise trials elicited significantly increased lactate but were not different from one another. BG was significantly elevated during the OGTT for all conditions, but was not different by condition. BG area under the curve was 6.2%% smaller ($p>0.05$) following resistance exercise, and 6.8% smaller for AER vs. CON (11330.6±320 vs. 11551.3±405 arbitrary units). **CONCLUSION:** Based on the results

of this investigation, acute resistance and aerobic exercise were not found to elicit enhanced post-exercise glycemic control. However, though not significantly lower, the exercise AUC responses may be meaningful in characterizing the potential for exercise to support blood glucose regulation.

Supported by Shippensburg University Undergraduate Research Grant Program

The Effects of Foam Rolling on Hamstring Flexibility, Muscle Soreness and Power

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Foam rolling is a therapeutic technique shown to increase blood flow and range of motion when used as a warm-up and to decrease delayed onset muscle soreness (DOMS). The research is still inconclusive as some studies claim beneficial effects while others do not. **PURPOSE:** To examine the effects of pre and post-exercise foam roll on flexibility, muscle soreness, power and torque. **METHODS:** Fourteen subjects (8 male and 6 female) participated in three testing sessions. On Day 1, subjects were familiarized with the protocol and performed single leg sit and reach test. On day 2 (7 days later), baseline extensor and flexor muscle power and torque were measured using isokinetic dynamometer. Subjects then foam rolled, performed the sit and reach test, followed by straight leg deadlifts, and then foam rolled again. Subjects returned 48 hours later (Day 3), rated their muscle soreness on a visual scale, and performed the same sit and reach and isokinetic dynamometer tests to measure flexibility, power, and torque, respectively. Two-way ANOVA with repeated measures was used to compare differences of dependent variables in foam rolled vs. control leg at different time points. **RESULTS:** Comparing day 1 to day 2, flexibility increased for the foam rolled leg (33.5±9.9 vs. 36.3±10.3 cm, p=0.01) as well as the control leg (33.2 ±9.5 vs. 35.5±9.8 cm, p=0.01). A decrease in flexor (Day 2: 56.5±16.5 vs. Day 3: 51.7±21.3 W, p>0.05) and extensor muscle power (Day 2: 107.7± 58.2 vs. Day 3: 100.7±58.5 W, p>0.05) were observed 48 hours after completing deadlift exercise, although the differences were not statistically significant. Interestingly, the foam rolled leg revealed a greater decline in muscle power than the control leg for both extensors and flexors, even though the difference was not significant. No significant differences were found in extensor or flexor torque for either leg. Although, the foam roll leg revealed a soreness level 6.45% lower than the control leg, the difference was not statistically significant (4.5±1.2 vs. 4.8±2.4, p>0.05). **CONCLUSION:** Foam rolling as a warm-up or post-recovery technique did not appear to have a positive influence on improving flexibility, muscle soreness, power, or torque. Due to the inconclusive results, further research on the effects of foam roll on flexibility and muscle soreness is warranted.

Finger Plethysmography and Heart Rate Monitors Provide Accurate Resting Heart Rate Variability Assessments vs Electrocardiography

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Heart rate variability (HRV) is a commonly used non-invasive assessment of autonomic nervous system function. The technique relies on accurate determination of cardiac interval duration. The electrocardiogram (ECG) is the established gold standard, but continuous heart rate monitors, and finger plethysmography can also be used. However, some question the validity of these other methods. **PURPOSE:** To compare beat-by-beat cardiac interval duration and HRV derived from ECG (control) and experimental measurements of chest heart rate monitor spikes (Polar), systolic (SBP) and diastolic blood pressure (DBP) peaks and nadirs, and blood pressure derivative peaks (dy/dx). **METHODS:** Five healthy subjects (age 21±2yrs; M 1, W 4) had a single lead ECG, chest heart rate monitor strap, and a finger continuous noninvasive blood pressure monitor attached to them. Subjects laid in the supine position for ≈5 minutes prior to any data collection. Once in a rested state, 5 minutes of data were collected. Root mean square error (RMSE) of the beat-by-beat cardiac interval duration was compared between techniques using a one-way ANOVA and Tukey's post hoc. Heart rate variability was assessed using ECG, Polar, SBP, DBP, and blood pressure dy/dx data. HRV indices (total included beats, average RR interval, standard deviation of the RR interval, average heart rate, root mean square of successive differences in RR interval, percent of successive RR intervals differing by >50ms, low frequency (LF) power, high frequency (HF) power, and LF/HF power) were compared between the control and experimental techniques using Pearson correlations. **RESULTS:** Cardiac cycle RMSE compared to control was not significantly different ($p>0.05$) between Polar (0.039±0.027s), SBP (0.027±0.025s), and DBP (0.032±0.022s). However, dy/dx RMSE (0.112±0.039s) was significantly greater than all other techniques ($p<0.05$). Pearson correlations between ECG derived HRV indices and the other cardiac signals were significant (all $p<0.001$) with strong coefficient of determination (all $r^2 \geq 0.955$). **CONCLUSION:** All techniques assessed showed a very strong relationship with the gold standard signal (ECG) for various HRV indices. However, dy/dx exhibited significantly more error in detecting accurate cardiac interval durations than the Polar, SBP, and DBP signals.

Diagnosed Concussion History Is Associated With Increased Risk for Lower-Extremity Injury in R.O.T.C. Cadets

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Concussions have been associated with an increased risk for lower extremity musculoskeletal injury (LE-MSI) among varying levels of athletes and U.S. Army Soldiers. This injury risk provides an added economic, physical, and social burden for athletes and military personnel, contributing to medically unavailable team-members. Yet, there is a paucity evidence on this relationship among Reserve Officer Training Corps (ROTC) cadets, a group which engages in

activities with injury risk potential similar to athletes and soldiers. **PURPOSE:** To examine the association between diagnosed concussions and LE-MSI in ROTC cadets. **METHODS:** A modified reliable injury questionnaire (ICC=0.92) was used to identify the total number of concussions and LE-MSI (e.g., muscle strains, ligament sprains) a cadet had suffered in their lifetime. A chi-square analysis was performed to identify the association between concussion and LE-MSI and an odds ratio was calculated. **RESULTS:** 61 cadets (19.5 $\pm$ 1.4 years, 41 males) were recruited from one Army ROTC program. Those with a history of concussion were 3.96 [95%CI: 0.99, 15.70] times more likely to have suffered an LE-MSI than those without a history of concussion. There was a significant association between diagnosed concussions and LE-MSI ($\chi(1) = 4.167$, $p = 0.041$). 36.1% (22/61) of cadets reported having a diagnosed concussion and 70.5% (43/61) had a history of LE-MSI. **CONCLUSION:** Cadets with a history of concussion displayed an elevated risk of suffering an LE-MSI than cadets who had no history of concussion. There was a statistically significant association between history of concussion and LE-MSI among ROTC cadets at this university. ROTC Cadre should be aware of this relationship when making return to duty decisions and should consider incorporation of injury prevention protocols. Future research is warranted on a larger cohort to determine if these relationships persist, and if so, should target reducing these injuries since cadets will soon commission, potentially risking injury while serving on active duty, causing limited duty days, reduced Department of Defense readiness, and increased healthcare costs.

Sex Differences in Endothelial Progenitor Cells and Circulating Endothelial Cells in Response to Acute Exercise

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Acute exercise provides a stimulus for improving the function and health of the endothelium by initiating release of endothelial progenitor cells (EPCs). However, this may also result in endothelial stress through the shedding of endothelial cells into circulation (CECs). The ratio of EPCs/CECs may serve as a unique indicator of vascular health but sex differences in the ratio of EPCs/CECs in response to acute aerobic exercise are unknown. **PURPOSE:** To determine whether there are sex differences in the EPC and CEC response to a single bout of submaximal treadmill running. **METHODS:** Subjects were healthy physically active men (n=14) and women (n=10) between the ages of 18-29 years. Maximal oxygen consumption (VO_{2max}) was assessed and 48 hours later, participants performed 30 minutes of treadmill running at 70% of their individual VO_{2max}. Fasted blood was obtained before and 30-minutes after the treadmill exercise. Peripheral blood mononuclear cells were isolated, FcR blocked and immunostained with antibodies specific to CD34-FITC, KDR-PE, CD146-PECy7 and CD45-PerCP, and fixed in paraformaldehyde. The forward-side-scatter plot was used to identify the lymphocyte and monocyte gates from a total of 5,000 events/sample using a flow cytometer. Total CD34+ and

KDR+ cells, EPCs (CD34+/KDR+) and CECs (CD146+/CD45-) were quantified. **RESULTS:** For CD34+, KDR+ cells, and EPCs there was no main effect for exercise or sex nor a sex*exercise interaction (P>0.05 for all). Regardless of sex, CECs increased from 45.2 ± 9.7 events to 66.7 ± 18.7 events after the acute exercise bout (P=0.027). CECs were higher in women compared to men at baseline (73.6 ± 20 vs. 26.9 ± 5.5 events) and after acute exercise (121.6 ± 43 vs. 31.4 ± 6.2 events), although this did not reach statistical significance (P=0.318). There was no main effect for exercise, sex, or a sex*exercise interaction for the EPC/CEC ratio (P>0.05 for all). **CONCLUSIONS:** A single bout of aerobic exercise increases CECs, but this is independent of sex. The lack of mobilization of EPCs in response to acute exercise suggests that other repair mechanisms may play a stronger role in maintaining the balance between endothelial repair and damage in younger physically active adults.

Supported by Towson University Faculty Development and Research Committee

Evoking the Mechanoreflex Using Static and Dynamic Approaches: The Influence of Free Radicals and Sex

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Passive leg movement (PLM) and static stretching (SS) likely activate the mechanoreflex, eliciting cardiovascular responses, though comparative study is lacking. Hyperoxia elevates free radicals (FR), though it remains to be seen, if acute elevations in FR alters the mechanoreflex, and if sex may alter this response. **PURPOSE:** to directly compare the central and peripheral hemodynamic responses to SS and PLM, after normoxic (FiO_2 0.21) and hyperoxic (FiO_2 1.0) exposure in males and females. **METHODS:** In a single-blind design, 23 young healthy females (F, n=12) and males (M, n=11) inspired normoxic or hyperoxic gas for 10 min, prior to PLM (knee flexion-extension) or SS (ankle dorsiflexion). Central hemodynamics (cardiac output [CO], stroke volume [SV], and HR), were measured using a Finometer, while a near-infrared spectrometer (NIRS) assessed the microvascular response (tissue oxygen saturation, StO_2%) on the vastus lateralis. **RESULTS:** Baseline central or peripheral hemodynamics were not different for PLM and SS ($p<0.05$). Though both methods induced HR driven increases in CO, the PLM responses were greater (ΔHR: 15.0±9.5 vs 8.6±8.1 bpm, ΔCO: 1.3± 0.8 vs. 0.8±0.7 L/min, $p<0.05$). Peripherally, PLM increased StO_2 from baseline, while SS decreased StO_2 (ΔStO_2: 2.8±2.5 vs. -1.3±1.1%, $p<0.05$). Regarding sex, no differences were observed at baseline ($p>0.05$), but in response to PLM, males exhibited a greater CO response greater (ΔCO: 1.7±0.7 vs. 0.9±0.6 L/min, $p<0.05$). Peripherally, PLM increased StO_2 from baseline for both sexes ($p<0.05$), though there was a significant difference in the peripheral response to PLM between the sexes (M: 4.2±2.0 vs F: 2.3±2.7 ΔStO_2%, $p<0.05$). Hyperoxia had no effect on CO at baseline ($p>0.05$), or the response to PLM, though the sex difference persisted (ΔCO: 1.8 ± 1.0 vs 1.1 ± 0.6 L/min, M v. F, $p<0.05$). Hyperoxia increased StO_2, but the response to PLM was unaffected, though the sex specificity remained (M: 4.5±1.8 vs F: 2.1±2.7 ΔStO_2%, $p<0.05$). **CONCLUSION:** The present study directly compared two methods of evoking the mechanoreflex, which appear disparate, though unaffected by hyperoxia.

Females exhibit an attenuated mechanoreflex, though, unlike the macrovascular responses to PLM which have been reported to be similar between sexes, the microvascular responses to PLM may differ.

Cerebral Blood Velocity Increases during Face Cooling in Symptomatic Concussed Athletes

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PURPOSE: Test the hypothesis that symptomatic concussed athletes (CA) have a blunted increase in cerebral blood velocity during face cooling (FC) compared to healthy controls (HC). **METHODS:** Four CA (age: 20±2y) and five HC (age: 22±2y) completed 5 min resting baseline followed by 3 minutes of FC where a plastic bag filled with ice water (~0°C) was placed on the forehead, eyes, and cheeks. Mean arterial pressure (MAP; photoplethysmography), middle cerebral artery blood velocity (MCAv; transcranial Doppler), and end-tidal partial pressure of CO_2 ($PETCO_2$; capnography) were recorded. Cerebral vascular resistance (CVR) was calculated as MAP/MCAv. Values are reported as a change from baseline to the third minute of FC. **RESULTS:** MAP (CA: 91±9 vs. HC: 91±9mmHg; P=0.46), MCAv (CA: 73.4±16.9 vs. HC: 66.3±14.3cm/s; P=0.26), $PETCO_2$ (CA: 44±2 vs. HC: 46±2mmHg; P=0.09), and CVR (CA: 1.30±0.42 vs. HC: 1.43±0.34mmHg/cm/s; P=0.32) were not different at baseline. The change in MAP (CA: 19±7 vs. HC: 14±6mmHg; P=0.15) was not different between groups. The change in MCAv was different between CA (4.9±5.8cm/s) and HC (-5.0±5.7cm/s; P=0.02). The change in $PETCO_2$ (CA: -1±1 vs. HC: -3±3mmHg; P=0.19) and CVR (CA: 0.20±0.19 vs. HC: 0.37±0.24mmHg/cm/s; P=0.14) were not different between groups. **CONCLUSION:** HC experienced a reduction in MCAv during FC that might be attributed to the combined effects of the increase in CVR and reduction in $PETCO_2$. CA experienced an increase in MCAv vs. HC that might be due to an attenuated rise in CVR. These preliminary data indicate cerebrovascular dysfunction in symptomatic CA. Further research is warranted to determine the underlying cause of the increase in MCAv in CA during FC.

Supported by the National Center for Advancing Translational Sciences of the NIH Pilot Grants Award Program UL1TR001412

A Comparative Analysis of Soccer Skill Tests on Varying Experience Levels

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Soccer skills such as passing, shooting, and dribbling are critical for success and are great measures of players' performance levels, as a result of player experience. It is hypothesized that differences in skill performance will be present between experience level in at least two of the parameters being assessed. Additionally, it is hypothesized that non-advanced players will have a lower performance. **PURPOSE:** To analyze performance differences between varying soccer experience levels. **METHODS:** Twelve (4 female, 8 male) subjects between the ages of 18 to 23 years came in for one session of testing, collecting data on soccer skills in Henderson Gymnasium. The participants were divided into either a beginner (n=5), intermediate (n=5), or advanced (n=2) skill level group based on previous playing experience. After a preparation period, the participants performed an eight-cone dribbling test. To assess shooting performance, participants completed the Loughborough Soccer Shooting Test for 10 trials. Finally, the participants completed a Loughborough Soccer Passing Test where they were instructed to hit a target with a designated color. **RESULTS:** We ran a series of one-way ANOVAs comparing results of the performance tests between the three skill-level groups. The results of the shooting test analysis ($F(2,9)=3.98$, $p=.058$) showed a trend towards significance, whereby the advanced participants ($M=3.00$, $SD=0.85$) scored higher in the shooting test than beginners ($M=1.84$, $SD=0.43$). The other two ANOVAs were not significant ($p>.05$). **CONCLUSION:** The implications from the experiment show that overall there is not a large significant difference found between soccer experience level and the variables tested, although some small speed-accuracy trade-offs may have occurred. One reason for this may have been the small sample size, especially in the advanced group.

Influence of Physical Activity and Sedentary Behavior During Pregnancy on Labor and Delivery Type

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Physical activity (PA) during pregnancy is known to be safe and does not increase risk of medical intervention during labor and delivery. While it is known that sedentary behavior (SED) and PA have independent health effects, whether higher SED during pregnancy increases risk for medical intervention in labor and delivery is unknown. **PURPOSE:** To examine the relationship of SED and PA patterns across pregnancy with labor and delivery outcomes. **METHODS:** In this prospective cohort study, objective SED (thigh-worn activPAL micro3) and physical activity (waist-worn ActiGraph GT3X-BT) were assessed in women for $\geq$ 4 days with $\geq$ 10 hours in each trimester of pregnancy. This secondary analysis includes women with available labor and delivery records, and PA and SED measures in $\geq$ 1 trimester (n=99). Trajectory analysis was used to identify patterns of PA and SED across pregnancy and assign women to the groups most closely related to their dominant activity patterns. Labor and delivery information was abstracted from participant medical records. Labor types were categorized as: spontaneous, induced-elective, or induced-medical. Delivery types were categorized as: vaginal, c-section-elective, c-

section-medical. Differences in labor and delivery type by SED and PA trajectories were analyzed using Fisher's exact tests due to small cell sizes. **RESULTS:** Trajectory analysis resulted in and assigned women to high, medium, and low groups for PA and SED across trimesters of pregnancy. Approximately 60% of labor was spontaneous, followed by 27% medical induction, and 13% elective induction. Deliveries were 79% vaginal, 13% medically indicated c-section, and 8% elective c-section. Type of labor (L) or delivery (D) did not significantly differ by SED (L: p=0.185, D: p=0.134) or PA (L: p=0.756, D=0.120) trajectories. When elective induction and c-sections were removed to only consider risk for medical intervention, differences remained insignificant by SED (L: p=0.136, D: p=0.088) or PA (L: p=0.527, D: p=0.128) trajectories. **CONCLUSION:** Objectively-measured patterns of SED or PA across pregnancy were not related to type of labor or delivery, including risk of medical intervention. Future research with larger samples could expand to the entire birth experience including duration of labor, medication use, or fetal complications.

Supported by American Heart Association (17GRNT33400168)

Effect of a 12-week Supervised Exercise Program on Anxiety and Depression in Cancer Survivors

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A life-altering diagnosis, such as cancer, and its coinciding treatments, can lead to a number of adverse side-effects in patients. Cancer-related anxiety, depression, and fatigue along with physiological changes are common side effects of patients with cancer. The cause of such psychological side-effects can be multifactorial and difficult to treat. Exercise under the supervision of an exercise professional has been shown to reduce levels of anxiety and depression in patients with cancer. **PURPOSE:** To determine the effect of a 12-week, supervised exercise program on levels of anxiety and depression in a population of rural cancer survivors. **METHODS:** Seven (male, n=3; female, n=4) cancer survivors aged 59.7 ± 9.5 years with a BMI 33.1 ± 7.9 kg/m^2, and a variety of cancer diagnoses and treatments, participated in twelve weeks of an individualized exercise program. Exercise sessions lasted 60 min and included balance, resistance, aerobic, and flexibility exercise for one to three days per week. Anxiety and depression scores were analyzed using the Hospital Anxiety and Depression Scale. **RESULTS:** Paired-sample T tests showed a significant decrease in anxiety from 4.86 ± 2.85 to 3.71 ± 2.93 (p = 0.03). No significant changes were observed in depression 3.00 ± 2.16 to 2.43 ± 2.57 (p = 0.36). **CONCLUSION:** A 12-week supervised exercise program may help the rural cancer survivor feel less anxiety during and after treatment and help them with their activities of daily living. All subjects in the study had depression scores in the "normal" range, meaning it was not necessary to recommend they seek further evaluation by a psychiatric professional. Although the changes in depression scores were not statistically significant, this suggests that an exercise program may help maintain these scores throughout and after cancer treatment.

The Inverse Association Between Muscular Strength and Carotid Intima-Media and Extra-Media Thickness in Young Women

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Cardiovascular Disease (CVD) is the leading cause of death among women in the United States, accounting for 1 of every 5 deaths each year. Muscular strength is important for cardiovascular health and has been associated with reductions in CVD risk. However, many studies on muscular strength and CVD risk have been conducted exclusively in men, leaving the relationship between muscular strength and CVD risk in women poorly defined. **PURPOSE:** The purpose of this study was to determine the relationship between strength and CVD risk in young women. Carotid intima-media thickness (cIMT) and extra-media thickness (EMT) were used as measures of subclinical atherosclerosis and CVD risk. **METHODS:** Muscular strength, cIMT, and EMT were measured in 70 young women (mean age = 21 ± 4 years). Strength was determined using a handgrip dynamometer consisting of 3 trials. The maximum value of the 3 trials was obtained and expressed relative to body mass. cIMT and EMT were measured using ultrasonography of the left common carotid artery in the supine position. **RESULTS:** Higher relative handgrip strength was associated with lower cIMT ($r = -0.25$; $p<0.05$) and lower EMT ($r = -0.29$; $p<0.05$). Associations between relative handgrip strength and cIMT ($r = -0.24$) as well as EMT ($r = -0.28$) remained significant after adjusting for potential confounders which included age, body fat, blood lipids, glucose, and blood pressure ($p<0.05$). **CONCLUSION:** These results show that there is an inverse association between strength, cIMT, and EMT in young women. Muscular strength may reduce CVD risk in women via favorable effects on subclinical carotid atherosclerosis.

Supported by NIH Grant 1R03MD011306-01A1

Sleep Variability is Associated with Measures of Peripheral Vascular Function in Healthy Undergraduate College Students

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Experimental studies suggest that highly variable sleep-wake patterns may impair vascular function, suggesting a potential mechanism for the increased risk of cardiovascular (CV) diseases seen in shift workers and others with poor sleep habits. However, it is unclear if naturalistic, day-to-day variability in sleep-wake patterns poses a risk to vascular function. **PURPOSE:** To examine the association between sleep variability (SLV) and peripheral vascular function in undergraduate college students. **METHODS:** SLV metrics were quantified in 28 healthy undergraduate students

(20.3 ±1 years) using wrist accelerometry for 14 days and nights. Sleep timing was defined by sleep midpoint (the halfway point between sleep onset and wake onset). Sleep timing variability (STV) was then quantified as the standard deviation (SD) of sleep midpoint, and sleep duration variability (SDV) as the SD of sleep duration across 14 days. Vascular function was assessed via flow-mediated dilation (FMD) and passive leg movement (PLM) in the morning on the day immediately following the end of sleep monitoring. Hemodynamics and artery diameters during FMD and PLM were measured via Doppler ultrasound of the brachial and femoral arteries, respectively. **RESULTS:** In a linear regression model of FMD% that controlled for sex and body composition, STV predicted FMD% (β=-0.42, $p<0.05$). Models controlling for sex and body composition found that SDV predicted peak leg blood flow (LBF) (β=-0.53, $p<0.01$), change in LBF from baseline to peak (β=-0.55, $p<0.01$), and LBF area under the curve (β=-0.60, $p<0.01$) during PLM. PLM associations remained significant when the model also included age and BP (all $p<0.01$). **CONCLUSION:** In adjusted models, greater STV and SDV appear to be associated with poorer vascular function in healthy college students. These preliminary data support the growing body of literature suggesting that regular sleep schedules may be important for CV health, even in otherwise healthy young adults.

The Psychoactive Effect of Exercise May Mediate Increases in Pain Tolerance Following Acute Exercise

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Several opioid related phenomena have been attributed to exercise including euphoria “runner’s high”, exercise analgesia and addiction to exercise. Therefore, exercise may have the potential to be used as an adjunct therapy for those suffering from opioid addiction. **PURPOSE:** To classify the psychoactive effects associated with acute exercise and acute exercise mediated analgesia. **METHODS:** Ten college aged students (age = 20.8 ± 2.3) underwent 30 minutes of exercise on a cycle ergometer. Following 5 minutes of light cycling each subject underwent 20 minutes of cycling at 8 METS followed by a 5-minute cooldown. Subjects were given a survey based off the Addiction Research Center Inventory (ARCI) Morphine-Benzedrine, Morphine and Excitement subscales. The minimal pain threshold was measured using a “Pain Test” algometer which was placed on the extensor carpi radialis of each subject both before and after exercise. Data was quantified using a two-tailed Student’s T-Test. **RESULTS:** Exercise increased minimal pain threshold from 30.2 ± 1.8 N at baseline to 53.6 N following exercise ($P<0.05$). The number of positive responses from the ARCI questionnaire increased by 27 ± 8% following exercise ($P<0.05$). These results indicate that exercise has a similar effect on psychoactive activity as opioid use. **CONCLUSION:** These data suggests that exercise can decrease the minimal pain threshold. Further, exercise appears to have psychoactive actions similar to opioids which may mediate the reductions in pain.

More Than One Personal Risk Factor is Associated with Worse Clinical Outcomes Among Adolescents Following Concussion

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PURPOSE: To examine the association between clinical outcomes following the incidence of a concussion and patient history containing both personal psychological risk factors (anxiety/depression) and headache risk factors (headache/migraine). **METHODS:** 399 (F: 208) participants aged 15.2 ± 2.1 years with a symptomatic, diagnosed concussion, completed the 1) Immediate Post-concussion Assessment and Cognitive Test (ImPACT), 2) Vestibular/Ocular-Motor Screening (VOMS), and 3) the Post-Concussion Symptom Scale (PCSS) within 10 days of injury. Anxiety, depression, and headache and migraine histories were obtained from electronic medical records, and individuals were categorized into four groups: 1) Personal Psychological History (PPH); 2) Headache/Migraine History (H/MH)); 3) combined PPH and H/MH (BOTH); or 4) No PPH or H/MH (NONE). A series of univariate ANOVAs, and post-hoc Scheffe pairwise comparisons, were conducted to compare initial ImPACT composite scores (verbal and visual memory, motor processing speed, and reaction time), VOMS and PCSS symptoms, and length of clinical recovery between groups. **RESULTS:** Number of days between concussion and first clinical evaluation were similar between PPH (M± SD 8.0 ±5.7), H/MH (14.8 ± 43.3), BOTH (10.3 ± 5.4), and NONE (10.2 ± 24.4) groups. BOTH had worse verbal memory performance (66.24 ± 3.53) than H/MH (77.58 ± 1.54, $p<0.05$), PPH (78.76 ± $p<0.05$), and NONE (77.92 ± 1.04, $p<0.01$) groups. The BOTH group reported greater total symptom severity (60.89 ± 4.86) than H/MH (31.74 ± 5.19, $p<0.01$), PPH (30.57 ± 6.97 $p<0.01$), and NONE (30.05 ± 4.98 $p<0.01$) groups. BOTH also reported greater symptoms during vestibular screening (87.68 ± 8.98) than H/MH (42.30 ± 3.80, $p<0.05$), PPH (39.64 ± 7.73, $p<0.05$), and NONE (45.74 ± 2.67, $p<0.05$) groups. Lastly, BOTH took more days (131.97 ± 29.10) until medical clearance than H/MH (83.46 ± 22.48 $p<0.05$), PPH (120.02 ± 28.11 $p<0.05$), and NONE (86.02 ± 21.75 $p<0.05$) groups. **CONCLUSION:** Adolescents reporting both psychological and migraine history exhibited worse symptoms, neurocognitive performance, and length of recovery than adolescents with only one of these histories or adolescents with neither history. Early identification for these risk factors should be considered as a part of the multidisciplinary management for concussion.

Peripheral Arterial Disease Patients with Exaggerated Pressor Response have Impaired Walking Ability.

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Exaggerated blood pressure responses to exercise in peripheral artery disease (PAD) patients suggests hemodynamic instability with a greater chance of major adverse cerebrovascular and cardiac events. Furthermore, a decline in blood pressure response is abnormal and indicates that the patient is potentially at a greater risk of experiencing a cardiac event. However, it is unclear whether the degree of pressor response is associated with impaired ambulation and more comorbid conditions. **PURPOSE:** To determine whether PAD patients who have a negative pressor response and exaggerated pressor response during treadmill walking have shorter peak walking time (PWT), shorter claudication onset time (COT), and higher prevalence of comorbid conditions than patients with a normal pressor response. **METHODS**: A total of 298 claudication patients were categorized to the following three groups based on their systolic blood pressure (SBP) responses at 2 minutes of treadmill walking at 2 mph and 0% grade: negative pressor response (group 1, defined by a decrease in exercise SBP), normal pressor response (group 2, defined by an exercise SBP increase of less than 18 mmHg), and exaggerated pressor response (group 3, defined by an exercise SBP increase of more than 18 mmHg). The patients were characterized by demographic variables, comorbid conditions, PWT, and COT. **RESULTS**: After adjusting for age, body mass index, ankle-brachial index, 6 min walk distance, sex, and race, group 3 had significantly reduced COT (161±132 sec vs. 217±172 sec, $p=0.011$) and PWT (369±214 sec vs. 453±252 sec, $p=0.002$) compared to group 2. Furthermore, group 3 had fewer patients with dyslipidemia ($p<0.001$), metabolic syndrome ($p<0.001$), and chronic kidney diseases ($p=0.043$) compared to group 2. In contrast, no significant differences ($p>0.05$) were found between group 1 and group 2. **CONCLUSION**: These data suggest that although symptomatic PAD patients with exaggerated pressor response are less likely to have comorbidities, they experience claudication earlier and have impaired walking ability compared to PAD patients with a normal pressor response. Also, PAD patients with negative pressor response are not different from PAD patients with normal pressor response on walking performance and prevalence of comorbid conditions.

Supported by NIA R01-AG-24296.

Changes in Circulating Angiogenic Cell Number and Function During and After an Ultramarathon

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Circulating angiogenic cells (CACs) have been identified as having an important role in vascular health and function. Typical bouts of aerobic exercise (≤60min) can increase the number and function of certain CACs; however, less is known about the effects of prolonged endurance exercise on CAC number and function. **PURPOSE**: To distinguish the effects of normal (10km) and extreme (50km) distances of running on CAC number and function. **METHODS**: Blood samples were obtained from seven ultramarathon participants (age 39±2 years) at four timepoints: before the race (0km), after 10km, upon race completion (50km), and 24 hours after race completion (24hrs). Peripheral blood mononuclear cells (PBMCs) were isolated from blood samples and cultured to generate conditioned cell culture medium (CM). Human umbilical vein endothelial cells (HUVECs) were then incubated in the resulting CM to assess the paracrine effects of CACs on endothelial cell proliferation at each time point. Specific CAC subtypes (CD34+, CD31+, CD3+, and CD3+/CD31+ cells) were enumerated at each timepoint by flow cytometry analysis. **RESULTS**: The cell proliferation assay showed clear differences among timepoints. Cell proliferation significantly increased by ~9% (759 ± 36 vs. 829 ± 28 RFU, p = 0.004) at 50km when compared with 0km results. Proliferation was reduced by 18% (759 ± 36 vs. 679 ± 12 RFU, p = 0.007) at 24hrs when compared with 0km results. CD31+ CAC number increased by 23% at 50km from 0km (65,674 ± 4,296 vs. 80,934 ± 3,236 cells/10^5 events, p = 0.01) and returned to baseline levels at 24hrs. Conversely, CD3+, CD3+/CD31+, and CD34+ CACs tended to decrease immediately after the race by 35% (48,024 ± 4,597 vs. 31,262 ± 2,249 cells/10^5 events , p = 0.04), 33% (25,221 ± 2,972 vs. 16,835 ± 1,826 cells/10^5 events, p = 0.08) and 49% (100 ± 24 vs. 51 ± 11 cells/10^5 events) respectively, and returned to baseline levels at 24hrs. **CONCLUSION**: CAC mobilization and paracrine function may actually improve after an acute, prolonged bout of aerobic exercise in trained subjects. While CD34+ and CD3+ CAC numbers decreased immediately following the race, the increase in CD31+ CACs may have contributed to increased cell proliferation immediately after the race, which may have implications for the effects of exercise on CAC and vascular function.

Barriers That Influence Adoption of ACL Injury Prevention Programs Among High School Girls' Soccer Coaches

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Injuries to the anterior cruciate ligament (ACL) of the knee are one of the most serious injuries sustained in sports. It has previously been shown that female athletes are at a risk 4-6 times greater than their male counterparts to sustain such an injury. Injury prevention programs (IPP) are available that have previously been shown to successfully reduce the risk of ACL injuries, but data on the implementation of these programs is limited. **Purpose:** To obtain data on the implementation of ACL IPP among high school girls' soccer coaches in Pennsylvania and to identify barriers that limit the implementation of such programs. **Methods:** An online survey was

completed by Pennsylvania high school girls' soccer coaches (N=32) to assess ACL IPP knowledge, attitudes, implementation rates, and barriers to implementation. **Results:** Overall, coaches reported a higher rate (45%) of implementation than shown in previously studied populations. Only one commonly used ACL IPP was found to be familiar to greater than 50% of participating coaches. When reporting barriers to implementation, lack of knowledge of ACL IPP was reported by 37% of coaches with only 21% of coaches reporting having received formal training on ACL IPP. Time was also reported by 17% of respondents and was the most frequent response in open ended questions regarding barriers. **Conclusion:** The data suggest that coaches may benefit from training opportunities providing instruction on ACL IPP and instruction on the use of programs that can be utilized with minimal time requirements. More research is needed on implementation strategies and the potential use of policy changes by regulating organizations to encourage the use of IPP.

The Effects of Acute Thermoneutral and Hot Water Immersion on Cerebrovascular Reactivity

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Repetitive hot head-out water immersion increases non-immersion cerebral blood flow and peripheral vascular function. However, it is not known if an acute bout of hot head out water immersion (HOWI) improves cerebrovascular reactivity versus thermoneutral HOWI. **PURPOSE:** We tested the hypothesis that cerebrovascular reactivity is greater during and following hot (HOT) vs. thermoneutral (TN) HOWI. **METHODS:** Six healthy participants (age: 23±3 y, 2 females) completed two randomized trials consisting of 30 min of HOT (39°C) or TN (35°C) HOWI. Beat-to-beat blood pressure (MAP; photoplethysmography), middle cerebral artery blood velocity (MCAv; transcranial Doppler), and end-tidal partial pressure of CO_2 ($PETCO_2$; capnograph) were recorded continuously. After 5 min of resting baseline, participants breathed hypercapnic gas (3, 5, and 7% CO_2 for 3 min each) in a stepwise fashion. Cerebrovascular reactivity (CVR) testing was completed pre, 25 min into immersion (during), and immediately post-HOWI. The slope of the linear regression line for MCAv versus $PETCO_2$ was calculated to represent CVR. **RESULTS:** MAP (HOT: 84±5 vs TN: 80±12 mmHg; P=0.14), MCAv (HOT: 65.1±7.3 vs TN: 64.2±17.0 cm/s; P=0.44), and CVR (HOT: 1.58±0.40 vs TN: 1.54±0.43 cm/s/mmHg; P=0.87) were not different between HOT and TN at baseline. $PETCO_2$ was different between HOT and TN at baseline (HOT: 43±2 vs TN: 45±3 mmHg; P=0.04). MAP was different between HOT and TN during (HOT: 80±9 vs TN: 89±12 mmHg; P=0.03) but was not different post (HOT: 84±8 vs TN: 90±17 mmHg; P=0.10). MCAv was not different between HOT and TN during (HOT: 65.0±12.5 vs TN: 70.1±17.1 cm/s; P=0.16) or post (HOT: 66.5±12.1 vs TN: 67.5±16.8 cm/s; P=0.41). $PETCO_2$ was not different between HOT and TN during (HOT:

44±2 vs TN: 46±3 mmHg; P=0.11) or post (HOT: 43±3 vs TN: 44±3 mmHg; P=0.17). CVR was not different between HOT and TN during (HOT: 1.65±0.28 vs TN: 1.77±0.76 cm/s/mmHg; P=0.36) or post (HOT: 1.23±0.81 vs TN: 1.64±0.86 cm/s/mmHg; P=0.15) and did not differ across timepoints within trials (P=0.08). **CONCLUSION:** These preliminary data indicate that an acute bout of hot or thermoneutral head-out water immersion does not improve cerebrovascular reactivity during or after immersion in healthy participants.

Supported by Office of Naval Research Award N00014-17-1-2665

The Effects of Essential Oils on Perception of Exertion, Task Pleasantness and Time on Task

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Essential oils have become wildly popular in recent years for their therapeutical and health-related benefits. Research that focuses on essential oils and their ergogenic effects may be helpful in increasing adherence to exercise by making the task more pleasant and/ or less exertive (Basevitch, 2011; Jaradat et al, 2016). **PURPOSE:** The purpose of this study was to test the effects of essential oils on perception of exertion, exercise task pleasantness and total time on task. **METHODS:** Thirty college students (24 females, 6 males) were recruited to perform a handgrip squeezing task. They were randomly assigned to one of three groups: placebo, bergamot essential oil, or peppermint essential oil ($n_{Peppermint}$ = 10, $n_{Placebo}$= 10, $n_{Bergamont}$ =10). Adhesive strips with each essential oil were placed under the noses of all participants. Participants in the placebo group had a strip with no essential oil. After establishing participants' baselines for maximal voluntary contraction, participants squeezed a handgrip dynamometer at 30% of their baseline for as long as they could tolerate. Participants' session RPE, perceived exercise-task pleasantness and total grip time were recorded at session completion. **RESULTS:** Results from ANOVA analysis showed no significant group effect for RPE session ($p>.05$). Chi square analyses indicated that participants in the placebo group rated the exercise task most pleasant, (n=6, Pleasant). Participants with bergamot essential oil rated the task as mildly pleasant, (n=5, Mildly Pleasant). Participants with peppermint essential oil rated the task as least pleasant (n=6, Neutral) and these differences were significant ($p<.05$). Due to small size in each group and the skewness of the distribution, group medians were also analyzed as more robust and sensible signs of central tendency. Results indicated that participants with bergamot essential oil squeezed the dynamometer longer durations than others with peppermint essential oil or placebo ($M_{Bergamot}$=18.07 minutes; $M_{Placebo}$=15.31 minutes; and $M_{Peppermint}$=12.27 minutes). **CONCLUSION**: These findings suggest that bergamot essential oil may help optimize exercise-related affects and increase exercise duration. Studies with larger sample sizes are needed to confirm these findings.

Functional Analysis of the Peroneus Longus and Tibialis Posterior Using Over-Stimulation

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Previous research (Stewart et al, 2006) has shown that muscle actions during walking may induce motion inconsistent with current understanding based on anatomical location and moment arm. Of particular clinical interest is the function of the peroneus longus (PL) and tibialis posterior (TP) in controlling foot motion during walking. **Purpose:** To identify the kinematic movement induced by the TP and PL when over-stimulated during walking. **Methods:** 11 subjects (4 male, 7 female, age = 29.4yrs, BMI = 23.2kg/m^2) volunteered to participate in this study. Self-adhesive electrodes were placed on the muscle belly of the PL while ultrasound guidance was used to insert an indwelling fine-wire electrode into the TP. Walking trials were completed in a random order of TP, PL, and no stimulation while kinematic data in the frontal, sagittal, and transverse planes were recorded through the gait cycle. The consistency of the responses across the 11 subjects was examined using a chi-square test. **Results:** Muscle function of the PL and TP was compared at 35% of stance phase due to the high muscle demand to control the foot at this point. In the frontal plane (TP 8/10 inversion vs. PL 9/11 eversion) and transverse plane motion (TP 6/9 adduction vs. PL 9/10 abduction) there was a significant difference ($p<.05$) in the function of the TP and PL. There was not a significant difference in function for sagittal plane movement. **Conclusion:** The TP and PL oppose each other when overstimulated during walking; the TP induces inversion and adduction while the PL induces eversion and abduction. These findings are consistent with literature using anatomical location and moment arm to infer muscle function. This has important clinical implications for understanding the function of these muscles during gait in the context of pathologic circumstances such as tibialis posterior tendon disorder or fibular nerve palsies affecting the PL.

Association between Physical Activity and Social Media Usage in College Students

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PURPOSE: To examine the association between self-reported physical activity (PA) participation and social media usage in a sample of college students. **METHODS:** College students completed a one-time online questionnaire regarding PA participation and social media use. PA participation was assessed using the International Physical Activity Questionnaire-Short Form. Students were eligible to participate if they were 18-29 years old and were registered for classes during the spring 2019 semester. **RESULTS:** Two hundred ninety-two participants completed the questionnaire. Participants reported engaging in an average of 184.4±174.2 minutes per week of moderate intensity PA and 269.20±206.3 minutes per week of vigorous intensity PA. While the mean self-report physical activity participation exceeded the minimum

physical activity recommendations, only 30.8% of the sample engaged in a minimum of 150 of moderate intensity activity each week, and 61.4% in the recommended minimum of 75 minutes of vigorous intensity PA. Furthermore, 31.6% of participants did not report engagement in moderate intensity PA and 27.9% did not report engagement in vigorous intensity PA. In this sample, 97.9% of students reported using social media daily, with 41.38% and 43.1% reporting 1-2 hours and 3-4 hours of social media use each day, respectively. There was no significant association between daily hours of social media use and PA for moderate intensity activity ($r = -0.109$, $p = 0.120$) or vigorous intensity activity ($r = -0.002$, $p = 0.973$). **CONCLUSION:** Not all college students are achieving the recommended amounts of physical activity, with an estimated 69.2% of students not achieving the minimum recommended amount of moderate intensity PA and 38.4% not achieving the recommended minimum of vigorous intensity PA. Approximately half of all students (51%) reported using social media for three or more hours per day. While PA participation and social media usage were not significantly associated, findings from this study indicate that there is a need to identify effective PA promotion strategies within this population. Social media is a channel that most college students use daily and future studies should investigate the efficacy of using a popular social media platform to promote regular PA behavior in this population.

Load Magnitude and Locomotion Strategy Alters Knee Mechanics in Recruit-Aged Women

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Female soldiers experience a greater incidence of Knee Osteoarthritis (OA). A proposed mechanism of OA is ruck marching, involving load carriage at a fast pace. Knee Total Joint Moment (KTJM) and changes of percent (%) contribution in each plane of motion moment has been linked to OA. **PURPOSE:** To determine the interactive effects of load magnitude and locomotion on KTJM % contribution in women. **METHODS:** Twelve healthy females (Age: 24.75 ± 2.17y) completed 3 testing sessions collecting kinematic and kinetic data. Subjects wore combat boots and weighted vest. Trials were conducted at body weight (BW), and loaded; +25%, +45%. At each load, 2 locomotion types (running [RN] and forced march [FM]) were performed at +10% above their gait transition velocity were performed. KTJM was calculated utilizing Euclidian norm with % contribution derived from KTJM for each plane: Knee Flexion (KF%), Adduction (KA%), and Rotation (KR%), and normalized to system weight. Multifactorial RMANOVA, load by locomotion (3x2), were conducted on Heel strike [HS] and Midstance [MS] data for each plane. Bonferroni-corrected pairwise comparisons were conducted when necessary (α=$p<.05$). **RESULTS:** KF% at HS there was an interaction ($p<.05$). Simple main

effect of load ($p<.02$) during RN; +25% ($p<.02$) and +45% ($p<.01$) greater than BW. No simple main effect of load for FM. There was a main effect of locomotion ($p=.006$), with RN (64.9 ± 4.8%) greater than FM (49.8 ± 2.7%). KF% at MS, there was an interaction ($p=.02$); RN was greater than FM at all load conditions ($p<.04$). KA% at HS, there was no interaction ($p=.09$). There was a main effect of load ($p=.01$); BW greater than +25% ($p=.03$). KA% at MS there was no interaction ($p=.31$). There was a main effect of locomotion ($p=.003$), with FM (43.8 ± 3.1%) greater than RN (29.9 ± 4.1%). No significant findings for KR%. **CONCLUSION:** At HS as load increased KF% increased for the RN, demonstrating appropriate movement response to load increases where the individual relies more on knee flexors/extensors to absorb energy. No change in KF% between load conditions for FM demonstrates an inability to modulate movement to accommodate to changes in load. At MS, RN exhibited greater KF% than FM. Thus, the FM strategy promotes successful task execution over safe task execution even if increased KA% is a consequence, potentially predisposing to OA.

Cellular Endothelin-1 Expression in Pre- and Post-menopausal Women

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Endothelin-1 (ET-1) is a potent vasoconstrictor that plays a key role in vascular function. ET-1 is produced and secreted primarily by endothelial cells (ECs). Plasma concentrations of ET-1 are generally increased with aging, however, plasma ET-1 may not reflect cellular ET-1 production, due to its abluminal secretion. Previous data has shown that ET-1 expression in ECs is greater in older men compared to younger men, but whether ET-1 expression is greater in postmenopausal (POST) compared to premenopausal (PRE) women is unknown. **PURPOSE:** To test the hypothesis that expression of ET-1 in venous ECs are greater in POST compared to PRE. **METHODS:** ECs were collected from the antecubital vein of healthy PRE (n= 18, 22±2 yrs, BMI 22±2 kg/m^2) and POST (n= 20, 60±5 yrs, BMI 24±4 kg/m^2). Following placement of an 18g IV catheter, a guide wire was threaded through the catheter to collect ECs. The guide wire was rinsed in dissociation buffer to remove ECs, which were then fixed in 4% paraformaldehyde, washed in phosphate buffered saline, pipetted onto coverglass, dried at 60^{o}C, and stored at -80^{o}C until staining. Immunocytochemistry was used to stain for ET-1, vascular endothelial cadherin (EC stain), and 4′,6-diamidino-2-phenylindole (DAPI, nuclear stain). Fluorescence intensity was measured in 30 cells on a Zeiss Axio imager using consistent exposure times. ET-1 expression was normalized to human umbilical vein endothelial cell expression. Results are reported as mean ± standard deviation. **RESULTS:** POST had significantly greater mean arterial pressure

(POST; 89±9 vs. PRE; 81±8 mmHg, p= 0.004), total cholesterol (POST; 203±36 vs. PRE; 162±24 mg/dL, p<0.001), LDL cholesterol (POST; 110±32 vs. PRE; 84±23 mg/dL, p= 0.008), and fasting plasma glucose (POST; 87±9 vs. PRE; 79±6 mg/dL, p= 0.002), although all values were within clinically acceptable limits. ET-1 expression was significantly lower in POST (POST; 0.6±0.2 vs. PRE; 0.88±0.4 au, p= 0.01). Plasma ET-1 concentrations were measured in a subset of participants and POST (n=8, 1.65±0.39 pg/ml) tended to have greater concentrations compared to PRE (n= 14, 1.34±0.43 pg/ml, p=0.11). **CONCLUSIONS:** Contrary to what has been shown in men, cellular ET-1 expression was attenuated in older women. These preliminary results further demonstrate sex differences in the endothelin system.

Supported by NIH R01 HL 146558, P20 GM 113125, AHA 16SDG30700015, and University of Delaware Research Foundation.

Cardiovascular Responses to the Cold Pressor Test Are Not Modified in Healthy Adults with a History of Concussion

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Recent evidence indicates that physiological recovery from a concussion appears to take longer than clinical recovery. We have shown that symptomatic concussed patients have attenuated cardiovascular responses to the cold pressor test versus healthy controls. However, it is unclear if the attenuated cardiovascular responses to the cold pressor test persist in asymptomatic healthy adults who reported experiencing a concussion more than one year ago. **PURPOSE:** We tested the hypothesis that asymptomatic healthy active adults who experienced a concussion more than one year ago have a blunted cardiovascular response to the cold pressor test compared to healthy active adults without a history of concussion. **METHODS:** Thirteen healthy adults without a history of concussion within 1 year from the time of testing performed a 2 min cold pressor test. Subjects were retrospectively grouped into those who reported experiencing a concussion more than a year ago (n=5, CH) and those without a history of concussion (n=8, NH). After 10 min of supine rest, participants immersed their right hand into agitated ice water (~0°C) for 2 min. Heart rate (HR, 3-lead ECG), mean arterial pressure (MAP, finger photoplethysmography), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were continuously recorded. Data were analyzed as the absolute change from baseline and are presented as mean ± SD. **RESULTS:** At baseline, there were no differences between groups in HR (NH: 58 ± 14; CH: 65 ± 5 bpm, P=0.35), MAP (NH: 89 ± 9; CH: 88 ± 8 mmHg, P=0.90), SBP (NH: 121 ± 15; CH: 125 ± 13 mmHg, P=0.67), and DBP (NH: 69 ± 7; CH: 69 ± 6 mmHg, P=0.93). At the end of the cold

pressor test, there were no differences in the increase in HR (NH: 16 ± 14; CH: 9 ± 9 bpm, P=0.22), MAP (NH: 20 ± 13; CH: 20 ± 12 bpm, P>0.99), SBP (NH: 21 ± 16; CH: 21 ± 13 bpm, P>0.99), and DBP (NH: 16 ± 9; CH: 16 ± 9 bpm, P>0.99). **CONCLUSION:** These preliminary data indicate that cardiovascular responses to the cold pressor test return to normal in otherwise healthy adults who have experienced a concussion more than one year ago. More frequent assessments of the cardiovascular responses to the cold pressure test in concussed participants are warranted to determine the course of physiological recovery.

Supported by the National Center for Advancing Translational Sciences of the NIH Pilot Grants Award Program UL1TR001412

Increased Deep Sleep May Relate to Compromised Perception-action Coupling Performance in Military Personnel

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Operational stressors, such as caloric restriction, sleep restriction and physical fatigue, may compromise perception-action coupling in military personnel. Prior sleep may protect against performance decrements and different sleep stages may conserve different aspects of performance. **PURPOSE:** To investigate changes in perception-action coupling during simulated military operational stress and understand the role of sleep stages on performance. **METHODS:** As part of a 5-day study assessing the effects simulated military operational stress on cognitive resilience, thirty-three (6 female) active duty and reserve status service members (25.8 ± 4.7 years) completed three trials of a novel perception-action coupling task (PACT) at 1700 after a night of baseline sleep (BASE), two nights of sleep restriction (T1) and a night of recovery sleep (T2). Participants had 8-hr for baseline and recovery sleep (2300-0700) and 4-hr disturbed sleep on sleep restriction nights (0100-0300 and 0500-0700). Polysomnography was used to identify sleep stages. The tablet-based PACT requires participants make quick, accurate perceptual judgments and responses about the ability of varying sized virtual balls to fit through virtual apertures. Outcomes of interest included response time (RT) and accuracy (ACC). Percent time in stage 2 (N2), slow wave (SWS) and rapid-eye movement (REM) sleep were median split to form high (more sleep in a stage) and low sleep groups. Differences in PACT performance between sleep groups across time were assessed using multiple mixed model (2 x 3) ANOVA. **RESULTS:** No significant sleep group x time interaction or main effect of time were found for RT or ACC. A significant main effect of SWS sleep group was found for RT ($F_{1,31} = 4.898$, $p = .034$, $n^2_p = .136$). The high SWS group had slower (worse) RT than the low SWS group (.886 ± .023 vs .814 ± .024 s). No other significant main effects of sleep group were found. **CONCLUSION:** Perception-action coupling was maintained during simulated military operational stress. Participants with more baseline SWS had worse PACT performance but other sleep stages, N2 and REM, did not relate to perception-action coupling performance. This suggests a specific effect of SWS, which is deep sleep, on perception-action coupling abilities and behaviors.

Supported by DOD # W81XWH-17-2-0070

Mental Health is not Affected by Multiple Concussions in Young Adults

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A history of multiple concussions is associated with an increased risk of anxiety and depression. As the number of concussions increases the more severe the long-term effects are including: mental health issues, memory, and a decline in cognitive function. Two common populations experiencing these effects are professional football players and military members. As the long-term effects of multiple concussions are known, research shows young adults with multiple concussions to have similar ImPACT scores as those with no concussion. Considering the mental health long-term risks associated with multiple concussions, studying mental health in young adults with multiple concussions is necessary. **PURPOSE:** The purpose of this study was to determine the effects of multiple concussions on mental health. **METHODS:** Each of the 41 college aged people (23 female and 18 male) participated in this study. They were divided into three groups based on diagnosed concussion history: no concussions (n=16, NONE); 1-2 concussions (n=12, FEW); and greater than two concussions (n=13, MANY). All participants completed the Hospital Anxiety and Depression Scale (HADS) and a Positive and Negative Affect Scale (PANAS). A One-way ANOVA was used to determine group differences. **RESULTS:** Mean scores ($\pm$ standard deviation) for each test for each group are as follows: NONE- Anxiety 7.50 (4.3), Depression 4.69 (4.2), Positive Affect 30.56 (7.1), Negative Affect 17.25 (6.7); FEW- Anxiety 5.17 (3.1), Depression 3.75 (3.5), Positive Affect 30.17 (6.6), Negative Affect 15.33 (3.7); MANY- Anxiety 7.46 (6.0), Depression 4.85 (3.2), Positive Affect 29.69 (9.8), Negative Affect 16.08 (8.1). No significant differences between the three groups were found for any measure (all $F \leq 1.062$, all $p > 0.355$). Of the 41 participants, 13 reported being on psychotropic medications (NONE: 4, FEW: 5, MANY: 4). There were no differences in medication by concussion group ($\chi^2 = 0.920$, $p = 0.631$). **CONCLUSION:** Mental health anxiety, depression, positive and negative affect scores are not affected by one or multiple concussions in the college age student population.

Hydration Status Response to Bolus Frequency and Volume Intake During Exercise in Heat

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Workplace hydration recommendations suggest consuming 237mL fluid every 15-20 min during physical work in the heat. It is unknown if these recommendations promote hydration during work and if consuming larger boluses of water less frequently maintains hydration better than smaller boluses of water consumed more frequently. **PURPOSE:** Examine if consuming 500mL water every 40 min maintains hydration better than 237mL water every 20 min during work in the heat. **METHODS:** Five healthy adults (age: 27±6 y, height: 177±11 cm, weight: 76.1±18.0 kg) completed 2 trials while fasted, either consuming 237mL water every 20 min (Trial A) or 500mL water every 40 min (Trial B). Subjects performed 2 h treadmill exercise at 6.4kph, 1.0% grade in 34°C, 30% relative humidity wearing shorts and a t-shirt, followed by 2 h rest in a temperate room. Heart rate (HR), rectal temperature (T_{rec}), and gastrointestinal (GI) symptoms were measured pre- and post-exercise and after recovery. Nude body mass was measured pre- and post-exercise. Blood and urine samples were collected pre- and post-exercise, and after recovery. **RESULTS:** T_{rec} increased from pre- (36.8±0.2, 36.7±0.3°C) to post- (37.9±0.2, 37.8±0.3°C $p<0.01$) exercise and returned to baseline (36.6±0.2, 36.6±0.2°C, $p=0.61$) following recovery, in Trials A and B, respectively. HR increased from pre- (58±9, 56±10 bpm) to post- (120±16, 130±22 bpm $p<0.01$) exercise and returned to baseline (59±7, 63± 10 bpm, $p=0.44$) following recovery, in Trials A and B, respectively. GI symptoms were similar among trials and times ($p=0.63$). In Trial B, urine specific gravity was lowest following recovery (1.005±0.003) compared to pre- (1.015±0.003, $p=0.02$) and post- (1.013±0.005, $p=0.02$) exercise. Plasma osmolality was maintained post-exercise (282±3, 285±4 mOsm/L) and following recovery (283±1, 284±2 mOsm/L) compared to pre-exercise (287±6, 286±3 mOsm/L, $p=0.96$) in Trials A and B, respectively. Change in plasma volume was similar among trials and times ($p=0.12$). Post-exercise body mass loss (0.1±0.5, 0.1±0.6 kg, $p=0.50$) and sweat rate (0.8±0.3, 0.8±0.3 L/h, $p=0.97$) were similar, in Trials A and B, respectively. **Conclusion:** Hydration status was similar between drinking larger, less frequent water boluses and smaller, more frequent boluses.

Racial Differences in the Effect of Influenza Vaccine on eNOS Expression and Regulatory MicroRNAs

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African Americans (AA) are at increased risk for cardiovascular disease compared with Caucasian Americans (CA), and this may be partially attributable to heightened responses to acute cardiovascular stress. The influenza vaccine induces acute inflammation and impairs vascular

function in healthy humans. MicroRNAs (miRs) are post-transcriptional regulators of gene expression that modulate eNOS expression and mediate effects of inflammation in endothelial cells. **PURPOSE:** To determine racial differences in the effects of influenza vaccine on eNOS and miRs important in eNOS regulation. **METHOD:** Human umbilical vein endothelial cells from healthy AA and CA individuals (n=3 of each race, experiments performed 3 times each) were cultured in basal media either with 250 ng/ml influenza vaccine (VAX) or without for 24 hours, after which cells and conditioned culture media were collected. Western blots were used to determine eNOS and phosphorylated eNOS (p-eNOS) protein expression. RT-qPCR was used to quantify eNOS mRNA, as well as the intracellular and extracellular expression of miRs 21, 126, 133a, and 199a. **RESULTS:** There were no differences between races in any measure in the basal condition. In response to VAX, eNOS mRNA significantly decreased in AA (-24±7%, p=0.04), but not CA (-20±14% p=0.10). eNOS protein expression did not differ from basal with the addition of VAX in either AA or CA (both p>0.05); however, CA had 85% higher eNOS protein than AA in the VAX condition (14.3±1.9 vs. 7.7±2.1 AU, p=0.04). There were no significant effects of VAX on p-eNOS or p-eNOS/total eNOS (all p>0.05). There were also no significant changes in the intracellular expression of any studied miR. In the media of both AA and CA, there were reductions in the levels of miRs 21 (-45±12% (p=0.007) and -37±39% (p=0.02)), 126 (-46±11% (p=0.007) and -37±38% (p=0.02)), and 199a (-52±7% (p=0.005) and -38±44% (p=0.048)) in response to VAX, while miR-133a was not reliably detected. **CONCLUSION:** AA endothelial cells responded to a VAX-induced acute inflammatory stimulus differently to CA, by decreasing eNOS mRNA. This response was reflected by lower eNOS protein in AA as compared to CA, but was not mediated by changes in any of the investigated eNOS-regulating miRs. The reduced release of these miRs may mediate systemic cardiovascular responses in both races.

Supported by Tier 1 (University of Maryland - College Park) to S.M.R.

The Cardiopulmonary Effects of Thoracic Load Carriage While Resting

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PURPOSE: To investigate the cardiopulmonary effects of thoracic load carriage (LC) while sitting and standing. **METHODS:** Eight males and one female (Age: 21.0 ± 1.4 yr; Height: 178.9 ± 5.8 cm; Weight: 86.1 ± 13.2 kg; Body Fat: 20.2 ± 7.2%) without LC experience participated in the study. On separate days, subjects completed four trials of sitting quietly for 5 minutes, and then standing quietly for 5 minutes without assistance. Testing sessions included an unloaded (UL) trial, which served as the control, and wearing a light load (LL; 24lb = 10.9kg), moderate load (ML; 48lb = 21.8kg) and heavy load (HL; 80lb = 36.4kg) weighted vest. The testing order of the weighted vest trials was determined by counterbalanced assignment. Vest weights were selected to approximate common gear of tactical populations: law enforcement (LL), firefighter (ML), and military personnel (HL). Minute ventilation (V_e), respiratory rate (RR), Tidal volume (T_v), oxygen consumption (VO_2), heart rate, and ratings of perceived

exertion (RPE) were assessed during all trials. An average value from the last minute was calculated for V_e, RR, T_v, VO_2, and heart rate and used in a repeated measures ANOVA for statistical comparison. **RESULTS:** While sitting, there were no differences observed across trials in any of the aforementioned variables. While standing, V_e was significantly higher during ML ($p = .013$) and HL ($p = .005$) compared to unloaded (UL = 12.6 ± 3.2, LL =12.2 ± 1.9, ML = 14.8 ± 3.7, HL = 14.9± 4.1 $l \cdot min^{-1}$). RR, T_v and heart rate were not different during any of the standing trials. Relative VO_2 while standing was significantly higher for ML ($p = 0.038$) and HL ($p = 0.001$) compared to UL (UL = 4.3 ± 0.6, LL = 4.6 ± 0.6, ML = 5.0 ± 0.7, HL = 5.3 ± 0.8 $ml \cdot kg^{-1} \cdot min^{-1}$). Standing RPE was significantly higher for ML ($p = 0.050$) and HL ($p = 0.014$), compared to UL (UL = 6.1 ± 0.3, LL = 6.9 ± 1.6, ML = 7.6 ± 1.9, HL = 7.9 ± 1.7). **CONCLUSION:** Sitting while under thoracic load carriage did not elicit any significant changes. While standing, ML and HL elicited an increase in V_e, although it is unclear if this response was due to RR, T_v, or a combination of both. ML and HL increased oxygen consumption by 16% and 23% respectively while standing, as well as increased the perceived effort.

Supported by Lock Haven University's Small Campus Grant

Investigating the effects of dietary nitrate supplementation on coronary and leg outcomes in peripheral artery disease: Rationale, methods, and feasibility

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Peripheral artery disease (PAD) severely limits exercise tolerance and confers significant coronary event risk. Dietary nitrate supplementation may be a particularly effective intervention for patients with PAD due to its ability to enhance oxygen supply to ischemic tissues; however, little is known about its' impact on oxygen supply in the heart or leg muscles during exercise in these patients. **PURPOSE:** This pilot and feasibility double-blinded RCT (NCT0255733) aimed to determine if short-term dietary nitrate supplementation improves oxygen supply-demand responses in the heart and leg muscles during acute exercise in patients with PAD. **METHODS:** Six PAD patients (ABI < 0.9, Fontaine ≤ 2) were randomized to consume either nitrate-rich or nitrated depleted (placebo) beetroot juice for 4 to 6 days, followed by a 7 to 14-day washout before crossing over to the other treatment. Coronary blood velocity (transthoracic ultrasound) and calf muscle oxygenation (NIRS) were measured during handgrip and plantar flexion exercise (Day 4), while claudication onset time, systemic blood pressure, and calf oxygenation were measured during graded treadmill exercise (Day 5 or 6). **RESULTS:** Beetroot juice-delivered nitrate supplementation in these patients was well tolerated and safe (0.7 to 1.8% methemoglobin). Plasma nitrite ($NO2^-$) concentrations increased 12-fold following nitrate

supplementation and remained high during laboratory testing, with negligible increases observed following placebo juice consumption. Compared to the placebo visit, dietary nitrate supplementation increased peak coronary blood velocity during plantar flexion (5 vs. 15 cm/sec, $p<0.05$) and attenuated peak diastolic blood pressure during treadmill exercise (89 vs. 79 mmHg, $p=0.02$). No other variables were significantly different between visits (all $p>0.05$).
CONCLUSION: In this small short-term pilot study, dietary nitrate supplementation lowered treadmill diastolic blood pressure and increased coronary hyperemia during isolated calf exercise. This novel, ischemia-targeted intervention has the potential to combat PAD symptoms, and should therefore continue to be studied in depth.

Calcium Activation of Mitochondrial Respiration is Maintained in Heart Failure Despite Altered Mitochondrial Membrane Potential

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Heart failure is a complex condition in which the heart is unable to meet the body's demand for fuel and oxygen, and patients often suffer from exercise intolerance. One theorized mechanism of this dysfunction is a reduction in mitochondrial ATP production, but it has been reported that maximal respiration rate (J_O) is unaltered in mitochondria (mito) from failing human hearts. Ca^{2+} entry into the mito is critical for the activation ATP production; however, elevated cellular Na^+, which have been reported in failing hearts, may reduce matrix Ca^{2+} activation by activating the Na^+/Ca^+ exchanger. **PURPOSE:** The goal was to examine how high and low extramitochondrial Na^+ affected oxygen consumption, membrane potential (Ψ_m), and redox potential in mito from healthy and failing hearts. **METHODS:** Heart failure was induced in male rats via transverse aortic constriction. J_O, Ψ_m, and NADH fluorescence were measured in isolated mito from control and failing rat hearts. The effect of Ca^{2+} on maximal and intermediate J_O, Ψ_m, and redox potential in mito incubated with healthy (5mM) or failing (15mM) [Na^+] were determined. Force-flow analysis was used to estimate the effective activity of the electron transport chain (ETC) and of the ATP synthase and the adenine nucleotide translocase (ANT). **RESULTS:** Maximal J_O was similar between failing and control hearts when incubated with healthy (498.2 ± 35.8 vs. 426.9 ± 40.1 nmol/mg/min) or failing Na^+ (520.9 ± 50.5 vs. 448.5 ± 46.0 nmol/mg/min). Maximal J_O occurred at the same [Ca^{2+}] between failing and control hearts. Intermediate J_O was similar between failing (199.7 ± 62.1 to 539.9 ± 143.1 nmol/mg/min) and control mito (126.8 ± 19.3 to 398.7 ± 23.4 nmol/mg/min), but failing mito respired across a smaller range of membrane potential (3.3 vs. 7.2 mV). The activity of the ATP synthase and ANT was similar between failing and control mito, but

ETC activity in failing mito was about 2 to 5 fold greater than control. **CONCLUSION:** Elevated $[Na^+]$ does not result in altered Ca^{2+} activation in mito from failing or control hearts. Failing mito had similar maximal and intermediate J_O compared to control, yet failing mito respired with smaller changes in Ψ_m suggesting control of mitochondrial respiration is altered in heart failure.

Supported by The American Heart Association Scientific Development Grant (**16SDG30770015)**

The Physiological Validation of Spectral Wavelet Analysis for Skin Flowmotion

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Microvascular dysfunction is a systemic disease process and the human cutaneous circulation is an accessible vascular bed to examine mechanisms underlying pathology. Spectral analysis of the oscillations, or skin flowmotion, in the blood flux signal obtained via laser-Doppler flowmetry is used to examine frequencies that align with different influences on blood flow response, including the cardiac (0.6–2.0Hz), respiratory (0.15–0.6Hz), myogenic (~0.05–0.15Hz), neurogenic (~0.02–0.05Hz), and endothelial (~0.0095–0.02Hz) components. **PURPOSE**: The aim of this study is to examine the validity of spectral analysis utilizing known physiological stimuli (local skin heating to 42°C) with pharmacological blockade of sensory nerves (topical 2.5% prilocaine 2.5% lidocaine). We hypothesized that the endothelial component will increase with local skin heating and that sensory nerve blockade will decrease the neurogenic contribution. **METHODS**: Twelve young healthy adults (n=7 women; 22±3 yrs, BMI: 25±2 kg/m) participated. Topical Lidocaine was applied to the ventral forearm for at least 45 minutes prior to physiological testing. Laser Doppler flux was monitored continuously at both a lidocaine treated site and non-treated site during thermoneutral baseline (33°C) and a standardized local heating protocol (42°C and 43°C). Spectral analysis was used to determine the contribution of different frequency bands on the total skin flowmotion. Cutaneous vascular conductance (CVC, flux/BP) was also calculated and normalized to maximal (heating to 43°C). **RESULTS**: The initial peak during local heating was reduced in the Lidocaine treated sites (62%±8 to 29%±23, $p<0.0001$, 95% lidocaine), validating the sensory nerve blockade. There was no difference between the lidocaine or control sites for any of the contributions to flowmotion when expressed as absolute or relative power. **CONCLUSION:** Sensory nerves and endothelium-dependent vasodilation increased during the physiological stimulus of local heating, and sensory nerves were inhibited using lidocaine. Local skin heating increased total spectral analysis power, however, despite pharmacological sensory nerve blockade, special analysis failed to show differences in any of the frequency bands.

American Heart Association Grant #18UFEL33900164
Noll Endowment for Undergraduate Research

Correlations of Body Composition and 1RM to Peak Velocity at different Exercise Intensities in Back Squat.

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Velocity-based training has gained popularity due to its reported enhancement in power performance. However, velocity during resistance training may be affected by body composition and maximal strength. **PURPOSE:** To assess if body composition and maximal strength are related to velocity during the barbell back squat at incremental loads. **METHODS:** Body composition and 1-repetition maximum (1RM) on the barbell back squat were assessed in college aged men (n=11) and women (n=7). Fat-free mass was recorded via whole-body dual energy x-ray absorptiometry scan. Seven randomized submaximal sets of the barbell back squat ranging from 30-90% of 1RM were completed 48 hours after 1RM testing. For the six sets between 30-80% of 1RM, subjects completed 5 repetitions, while 3 repetitions were completed for the set at 90% of 1RM. Subjects were instructed to complete each repetition "as fast as possible", and were provided 3-5 minutes of rest between sets. An accelerometer (ACC) was fixed to the barbell to record peak velocity (PV) for each repetition. For each submaximal load, the set average PV was calculated, and the percent decline in PV from 30% to 90% was calculated. Pearson correlations were run to determine the relationships between FFM, 1RM, PV at each prescribed load, and the relative decline in PV from 30 to 90% 1RM. The alpha level was set a $p \leq 0.05$, and all data are presented as mean±standard deviation. **RESULTS:** FFM (59.4±12.3 kg) was significantly correlated to PV at 40% (r=0.527, p=0.030), with a trend towards a relationship at 30% (r=0.425, p=0.089). Furthermore, 1RM (115.6±39.9 kg) was significantly correlated to PV at 30% (r=0.498, p=0.042) and 40% (r=0.501, p=0.040). However, FFM and 1RM was not significantly correlated with PV at any other prescribed loads. Additionally, FFM did not significantly correlate (r=0.159, p=0.543), while 1RM was significantly correlated (r=0.484, p=0.049) to the percent decline in PV. **CONCLUSION:** PV produced at the lightest relative loads correlated with both FFM and 1RM. However, neither was significantly correlated with PV at moderate or heavy loads. When assessing the relative decline in PV, the strongest individuals may have the greatest drop-off in PV when transitioning to higher loads.

Supported by Bloomsburg University Research and Scholarship Mini Grant (001071).

The Effects of Varying Doses of Caffeine on Sports Skill Related Performance and Reaction Time

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Caffeine is a stimulant agent used frequently by a large population and can be found in a number of beverages ranging from soft drinks to energy drinks. It is not clear what the optimal dosage of caffeine would be to improve cognitive function and skill related exercise performance. **PURPOSE:** To examine the effects that caffeine would produce on strength, sports related performance activities and cognitive function when taking varying doses. **METHODS:** Ten (1 female, 9 male) subjects (Age=20.5 yrs) came in on four separate occasions and consumed varying doses of caffeine (baseline, 200, 300, and 400 mg) in randomized order and performed

several sports performance related tests. After consuming assigned dose of caffeine, subjects were instructed to rest for 30 minutes prior to performing the tests. After obtaining blood pressure (BP) and heart rate (HR), each subject was asked to complete an online cognitive reaction time, handgrip strength, vertical jump, broad jump, and shuttle run tests. One-way ANOVA with repeated measure was used to compare differences in reaction time, handgrip strength, vertical jump height, broad jump distance and shuttle run time at varying doses of caffeine. **RESULTS:** A decrease in cognitive reaction time was shown in all three trials (200, 300, 400 mg) when compared to the baseline although the differences were not statistically significant (244.7±19.1, 242.8±14.1, and 268.4±50.6 vs. 264±48.6 msec, $p>0.05$). A significant increase was observed in handgrip strength with 300 mg dose showing the greatest increase from the baseline for both non-dominant (44.9±14.5 vs. 51.9±16.0 kg**,** $p=0.03$) and dominant hand (47.9±13.8 vs. 51.0±12.8 kg, $p=0.03$). Moreover, modest but not significant increases were shown in vertical jump height with 300 mg dose showing the greatest improvement (54.9±7.59 vs. 58.4±7.0 cm, $p=0.071$). Comparing to the baseline, significant decrease in shuttle run time was observed in all 200, 300, and 400 mg trials (3.7±0.4 vs. 3.4±0.3, 3.5±0.3, and 3.4±0.3 sec, $p=0.02$). No significant caffeine effect was observed for BP or HR. **CONCLUSION:** Based on the results of study, the optimal dosage of caffeine for improvements in performance appear to be in the 200-300 mg range while 400 mg dose seemed to have negative effects.

Cardiac Responses to β-adrenergic Stimulation and Induced Vasodilation are Similar in Young Male and Female Rats

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The ability of the heart to increase its work output involves sympathetic activation and coronary vasodilation. It is known that regulation of these systems is different between sexes, as well as with age, however the mechanisms have yet to be fully elucidated. **PURPOSE:** Therefore, the goal of this study was to investigate the functional responses of male and female rat hearts to β-adrenergic stimulation and nitric oxide-induced vasodilation, as well as the effects of SNP-induced vasodilation on myoglobin and mitochondrial oxygenation. **METHODS:** Male and female rats were anesthetized, hearts were excised, and Langendorff-perfused via the aorta at 62 mmHg with a Krebs-Henseleit buffer, pH=7.4, 37^{o}C. After15 min functional equilibration, 25 uM sodium nitroprusside (SNP), a vasodilation drug which causes smooth muscle relaxation by breakdown to nitric oxide, was added to the perfusate. In a second subset of hearts, albuterol, a β-adrenergic receptor agonist, 5 uM was added to the perfusate. Heart rate, coronary flow rate, and aortic pressure were continually monitored. In the SNP experiments, myoglobin oxygenation and mitochondrial redox status were monitored utilizing optical spectroscopy. **RESULTS:** Upon addition of SNP, coronary flow rate increased from 11.2 ± 1.2 mL/min to 13.6 ± 2.1 mL/min in male rats and from 8.9 ± 1.1 mL/min to 11.1 ± 1.6 mL/min in female rats. In both male and female rats, the increase in flow was associated with an increase in myoglobin oxygenation. In

response to albuterol, heart rate increased from 257 ± 6 beats/min to 300 ± 10 beats/min in male rats and from 200 ± 13 beats/min to 228 ± 1 beats/min in female rats. **CONCLUSION:** Young male and female rats demonstrate similar responses to SNP-induced vasodilation and β-adrenergic stimulation, however the magnitude of the response may be different. Future studies will assess the response to these drugs in older male and female rats, to determine if there is an interplay between sex and age in response to β-adrenergic stimulation.

Field Based Assessment of Running Metrics

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Recreational and competitive running has been linked to positive health outcomes and is a popular method of physical activity. Despite its popularity, 56% of recreational runners and up to 90% of competitive runners sustain a running-related injury (RRI) during the course of training. Examination of running kinematic metrics (i.e. pronation, pronation velocity, impact force, step rate/cadence, etc.) provides opportunities to explore and quantify risk factors related to the development of RRIs and/or performance improvement. The collection of running kinematic data has traditionally been completed in laboratory settings. With the advancement of wearable technology, real-time running kinematic data can be collected during field-based training sessions. **PURPOSE:** The purposes of this investigation were to collect running metric data using wearable technology in a field-based approach and to examine the relationship between running kinematic metrics. **METHODS:** Data were collected using wearable sensors mounted to the laces of running shoes of NCAA Division I distance runners (n=13) during team or individual training sessions during a one-week period. Data collected included impact force, stride length, breaking force, overall impact (Gs), and cadence. Pearson R correlations were used to analyze the relationships between kinematic variables. **RESULTS:** Analysis revealed a negative correlation (r=-.588, p=0.03) between average cadence and impact force. Stride length (r=-.541, p=.056), breaking force (r=.042, p=.891), and average G force (r=-.467, p=.107) were not significantly correlated. **CONCLUSION:** Excessive impact forces cause strain on the musculoskeletal system contributing to the development of injury. Increasing cadence may decrease impact force and therefore, reduce the likelihood of injury. From a training perspective, the use of wearable technology provides researchers, clinicians, and coaches a tool to provide real-time feedback to runners during field-based training.

Exercise Attenuates Weight Gain and Modulates Satiety Hormones in Female Mice

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Exercise contributes to both caloric expenditure and nutrient partitioning. We have shown that lean sedentary (LS) male mice had lower levels of insulin and Interlukin-6 (IL-6) when compared to their high-fat fed sedentary (HFS) counterparts. Further, both exercise groups, lean (LX) and high-fat fed (HFX) demonstrated lower ghrelin, a hormone that regulates appetite and energy homeostasis levels compared to their sedentary counterparts. However, there is little work done in understanding the female response to blood biomarkers and exercise. **PURPOSE:** Therefore, the purpose of this study was to replicate our previous study in female mice to ascertain which biomarkers are similar across gender, and further evaluate any potential differences. We hypothesized that female mice would have a similar inflammatory biomarkers response as males, but a different hormonal profile. **METHODS:** Thirty-six, 6-week old C57BL/6NTac female mice were fed a normal or high-fat diet for 12-weeks and randomly assigned to exercise or sedentary groups. After 12 weeks animals were sacrificed, and blood was collected for metabolic hormone analysis using a magnetic bead-based multi-analyte panel. A total of seven biomarkers were analyzed including: insulin, peptide-YY (PYY), ghrelin, amylin, IL-6, tumor necrosis factor alpha (TNF-a), and pancreatic polypeptide (PP). **RESULTS:** HFS female mice had the highest body weight, kcal intake per day and percent weight increase compared to all other groups ($p<0.05$). Exercise attenuated the body weight gain in HF-fed mice (24.7g vs. 30.3g). Exercised groups had significant decreases in levels of insulin (1286.925 pg/ml, 2819.299 pg/ml; $p=0.021$) and amylin (67.233 pg/ml, 95.048 pg/ml; $p=0.009$), and increased levels of PYY (18.840 pg/ml, 61.688 pg/ml; $p=0.031$) compared to sedentary groups. Groups fed HF diets also had increased levels of PYY (64.673 pg/ml, 15.978 pg/ml; $p=0.018$) compared to normal diet groups. **CONCLUSION:** Exercise attenuates body weight gain and the rise in insulin in mice fed high fat diet and this is consistent between genders. Further, appetite/glucose regulating hormones like amylin and PYY are significantly altered in females but display different responses in males. This continues to add to the exciting story of metabolic differences between males and females.

Peripheral Revascularization Reverses the Decline in Active Muscle Oxygen Saturation in Peripheral Artery Disease

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Peripheral artery disease (PAD) is a progressive atherosclerotic disease that limits blood flow to the skeletal muscles in the lower extremity. Reductions in blood flow may be more pronounced during ambulation or exercise and produce leg cramping or pain known as intermittent claudication. Recent studies have shown an exaggerated blood pressure response with lower muscle oxygen saturation (SmO_2) during foot exercise in patients with PAD. However, it is unclear whether surgical and/or endovascular interventions normalize this response. **PURPOSE:** To examine whether revascularization procedures improve calf muscle SmO_2 and reduce blood pressure responses during dynamic foot exercise in patients with PAD. We hypothesized that

revascularization would improve SmO_2 responses (indicating greater tissue perfusion) and that the blood pressure response would be attenuated during exercise. **METHODS**: Patients with symptomatic PAD (n = 6) performed incremental supine plantar flexion exercise, starting at 0.5 kg and increased by 0.5 kg every minute for up to 6 minutes, pre- and one-month post peripheral revascularization procedure. SmO_2 was measured continuously from the gastrocnemius muscle, while heart rate and blood pressure were measured beat-by-beat. **RESULTS**: Reductions in SmO_2 from baseline to end-exercise were attenuated post-revascularization when compared to pre-intervention (-6.5 ± 6.2% vs. -39.8 ± 22.5%, $P < .05$). The change in mean arterial blood pressure was reduced post-revascularization (4 ± 4 mmHg vs. 16 ± 12 mmHg $P < .05$). PAD patients exercised longer post-revascularization (5.8 ± 0.4 min vs. 4.0 ± 1.5 min $P < .05$). **CONCLUSION**: These data suggest that revascularization lessens the degree and rapidity of decline in SmO_2 during exercise, and lowers the exaggerated blood pressure response in patients with PAD.

Supported by NIH Grant P01 HL134609

Determining the Accuracy of Basal Metabolic Rate Prediction Equations for Athletes

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Resting metabolic rate (RMR) is the energy required to perform basic functions when at rest. Different types of basal metabolic rate (BMR) prediction equations also exist, but they vary in terms of accuracy and specific factors taken into account by the researchers who developed them (i.e., age, lean body mass, fat mass). It has been reported that these equations tend to overestimate RMR; but, the majority of sample sizes used for analyses were either small or favored specific populations. **PURPOSE:** To determine the accuracy of BMR prediction equations for athletes. **METHODS:** Two hundred and eighty-five athletes (157 women, 128 men), ≥ 26 years of age, who exercised at least twice a week and were non-smokers, participated in this study. RMR was measured using indirect calorimetry. Prior to RMR measurements, participants were required to fast and avoid caffeine for 12 hours, avoid alcohol and exercise for 24 hours, and rest in a recliner for 15 minutes before data collection. Lean body mass, fat-free mass, fat mass, and percent body fat were determined using dual-energy X-ray absorptiometry (DXA). The Mifflin-St. Jeor, Harris-Benedict, Cunningham, and Owen prediction equations were compared to indirect calorimetry using one-way analysis of variance (ANOVA) with repeated measures. **RESULTS:** Indirect calorimetry (1416±267 kilocalories [kcal]) was significantly lower than the Mifflin-St. Jeor (1531±258 kcal), Harris-Benedict (1599±266 kcal), Cunningham (1650±246 kcal), and Owen (1579±247 kcal) ($p < 0.001$) equations. The Mifflin-St. Jeor equation had the lowest mean difference and highest percent accuracy for all participants combined and women (115, 54.8%; 95, 57.2%, respectively). However, the Owen equation seemed to be more accurate for men (98, 61.3%). The Cunningham equation yielded the highest mean difference and lowest percent accuracy for all participants combined, women, and men

(234, 29.1%; 221, 23.6%; 250, 35.9%, respectively). **CONCLUSION:** We found that the four BMR prediction equations analyzed all over-predicted support the need for a more suitable BMR prediction equation for athletes.

Evaluation of VO_2max Criteria in High-Active Trail Runners

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PURPOSE: To compare the achievement of classic versus contemporary maximal oxygen consumption (VO_2max) criteria using the Bruce treadmill protocol in high-active adult trail runners. **METHODS**: Nineteen (12 men, 7 women; 36.1 ± 6.4 yr) high-active trail runners (376 ± 137 min of running per week) performed the Bruce treadmill protocol to volitional exhaustion. Pulmonary ventilation, VO_2, and VCO_2 were collected continuously using a metabolic measurement system. Heart rate (HR) was monitored and recorded each minute using an electrocardiogram. Individual exercise test data was analyzed for achievement of the following classic VO_2max criteria: 1) VO_2 plateau, < 2.1 ml·kg^{-1}·min^{-1} increase with increasing workload, (2) HR within 10 beats·min^{-1} of age-predicted maximal HR (APMHR: 220 – age), and (3) respiratory exchange ratio (RER) ≥ 1.15. Data was also analyzed for the following contemporary criteria: 1) VO_2 plateau, < 2.1 ml·kg^{-1}·min^{-1} increase during the final minute of exercise, (2) HR within 10 beats·min^{-1} of APMHR (208 – 0.7*age), and (3) RER ≥ 1.10. The proportion of subjects achieving classic versus contemporary criteria was compared using the Chi-Square Test of Independence, completed separately for each criteria type (plateau, HR, RER) and overall (achieving 2 of 3 criteria for accepted VO_2max achievement). **RESULTS**: Mean time until test termination was 13.6 ± 1.7 minutes. The highest 30-second average VO_2 for the overall sample was 53.8 ± 8.6 ml·kg^{-1}·min^{-1}, ranging from 38.6 – 52.6 ml·kg^{-1}·min^{-1} in the women and 43.6 – 72.7 ml·kg^{-1}·min^{-1} in the men. A significantly lower proportion of subjects achieved the classic compared to the contemporary criteria for VO_2 plateau (1/19 vs 15/19; Chi-Square = 21.16, p < 0.001), RER (7/19 vs 16/19; Chi-Square = 8.92, p = 0.003), and overall (4/19 vs 17/19; Chi-Square = 17.99, p < 0.001). A similar proportion of subjects achieved the classic and contemporary HR criteria (11/19 vs 13/19; Chi-Square = 0.45, p = 0.501). **CONCLUSION**: In this sample of high-active adult trail runners, the less conservative contemporary VO_2max criteria resulted in a greater proportion of subjects achieving VO_2max using the Bruce treadmill protocol.

Oral Contraceptives Do Not Affect Exercise Pressor Reflex During Active Pill Phase

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The cyclical nature of the ovarian cycle influences blood pressure (BP) and heart rate (HR) responses to isometric handgrip exercise (IHG) in females. Exercise pressor reflex to IHG is augmented in females taking oral contraceptives (OCP) during the placebo pill phase as compared to naturally menstruating females (NOCP) in the early follicular phase. However, it is currently unknown if oral contraceptives affect the exercise pressor response in OCP females during the active pill phase when compared to the high hormone phase (mid-luteal) in NOCP females. **PURPOSE:** The purpose of the current study was to evaluate the effect of the high hormone phase (active pill) on the exercise pressor response to IHG in females taking OCP as compared to NOCP females during the mid-luteal phase. **METHODS:** 12 female participants (age= 22 ± 1 years old) were recruited; 7 were taking OCP and 5 were NOCP. OCP females were tested during the active pill phase, and NOCP females were tested during the mid-luteal phase. Beat to beat BP and HR were recorded via a finger cuff and 5 lead electrocardiography for a 2 minute baseline and during the IHG, which was performed at 40% of maximal voluntary contraction until fatigue. To determine peak BP and HR values, 30-second bin averages of BP and HR were calculated for the entirety of the IHG exercise. Peak values for BP and HR were recorded during the last 30 seconds of the IHG. BP and HR response values are reported as change from baseline (delta). **RESULTS:** There were no differences in delta values for mean arterial pressure (MAP), systolic blood pressure (SBP), diastolic blood pressure (DBP), or HR responses between the OCP and NOCP females during IHG. For OCP active pill phase, the changes in MAP, SBP, DBP, and HR were 34.92 ± 6.72 mmHg, 28.65 ± 9.97 mmHg, 23.98 ± 5.70 mmHg, and 19.08 ± 3.40 bpm. These values were not significantly different from the NOCP mid-luteal phase IHG delta values for MAP, SBP, DBP, and HR, which were 27.08 ± 3.74 mmHg, 29.55 ± 5.25 mmHg, 23.18 ± 2.67 mmHg, and 20.12 bpm ± 6.51, respectively ($p= 0.39$, $p= 0.95$, $p= 0.91$, $p= 0.88$, respectively). **CONCLUSION:** These data suggest that the exercise pressor response to IHG is not augmented during the active pill phase in females taking OCP as compared to normally menstruating females.

An Analysis of the Differences in Exercise, Wearable Exercise Technology Device Use and Increased Exercise Behaviors in University Women

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Research indicates that increased exercise behaviors of frequency, intensity and time, collectively called FIT values, equate with positive health outcomes and decreased risks of obesity and chronic disease in college-aged women. Yet many young women do not get the recommended amount of physical activity during their college years. **PURPOSE:** This study sought to understand whether wearable exercise tracking technology device use (i.e. smartphones, dedicated devices, watches) was associated with increased exercise among university women. **METHODS:** The study used a quantitative design, administering a self-report questionnaire to university women (N = 289), identifying motivational readiness, from

never to regularly, for exercise and motivational readiness for wearable exercise technology device use. The data were collected through an online data collecting method, which was used to administer the questionnaire. **RESULTS:** Of the 80 women identified as meeting all three exercise FIT recommendations issued by the American College of Sports Medicine, 27 were regular users (six months or longer) of wearable exercise tracking technology devices. Of the 27 regular users of the devices, 23 were also regular exercisers. A Chi-square identified a strong association between the *most motivated* group for regular exercise and the *most motivated* group for regular wearable technology device use, showing that students who regularly used the devices were significantly more likely to be regularly exercising than either the *least motivated* or *middle motivated* to use a wearable technology (X^2 (4) = 9.41, p = .05.) **CONCLUSION:** Findings indicated that women regularly using a wearable exercise technology device were also shown to be regularly exercising for 6 months or longer. Lack of exercise in college women today is a serious public health concern. Findings suggest wearable exercise technology may be associated with increased exercise FIT values in university women who regularly use the technology during exercise.

ET-1 Receptor Responses in Young Women with a Family History of Hypertension

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Endothelin-1 (ET-1) contributes to endothelial dysfunction, a primary driver of hypertension and cardiovascular disease. Young women with a family history of hypertension, a group at risk for developing hypertension, display elevated resting plasma ET-1. However, the responsiveness of the ET-1 system in the vasculature, including the contribution of ET_A and ET_B receptors, has not yet been compared between young women with (+FH) and without (-FH) a family history of hypertension. **PURPOSE:** The purpose of this study was to test the hypothesis that ET_A and ET_B receptors differentially regulate vascular function in +FH young women. **METHODS:** We conducted a retrospective analysis on 17 -FH young women (21±2 yrs, 23±3 kg/m^2) and 16 +FH (22±5 yrs, 23±2 kg/m^2) young women (self report). Vasodilatory responses to local heating of the skin were measured using laser doppler flowmetry during microdialysis perfusions of lactated Ringer's (Control), ET_A receptor blockade (BQ-123, 500nM), and ET_B receptor blockade (BQ-788, 300nM). Cutaneous vascular conductance (CVC) was calculated during the plateau phase of local heating (42°C), and normalized to maximal vasodilation achieved by perfusion of sodium nitroprusside (28mM) and heating to 43°C. A two-way ANOVA was performed to compare the impact of familial history of hypertension on vasodilatory responses to ET-1 receptor antagonist. Threshold for significance was set a priori at P<0.05. Data are presented as mean ± SD. **RESULTS:** Vasodilatory responses to lactated Ringer's (-FH: 90±8 vs. +FH: 88±8 %CVC max, P>0.05) were similar in both groups. Blockade of ET_A receptors (-FH: 92±5 vs. +FH: 90±6 %CVC max, P>0.05) or ET_B receptors (-FH: 87±7 vs. +FH: 89±6 %CVC max, P>0.05) did not elicit differential responses between -FH and +FH young women. Plasma

ET-1 (-FH, n=12: 1.3±0.5 vs. +FH, n=10: 1.5±0.5 pg/mL, *P*=0.29) and mean arterial pressure (-FH: 83±8 vs. +FH: 82±8 mmHg, *P*=0.60) were also not different between groups.
CONCLUSION: These preliminary data suggest that in young, otherwise healthy women, ET-1 receptor function is not altered based on hypertensive family history status. Given the known sex differences in the ET-1 system, additional data are needed to determine whether ET-1 receptor function is altered in young men with a family history of hypertension.

Supported by: NIH R01 HL 146558, P20 GM 113125, AHA 16SDG30700015, and University of Delaware Research Foundation.

RFD-SF and Time to Peak Force for Grip Strength is not affected in College Aged Students with Multiple Concussions

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INTRODUCTION: Concussions are a brain injury caused by a collision of the brain against the skull. Known symptoms of a concussion are headaches, dizziness, nausea, and fatigue. Long term effects of multiple concussions include having mild cognitive impairment, memory loss, and increased risk of depression/anxiety. Iverson found multiple concussions to not have an affect on ImPACT test scoring in high school and college aged athletes. However, there was a drop in score regarding verbal memory composite, suggesting that there may be a lingering effect. Neural control of rapid movement decreases with age and disease and is measured via the rate of force development scaling factor (RFD-sf). The effects of multiple concussions on neural control of rapid movement are unknown. **PURPOSE**: The purpose of this study was to determine the effects of multiple concussions on the rate of force development scaling factor. **METHODS**: 39 volunteers (21 females, 18 males) participated in this study. 15 of the subjects did not have concussions (NONE), 12 have experienced 1-2 concussions (FEW), and 12 have had more than two concussions (MANY). Participants performed 2 to 3 sets of rapid grip force pulses to varying peak forces between 15% and 80% of MVC. Each set was one minute in length with at least one minute of rest in between. Force data was Butterworth filtered with a 50Hz cutoff. RFD was calculated with the slope of a central tendency 50ms moving window. Peak RFD and peak force were plotted with a best fit regression line. Slope (RFD-SF) and r^2, were recorded from the best fit regression line and time to peak force (TtpkF) were recorded from the time-force curve. A one-way ANOVA was used to analyze the data. **RESULTS:** The mean and standard deviation for RFD-SF, r^2, and TtpkF (ms) for each group is as follows: NONE - RFD-SF = 8.61 (1.96), r^2 = 0.838 (0.06), TtpkF = 0.122 (0.03); FEW - RFD-SF = 8.37 (2.11), r^2 = 0.780 (0.11), TtpkF = 0.125 (0.02); MANY - RFD-SF = 8.25 (1.66), r^2 = 0.780 (0.14), TtpkF = 0.131 (0.04). There were no significant differences between the groups for RFD-SF [F(2,36)=0.119, p=0.888]; r-squared [F(2,36)=1.250, p=0.299]; or time to peak force [F(2,36)=0.338, p=0.715]. **CONCLUSION:** RFD-SF and time to peak force in grip strength are not affected by multiple concussions in college aged students.

The Impact of Dietary Sodium on Blood Pressure During the Cold Pressor Test

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High dietary sodium intake increases blood pressure (BP) reactivity in rodents, but it is not known if dietary sodium similarly affects BP reactivity in humans. **PURPOSE**: We hypothesized that high dietary sodium would increase BP reactivity in males and females. The cold pressor test (CPT) was used to assess BP reactivity. **METHODS:** Twenty-seven healthy, normotensive adults (16M/11F; age: 26±7yrs; BMI: 24.7±1 kg/m^2) participated in a controlled feeding study that consisted of 10 days of either low (LS: 1 g /day), medium (MS: 2.3 g /day), or high (HS: 7 g /day)-sodium diets, in randomized order with at least a 1-month washout between diets. Twenty-four hour urinary sodium excretion was used to ensure compliance of diets. Beat-to-beat BP (Finometer) was assessed throughout the CPT. The CPT was accomplished by having participants immerse their right hand in an ice slurry (3° to 5°C) for 2 minutes. Data was analyzed using two-way repeated measures ANOVA. **RESULTS:** As expected, twenty-four hour sodium (LS: 42±40, MS: 84±36, HS: 253±111 mmol/24 hours, main effect of diet, $p<0.0001$) increased with increasing levels of dietary salt, with no sex differences, $p = 0.98$. The CPT acutely increased systolic BP, but dietary sodium intake did affect the systolic BP responses to the CPT (ΔSystolic BP LS: 18±11, MS: 20±12, HS: 18±11 mmHg, $p = 0.44$). **CONCLUSION:** These data suggest that 10 days of high dietary salt intake does not affect the BP responses to the CPT.

Supported by NIH Grant 1RO1HL128388

Circulating extracellular vesicles from dystrophic mice do not alter mitochondrial dysfunction in cardiomyocytes

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Duchenne muscular dystrophy (DMD) results in loss of ambulation and respiratory problems, but cardiomyopathy is emerging as the leading cause of death. Extracellular vesicles (EVs) are small lipid vesicles released from cells and we and others have shown that damaged cells, including muscle cells, 'selectively package' specific molecules including toxic molecular cargo into EVs. When released into the extracellular environment many of these EVs enter systemic circulation, are uptaken by recipient cells, and cause or contribute to cellular dysfunction. Thus,

feasibly EVs could contribute to severity and progression of cardiomyopathy in DMD. **Purpose:** The purpose of the present study was to determine if EVs isolated from the plasma of dystrophic mice induce mitochondrial dysfunction, a hallmark in DMD cardiomyopathy, in healthy cardiomyocytes. **Methods**: EVs were isolated from plasma collected from eight month old wild type (WT) and dystrophic (D2.B10-Dmdmdx/J) mice. EVs were quantified using nanotracking analysis (NTA) and incubated on HL-1 cardiomyocytes at concentrations of 10x10^10 EVs per well treated for 18-24 hours (repeated in 3 separate independent experiments). Mitochondria function was tested and statistical analysis was performed by t-test with $p<0.05$. **Results:** Compared to WT EVs the dystrophic EVs did alter basal respiration ($p = 0.88$), maximal respiration ($p = 0.15$), proton leak ($p = 0.87$), ATP production ($p = 0.32$), spare respiratory capacity ($p = 0.40$), or non mitochondrial oxygen consumption ($p = 0.55$). **Conclusion:** EVs isolated from circulation of dystrophic mice that are added to cultured cardiomyocytes do induce mitochondrial dysfunction. Future studies should examine altered levels of EVs and different time courses of EV exposure.

Supported by NIH R01 NS102157 and P20 GM113125

The Effects of Music Genre on Cardiovascular Performance and Enjoyment in Young Adults

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Music is a tool used not only to relieve stress, but to also motivate individuals and enhance performance in everyday tasks, both physically and mentally. Depending on how much an individual enjoys listening to a specific genre of music, it could affect both their enjoyment and level of performance during exercise. **PURPOSE:** To determine the effectiveness of music genre on cardiovascular performance in young adults. **METHODS:** Ten subjects (two males, eight females) participated in this study. Subjects completed 20-minutes of cycling on three separate testing days, each day listening to a different music genre (control (no music), pop, or classical). Resting heart rate and blood pressure were taken prior to the cycling session. Heart rate (HR) and blood pressure (BP) were measured during the cycling every 2 minutes and rating of perceived exertion (RPE) was measured every 10 minutes using Borg's RPE Rating Scale. At the end of every session, final HR, BP, and distance traveled were recorded. Participants also filled out a level of enjoyment questionnaire after completing each cycling session. **RESULTS:** To test the effects of music on performance, a repeated measures ANOVA was conducted, which was not statistically significant, $F(2,18)=1.25$, $p>.05$, meaning that distance pedaled was the same. An additional repeated measures ANOVA was conducted with enjoyment. The results were statistically significant, $F(1.76,15.87)=6.27$, $p<.05$. Post-hoc tests indicated that participants' levels of enjoyment were significantly better when listening to pop music ($M=5.50$ $SD=.45$) compared to the no music at all condition ($M=4.10$ $SD=.59$). **CONCLUSION:** Music genre did not affect distance traveled among groups, but it did influence enjoyment levels. Limitations of

this study include a small sample size as well as shuffling the music instead of keeping it in a consistent order. Music influences enjoyment of individuals during cardiovascular activity, so further research should explore the same ideas with other forms of exercise and also for maintaining an exercise program.

The Effects of a 12-Week Resistance Training Program on Arterial Stiffness in Females: A Pilot Study

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Arterial stiffness is a leading risk factor for cardiovascular disease and early detection is crucial in seeking appropriate treatment interventions. Current research studies have reported findings in positive correlations with chronic resistance and others did not find any correlations. This study was conducted to further examine the inconsistencies from previous investigations utilizing two resistance training models. **PURPOSE:** To examine the influences of two separate resistance training programs on arterial stiffness. **METHODS:** Subject characteristics included 16 female, untrained college students aged 18-22 years that were randomized into one of three groups: control (CON) group (n=6), high-intensity resistance exercise (HI) group (n=5), and high-volume resistance exercise (HV) group (n=5). Subjects randomized to the whole-body resistance training groups were required to perform strength training exercises three to five days a week for 12 weeks. The exercise regimen consisted of 2-3 sets of 3-8 repetitions (80-90% of 1-repetition maximum (1 RM)) for the HI group and 3-4 sets of 10-15 repetitions (50%-70% of 1 RM) for the HV group. Subjects randomized to the control group abstained from resistance training during study period. All subjects were instructed to continue their normal diet and avoid cardiovascular exercise during the study. **RESULTS:** Following the intervention, there was a significant time effect in the central systolic blood pressure (cSBP) (108±10 vs. 101±8 mmHg; P=0.042) in the HI group only. There were no other changes in arterial stiffness indices between the groups. Both HV and HI groups significantly increased in the squat (57.2±30.0 vs. 36.4±8.9 percent change; P=0.001), bench press (27.8±12.2 vs. 30.7±11.2 percent change; P=0.004), and seated row (27.4±6.5 vs. 18.7±12.7 percent change; P=0.012), respectively. **CONCLUSION:** The application of a randomly controlled trial with validated measurements of arterial stiffness, chronic resistance training does not impact central arterial stiffness regardless of training volume and load. Our findings support the use of resistance training exercise without undue impact on vascular compliance in otherwise healthy, female populations.

Positional Differences in Training Load During Matches and Practices in Collegiate Female Soccer Players.

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In soccer, players are subjected to differential movement demands based on their position. Further, research describing the specific positional demands during matches and practices in Division III female collegiate soccer athletes is limited. **PURPOSE:** To assess position differences in movement kinematics and energy expenditure in Division III female soccer athletes during matches and practices. **METHODS:** Twenty-six Division III female soccer athletes (height: 1.61 ± 0.3 m; body mass: 66.7 ± 7.5 kg; fat-free mass: 50.3 ± 6.5 kg; body fat %: 25.6 ± 5.1%) were equipped with a wearable athlete monitoring system to assess training load, total distance, distance in high speed zones (>4.16 $m \cdot s^{-1}$), acceleration/deceleration, and energy expenditure during four non-conference matches and practices. Data were then collapsed by session type and analyzed to determine whether differences existed between position groups (goal keepers [GK], center defenders [CB], flank players [FP], forwards [F] and center midfielders [CM]). Paired sample t-tests were used to detect differences in movement kinematics between matches and practices. A one-way ANOVA was used to detect differences by position group for session type. **RESULTS:** There were no significant differences in training load, total distance covered, distance in high speed zones or high intensity accelerations/decelerations between matches and practices. However, total energy expenditure was significantly higher during matches compared to practices (1,060 ± 282 vs. 930 kcal; $p = 0.033$). During matches, GK covered significantly less distance than CB (GK: 3.6 ± 1.5 vs. CB: 8.7 ± 1.6 km; $p = 0.04$). In practice, GK (4.1 ± 0.4 km) covered significantly less ($p<0.05$) distance than F (7.9 ± 0.6 km), CB (8.0 ± 0.7 mi), and FP (7.6 ± 1.5 km) and less distance in high speed zones than F and FP (GK: 0.2 ± 0.1 vs. F: 0.8 ± 0.2; FP: 0.7 ± 0.3 km; $p < 0.05$), respectively. **CONCLUSIONS:** Training load and distances covered were similar during matches and practices however energy expenditure was higher during matches. Players should focus on a post-match recovery beverage or snack to help maintain energy balance and facilitate recovery. GK appear to cover less distance during matches and practices compared to other position groups.

No funding was provided to support this study.

Effects of Pre-infusion and Home Exercise Program on Quality of Life and Fatigue During Chemotherapy Treatment: A Case Study

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Given the paucity of research examining the effects of exercise during chemotherapy, research exploring exercise concomitant to infusion treatments is justified. **PURPOSE:** The present study

investigated the effects of a pre-infusion and home exercise program (HEP) on Quality of Life (QoL) and cancer-related fatigue. **METHODS:** The intervention spanned eight weeks with a functional assessment and a cancer-specific QoL questionnaire given at start and end of study. A general health-related QoL questionnaire was administered at the time of each supervised exercise session which occurred 72 hours prior to infusion treatments. Exercise prescriptions were provided and activity was tracked via accelerometer and surveys between the supervised exercise sessions. Exclusion criteria included ECOG scores outside of the required 0-2 range. The single participant in this study was cleared by their oncologist for participation. **RESULTS:** A substantial improvement in physical well-being from 4.85 to 0.57 following the intervention was revealed. Consistent with these results, pain interference and pain intensity largely improved from 2 to 1 from pre to post intervention. Fatigue interfering with ADLs decreased from moderate to not at all at 9 days post-infusion and moderate to slightly at 5 days post-infusion. Psychological well-being items went up from 5.44 to 6.89 indicating that the patient's psychological well-being improved after intervention. The mean scores for distress and fear of recurrence also improved from 6.2 to 6 and 7.25 to 6, respectively, from pre to post intervention. There was however, a slight increase in social concerns from 6 to 6.63 indicating the participant had more concerns than at start of study. Lastly, spiritual well-being improved modestly from 4.57 to 5.14 at the end of the intervention. **CONCLUSION:** It was found that this intervention had a positive impact on overall QoL, specifically with respect to physical well-being, fatigue, and pain interference and perception. Moreover, the infusion-based timing of this exercise intervention may have contributed to further gains in psychological well-being including a reduction in distress and fear of recurrence.

Supported by West Chester University Student Faculty Research Award

The Impact of a Parkinson's Disease Workshop on Student's Attitudes and Competencies Towards Interprofessional Collaboration

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PURPOSE: To evaluate the perceptions and experiences of undergraduate and graduate students participating in an interprofessional workshop aimed at addressing the various facets of Parkinson's Disease (PD) from an interprofessional, patient-centered approach. **METHODS:** Thirty students from various health sciences' majors (18-60 y) participated in a two-hour workshop where they interacted with six individuals diagnosed with PD, professional healthcare providers and other students. Student's knowledge of PD, attitudes towards health care teams, and competencies related to collaborative practice were evaluated using a PD Knowledge Quiz**,** Attitudes Towards Health Care Teams Scale (ATHCS)**,** and Interprofessional Education Collaborative Competency (IPECC) Self-Assessment Tool pre and post workshop engagement. Within 1 month after completing the workshop, students completed a survey with open-ended questions prompting them to reflect on their perceptions, participation, and their attitudes

towards working with the participants with PD and other health professions. Independent samples t-tests were used to identify whether students performance on the PD Knowledge Quiz, ATHCS and IPECC improved pre-to-post workshop. Two authors independently reviewed the students' responses to open-ended post-workshop questions and engaged in open-coding to identify reoccurring terms, concepts and common themes nested within the student's responses. **RESULTS:** Students significantly improved their performance on the Parkinson's Knowledge Quiz ($t(46) = -1.99$, $p = 0.05$) while no significant changes in students' attitudes towards health care teams $t(47) = -0.28$) or competencies related to collaborative practice (Overall: t(46) = -0.86; Values: t(47) = -1.07; Interaction: t(47) = -1.19) were observed ($p = >0.05$). **CONCLUSION:** Improved scores on the PD knowledge quiz demonstrates that engagement in an interprofessional, patient-centered workshop led to considerable gains in knowledge related to this clinical population. While scores in attitudes and competencies were not statistically significant, we did observe measurable improvements on each of these scales. Furthermore, responses from the post workshop survey suggests that students the workshop had a positive impact on students in these areas.

Relationship Between Sleep Quality and Quantity with Sports-Related Injury Rates

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Sleep may be considered one of the most important mechanisms of recovery in athletes. For an individual to obtain good quality and quantity of sleep has been shown to be very beneficial, especially when looking at athletes. Athletes that lack proper sleep can have many detrimental effects, but in this case the question is does a lack of sleep lead to possible injury due to fatigue or tiredness. There has been inconsistent research to this question. **PURPOSE:** The primary aim of this study is to evaluate the relationship between sleep and injury rates in NCAA Division II athletes. **METHODS:** Following IRB approval, surveys and informed consent forms were given to the coaches of eight NCAA Division II sports teams to distribute during team meetings. Athletes were instructed to fill out the informed consent form prior to survey. Teams included in this study were: soccer (women: n=21, men: n=11), softball (n=16), volleyball (n=5), baseball (n=24), lacrosse (n=6), track and field (n=37), field hockey (n=21). The surveys asked questions related to sleep quantity, perceived sleep quality, and sport-related injury. Paired sample t-tests were used to compare dependent variables. Significance was defined as $p<0.05$ **RESULTS:** Out of 114 subjects, 78 reported sport-related injuries in the past 6 months. Sleep quantity for all athletes was 7.10±1.0 hours. There were no significant differences (p=0.77) in sleep quantity between injured (7.06±1.1 hours) and non-injured (7.13±1.0 hours) athletes. Perceived sleep quality for all athletes was 6.87±1.6 on a ten point scale. There were no significant differences (p=0.82) in sleep quantity between injured (6.82±1.7) and non-injured (6.90±1.6 hours) athletes. **CONCLUSION:** Amount of sleep and quality of sleep had no effect on sport related injuries. The reason for this is unknown but may point in the direction to the research that is supporting overuse injuries as compared to fatigue related injuries. Some future suggestions for the research may be to set the recommended

sleep hours to the NCAA standard of 8-10 rather than 7-9 since they are athletes and not the general population. The second suggestion may be to track the athletes sleep over a period of time via Fitbit, apple watch, ect, instead of through a survey.

Associations of Sedentary Behavior and Moderate-Vigorous Intensity Physical Activity with Depressive Symptoms throughout Pregnancy

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High levels of sedentary behavior (SED) are associated with increased risk of depression, while high levels of moderate-vigorous intensity physical activity (MVPA) protect against depressive symptoms. Although depression is common during pregnancy, the associations of lower SED and higher MVPA across pregnancy with less depressive symptoms in pregnancy is unclear. **PURPOSE**: This current study aimed to evaluate associations between patterns of objectively measured SED and MVPA across pregnancy with concurrent depressive symptoms. **METHODS**: This cohort study of pregnant women (n=105) measured SED (thigh-worn activPAL3 micro) and MVPA (waist-worn Actigraph GT3X) for ≥4 days with ≥10 hours in each trimester. The 10-item Center of Epidemiological Studies Depression Scale (CES-D-10) questionnaire measured depressive symptoms during each trimester. Group-based trajectory model (GTBM) was used to group women into patterns of SED, MVPA and depressive symptom score across pregnancy. Fisher's exact test analyzed differences in depressive symptom trajectory distribution across SED and MVPA trajectories. One-way ANOVA compared continuous depressive symptom scores across SED and MVPA trajectories. **RESULTS**: Depressive symptoms worsened by the end of pregnancy (1st trimester: 5.49 ± 3.54 pts; 3rd trimester: 6.06 ± 3.56 pts; p=0.039). GBTM designated women into three trajectories (high, moderate, or low) of SED, MVPA and depressive symptoms across trimesters. Depressive symptom trajectories were associated with MVPA trajectories (p=0.025) such that the proportion of women classified in the 'high' depressive symptoms trajectory decreased with increasing MVPA trajectory: low (52.6%), moderate (26.3%), and high (21.1%). Continuous depression scores did not differ by MVPA trajectory in the 1st or 3rd trimesters; in contrast, the low MVPA trajectory had higher depression scores vs. the moderate and high MVPA trajectories in the 2nd trimester (7.08 pts, 4.31 pts, and 4.65 pts, respectively; p<0.05). Depressive symptom trajectories and scores did not differ by SED trajectories. **CONCLUSION**: Across pregnancy, depression appears to be associated with MVPA but not SED. Further research examining increasing MVPA during pregnancy is necessary to evaluate a potential benefit to mitigate depressive symptoms.

Supported by American Heart Association 17GRNT3340016 and University of Pittsburgh Clinical and Translational Science Institute NIH UL1TR000005

Healthy Men and Women are Protected from Prolonged Sitting and Postprandial Hyperglycemia-Induced Endothelial Dysfunction

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Previous studies have shown that postprandial hyperglycemia and prolonged sitting are predictors of cardiovascular disease (CVD), potentially due to the detrimental effects of glycemic excursions on the artery wall and reductions in shear stress, respectively. It is possible that prolonged sitting, when combined with consumption of high sugar drinks, may lead to severe endothelial dysfunction. **PURPOSE:** To determine if sitting exacerbates postprandial hyperglycemia-induced endothelial dysfunction. **METHODS:** In twelve young healthy subjects (six men, six women), brachial artery flow-mediated dilation (FMD) was assessed at baseline, 1 hour, and 2 hours post oral administration of a 75g glucose load (oral glucose tolerance test, OGTT). Subjects were tested on two separate visits in a randomized, crossover design: after either accumulating 15,000 steps or remaining seated, each throughout an eight-hour period. **RESULTS:** The average number of steps during the walking and sitting conditions were 15,972 ± 189 and 315 ± 37 ($p<0.0001$), respectively. FMD was not reduced during hyperglycemia in either the walking (baseline: 5.98± 0.8%, 1hr: 4.99± 1.01%, 2hr: 6.40 ± 1.12%) or sitting (baseline: 5.24 ± 0.8%, 1hr: 4.84± 0.65%, 2hr: 5.97± 0.94%) condition. However, plasma glucose levels were elevated in the final hour of the OGTT in the walking, but not sitting, condition ($p<0.01$). Additionally, non-esterified fatty acid (NEFA) levels were also elevated in response to hyperglycemia in the walking condition, supporting the tenet that prior walking promotes a substrate shift towards increased lipid utilization. **CONCLUSION:** These preliminary results suggest that young, healthy subjects may be protected against acute hyperglycemia–induced endothelial dysfunction. This effect is associated with increased plasma glucose and NEFAs following the glucose drink, potentially suggesting a difference in substrate utilization between conditions.

Supported by NIH R21DK105368

Qualitative Analysis of Patient Comments Regarding Adherence to an Exercise Oncology Rehabilitation Program

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INTRODUCTION: Previously, we showed that medical professionals are the most effective referrals to exercise oncology rehabilitation programs. We also identified four themes as to why patients continue to participate in such programs with personal results identified as most important. **PURPOSE:** The purpose of this study was to identify more clearly those factors that promoted adherence within the four general themes of personal results (46%), the trainer (28%),

not yet meeting their goals (23%), and family influence (3%) as reasons for remaining in an exercise oncology rehabilitation program. **METHODS:** Within the four themes, patient comments were re-analyzed and categorized to determine more specific response patterns to clarify the motivation of the patient to continue with their respective program. **RESULTS:** Four major sub themes were identified: physical health, mental/emotional health, the trainer/facility staff, and progress/success achieved. Of these sub themes, across all 4 original themes, 39% of patients referenced their physical health while 7% mentioned their improved mental health as reasons for remaining in the program. 34% noted the role of the trainer with approximately 14% specifically linking the trainer with their progress/success in the program. Separately, approximately 20% identified their progress/improvements as the reason to continue in the program. **CONCLUSIONS:** While previously and currently presented data report that physical health and improvements recognized by the patient are primary motivators to maintain adherence to the exercise program, this study found that the trainer/staff of the facility also play a significant role in maintaining enrollment, and therefore, adherence to the rehabilitation program. It is likely the progress/improvements identified by the patients are most likely a result of the work of the trainer/facility staff. Therefore, combining these sub-themes, we conclude that the trainer/facility staff is the most important factor in building patient confidence, trust, and most importantly, adherence to the program.

High-Speed Treadmill Running Reduces Systemic Inflammation But Fails as Secondary Intervention For Peripheral Musculoskeletal Discomfort

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It has been shown that performance of highly repetitive tasks increases serum cytokines, nerve inflammation and sensorimotor declines in a rat model. **Purpose:** Investigate the effectiveness of flat treadmill running in preventing these responses. **Methods:** Thirteen young adult female Sprague-Dawley rats were trained to perform a high force task for 5 weeks (15 min/day, 5 days/week). All trained rats went on to perform a high repetition, high force reaching and lever-pulling task for 10 weeks (10-week HRHF; 2 hrs/day in four 30 min sessions, 3 days/week). Five task rats were randomly chosen to run on a flat treadmill (TM) for the last 6 weeks of task performance (10-week HRHF+TM; ramping up to 23 m/min, 1hr/day, 5 days/week). Results were compared to 10 control rats. Voluntary task and reflexive sensorimotor behavioral outcomes were assessed and compared. Serum was assayed for inflammatory cytokines, median nerves were assayed for CD68+ macrophages and extraneural thickening, flexor tendons were assayed for any pathological changes. **Results:** Treadmill running attenuated HRHF task-induced increases in serum TNF-alpha (HRHF+TM 7.720 ± 11.89 vs HRHF 146.7 ± 228.1 pg cytokine/mL serum), IL-1beta (HRHF+TM 0.00 ± 0.00 vs HRHF 42.47 ± 56.15 pg cytokine/mL serum) CXCL2/MIP2 (HRHF+TM 1.320 ± 0.3633 vs HRHF 12.32 ± 3.800 pg cytokine/mL

serum) and IL-10 levels (HRHF+TM 1.600 ± 3.578 vs HRHF 23.58 ± 21.97 pg cytokine/mL serum). However, voluntary task performance outcomes such as percent successful reaches (HRHF+TM 9.4 ± 5.8 vs HRHF 45 ± 12 %) worsened with treadmill running. The treadmill intervention failed to rescue HRHF task-induced declines in reflexive grip strength (HRHF+TM 349.9 ± 84.79 vs HRHF 300.8 ± 149.5 g) and forepaw mechanical sensitivity (HRHF+TM 1.764 ± 2.351 vs HRHF 4.364 ± 0.8090 g of withdrawal threshold), and increases in CD68+ macrophages and extraneural fibrosis (HRHF+TM 86.34 ± 5.907 vs HRHF 56.43 ± 17.16 % Dense CT Surrounding Nerve) within and around median nerves. **Conclusions:** The treadmill intervention attenuated systemic inflammation and moderate tendinosis, but did not improve task performance or sensorimotor behaviors most likely because this exercise intervention continued to load involved injured forelimbs and worsened median nerve inflammation and fibrosis.

Supported by NIAMSD Grant ROI AR056019

Peak Height Velocity Maturity Offset Estimated from Cross-sectional vs. Longitudinal Growth Data

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Appropriate evaluation of pediatric health indices relies on assessment based on physical maturity status. Regression equation methods have been developed to estimate maturity offset (MO) relative to age at peak height velocity (APHV) using cross-sectional anthropometric data, with extensive application in pediatric exercise research. **PURPOSE:** We evaluated agreement of these estimates against standards calculated using superimposition, translation and rotation models (SITAR) of longitudinal data, targeting specific time windows relative to PHV and menarche. **METHODS:** Height data were drawn from a longitudinal dataset evaluating female bone growth in 141 participants for whom SITAR-based APHV had been calculated using ≥3 datapoints. Two subsamples were selected based on available repeated measures in target maturity ranges based on SITARAPHV and menarche: PREPHV (-2.5 to -1.5yr), POSTPHV (+1.5 to +2.5yr); CIRCAPHV (-0.5 to +0.5yr) & POSTMEN (0 to +1.0yr). Mirwald et al. and Moore et al. regression equations were used to calculate APHV and MO, yielding MO_1 and MO_2 (respectively) for comparison against SITARMO. Spearman's rho evaluated correlations, and Bland-Altman plots evaluated agreement with SITARMO in each target maturity range. **RESULTS:** For PREPHV and POSTPHV comparisons, n= 58, with mean SITARMO -2.1yr (sd 0.3) and +2.1yr (sd 0.3), respectively. For CIRCAPHV & POSTMEN comparisons, n=108, with mean gynecological ages -1.1yr (sd 0.7) and +0.6yr (sd 0.3) and mean SITARMO -0.1yr (sd 0.4) and +1.6yr (sd 0.7), respectively. Except POSTMEN, on average, MO_1 underestimated SITARMO [PREPHV -1.5yr, POSTPHV -2.8yr; CIRCAPHV= -2.3yr, POSTMEN= +0.5yr]. Mean discrepancies for MO_2 vs. SITARMO were subtle, near zero [PREPHV= +0.4yr, POSTPHV= +0.1yr; CIRCAPHV= -0.1yr, POSTMEN= -0.01yr]. **CONCLUSION:** MO_1 maturity estimates are flawed; <50% of estimates were within 1yr of SITARMO for assessed maturity ranges. MO_2 provides better

SITARMO estimates using cross-sectional data. However, it is unclear whether MO_2 is an improvement over chronological age for most individuals, as MO_2 effectively assesses whether girls are short or tall for their age. In many cases, height for age may primarily reflect genetic height potential rather than maturity status, particularly at older maturity stages.

Supported by funding from NIH/NIAMS (R03 AR047613-03; R01 AR54145-05); Orthopaedic Research & Education Foundation; SUNY Upstate Medical University; University of Wisconsin-Madison Department of Orthopedic Surgery; 233-PRJ87IH Bridge Funding- University of Wisconsin-Madison School of Medicine & Public Health; Ballantine Orthopedic Surgery Research Professorship (University of Wisconsin-Madison); Grants to Binghamton University [Howard Hughes Medical Institute (HHMI) through the Precollege and Undergraduate Science Education Program; New York State Regional Economic Development Council; SUNY Investment & Performance program].

Lower Body Kinematics Do Not Differ Between Flat Ground and Mound Baseball Throwing

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It is well known that a throwing program is essential for baseball pitchers to build up their arm strength and stamina. Many research studies have been conducted to determine the best way to perform a throwing program, but no definitive answer for how to properly conduct such a program has been determined. Many programs are designed and implemented on flat ground, however, a training program utilizing a mound enables a pitcher to push off and generate downward force prior to throwing the ball and provides a better transfer to real game situations. Long tossing from a mound has the potential to simulate in-game throwing and could better prepare a pitcher to pitch during a game. **PURPOSE**: The purpose of the study was to determine if lower body kinematics differed between throwing off flat ground and throwing off a mound. **METHODS**: Six healthy individuals (20Y±1.26) with previous pitching experience were recruited for this study. Subjects had 38 retro-reflective markers placed in various anatomical locations to quantify lower extremity kinematics during the throwing motion using a motion capture system. Subjects completed 10 total throws, five from flat ground, and five from a mound at a throwing distance of 67 meters. Pelvic rotation angular velocity, trunk rotation angular velocity, and stride length were calculated and analyzed with PitchTrak software. A dependent t-test was used to compare the flat ground and mound conditions for each dependent variable. **RESULTS**: There were no differences between the flat ground and mound throwing conditions for pelvic rotation angular velocity (Flat Ground 715.17±306.88, Mound 640.97±155.80, $p > .05$), trunk rotation angular velocity (Flat Ground 888.63±84.57, Mound 857.33±120.45, $p > .05$), and stride length (Flat Ground 73.47±9.50, Mound 73.83±10.32, $p > .05$). **CONCLUSION**: Lower body kinematics did not differ between long tossing off a mound

or flat ground. Due to this, coaches may implement flat ground throwing programs without any negative consequences to pitching mechanics. Consequently, they may also implement throwing programs from a mound to simulate pitching in a game without any increased risk of potential injury.

Supported by Research as a High Impact Practice Grant 841024

The Influence of Social Evaluation on Hear Rate Variability and Motor Performance: A Study of "Real-Life" Competition

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It is well known that stress affects performance. Heart rate variability (HRV), which has become a general indicator of stress, can be measured to examine autonomic balance. **PURPOSE:** To examine HRV in participants to determine how competition stress affects performance. **METHODS:** Participants (n=17) from the University of Maryland ROTC program completed two testing sessions: a performance alone condition (PA) and a competition condition (C). Participants completed a dry-fire pistol shooting task of 40 shots per condition. PA condition was executed without any evaluation of performance. C condition involved direct comparison to another study participant as well as superior officer observation and monetary compensation. Electrocardiogram (EKG) was collected using a Thought Technology Procomp2 system. EKG was sampled at 256 Hz through a single chest lead. HRV was analyzed through QRSTool and Kubios HRV. HRV measures were SDNN and RMSSD. **RESULTS:** SDNN decreased by condition ($F(1, 16) = 3.668$, $p = .074$, $d = 0.464$). RMSSD decreased by block, but not by condition ($F(1, 16) = 4.557$, $p < .05$ $d = 0.517$). Cortisol response ANOVA revealed a significant main effect of condition ($F(1, 16) = 12.02$, $p = .003$, $d = 1.05$) such that cortisol was higher during C compared to PA. **CONCLUSION:** The decrease in SDNN indicates a decrease in HRV in response to increased stress. This decreased HRV reflects a change in autonomic balance which is negatively correlated with adaptability and resilience. The decrease in RMSSD represents decreased parasympathetic modulation of heart rate. Although not measured directly, it is likely that participants experienced moderate fatigue throughout blocks. As cerebral cortical activity increased during C, one can speculate that the change in autonomic balance was influenced by the changes in the autonomic nervous system.

This research was supported in part by a grant from the Department of Defense, Army Research Office W911NF0810314.

Normalization Removes Differences in Contractile Properties and Corticospinal Excitability Between Single- and Multi-Joint Exercises

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Single- and multi-joint exercises are commonly used resistance modalities to assess contractile function and corticospinal excitability. Initial work suggests neurophysiological function may be task-specific, but results are constrained to smaller corticospinal excitability ranges. **PURPOSE:** The purpose of this study was to compare neurophysiological function during stimulus-response curves (SRC) between an isometric squat (SQT) and knee extension (KE). **METHODS:** Twenty-two young adults (2 women, 20 right-footed, age: 25±5yrs, BMI: 25.9±3.1, VO2: 46.2±8.8 $ml \cdot kg^{-1} \cdot min^{-1}$) performed isometric SQT (n=7) or KE (n=15), with hip-, knee- and ankle-joint angle at 90° as part of a larger study, exposing participants to operational stress during a 5-day long testing series. Maximum strength and muscle activity (RMS) were recorded during maximum voluntary contractions (MVCs) using a linear force transducer and electromyography (EMG) sensors placed over the vastus lateralis, respectively. SRCs were conducted with transcranial magnetic stimulation and a double cone coil from 5-100% of stimulator output over the dominant motor cortex leg hotspot during intermittent isometric contractions at 15% MVC. Corticospinal excitability was assessed by SRC_{MAX}, SRC_{SLOPE} and SRC_{V50} (midpoint of the rising phase). As responses did not differ across days, outcomes were grand-averaged and independent t-tests or Mann-Whitney U were used for between-group comparisons. **RESULTS:** Greater maximum force and muscle activity were evident for KE compared to SQT (Force: 1303.9±407.0 vs. 812.8±189.5N, $p<0.001$; EMG_{RMS}: 0.24±0.1 vs. 0.14±0.1, $p=0.02$). During sustained isometric contractions, absolute EMG_{RMS} was higher in KE (0.056±0.014 vs. 0.043±0.003, $p=0.03$), but similar when normalized to EMG_{MAX} (29.8±15.8 vs. 34.0±11.3%, $p=0.21$). Absolute SRC_{MAX} was almost twice as high in KE compared to SQT (1.4±0.7 vs. 0.7±0.4mV, $p=0.02$), but similar when normalized to mean EMG_{RMS} during sustained isometric contractions (KE: 25.3±14.0 vs. SQT: 17.4±10.7$mV \cdot EMG_{RMS}^{-1}$, $p=0.21$). SRC_{V50} and SRC_{SLOPE} did not differ ($p>0.05$). **CONCLUSION:** Single- and multi-joint exercises present distinct contractile and absolute corticospinal properties, which vanish after normalization, warranting caution when comparing results between studies.

Supported by the Department of Defense W81XWH-16-PHTBIRP-CR3A.

Impact Forces of Unilateral and Bilateral Landings in Various Ballet Jumps

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Biomechanical studies have been conducted regarding ballet jumps and leaps measuring the stresses on the lower extremity with major focus on how the type of shoe and foot position affects landing forces. Although one study compared several different ballet jumps and their

different ground reaction force (GRF), little research has been done in comparing jumps that land and takeoff on one foot versus two feet, or looking at the specific joint moments during various movements . **PURPOSE:** This study examined different forces and moments on the lower extremity musculoskeletal system during varied ballet jumps. Specific focus was directed to looking at jumps that both takeoff and land on one or two feet. **METHODS:** 7 ballet dancers (both pre-professional and professional) performed two ballet jumps over force plates, one taking off and landing on one foot (Ballotté), the other taking off and landing on two feet (Changement). 30 reflective markers were placed on the dancers' bodies in order to capture their movements during dance. A 16 camera Vicon Nexus system collected motion and force data of the subjects. **RESULTS:** Landing during the one legged jump and land was more stiff and resulted in greater loads than the two legged jump and land. The peak flexion angle of the knee was greater in the two legged landing (59.5°) compared to the one legged (48.6°, $p<0.001$). The peak moments of the knee were larger in the one legged landing compared to the two. The extension moment was nearly 15% greater while the abduction moment was 27% greater (1.86 Nm/kg vs. 1.59 Nm/kg and 1.11 Nm/kg vs. 0.81 Nm/kg, respectively). The peak ground reaction force was 30% greater in the one legged landing (1297 N) compared to the two legged (895 N, $p<0.001$). **CONCLUSION:** As hypothesized, jumps that landed on one foot displayed greater GRF, as well as peak joint moments. These larger stresses on the lower extremity may lead to greater risk of injury for the dancer who regularly engage in jumps and lands on one foot. Ballet teachers may want to consider decreasing how often these jumps are performed in order to lessen the risk of injury. Further research is needed to see if changes in body position/angles of the lower extremity might lead to decreased loading during these jumps and make it possible for instructors to focus on safely teaching these steps.

Cardiovascular Disease Associated with Occupational and Leisure-Time Activity: The Physical Activity Health Paradox in the United States

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PURPOSE: Emerging literature exists describing opposing effects of occupational physical activity (OPA) and leisure-time physical activity (LTPA) on cardiovascular health among European and Asian populations; little research has demonstrated a similar effect in the U.S. This analysis examines the prevalence of cardiovascular disease (CVD) associated with OPA and LTPA in a nationally representative U.S. sample. **METHODS:** This is a cross-sectional analysis from individuals completing the 2015 National Health Interview Survey (NHIS) and its occupational health supplement questionnaire from the National Institute for Occupational Safety and Health (NIOSH) (n=19,429). Logistic regression estimated the odds of self-reported composite CVD (coronary heart disease, heart attack, stroke, or angina) and its component diseases associated with self-reported OPA and LTPA. OPA was measured as "How often does

your job involve repeated lifting, pushing, pulling, or bending?" on a 5-item Likert scale (never–always). LTPA was operationalized into three categories: 0 minutes/week of reported moderate-to-vigorous activity, 1-149 minutes/week, or ≥150 minutes/week. Additional analyses were stratified by sex, smoking status, and level of LTPA. All models were adjusted for age, sex, race/ethnicity, smoking status, alcohol consumption, family income, body mass index, education, US nativity, LTPA category, and OPA level. **RESULTS:** "Always" performing OPA was associated with higher odds for composite CVD, coronary heart disease, heart attack, and angina compared to "never" (OR=1.84, p=0.001, OR=1.83, p=0.006, OR=2.81, p=0.006, and OR=1.93, p=0.049, respectively). Additionally, "often" performing OPA was associated with higher odds for heart attack (OR=1.89, p=0.038). Level of LTPA was not associated with odds of CVD (p>0.05). Associations of high OPA with CVD outcomes were more apparent in females vs. males, with lower LTPA levels, and when the sample was restricted to never smokers. **CONCLUSION:** While LTPA was not associated, individuals with higher OPA had higher rates of CVD. Although uncontrolled confounding is still possible, even after extensive adjustment, the seemingly paradoxical, adverse effect of OPA on CVD should be investigated further.

Effects of Anxiety Symptomology on Subclinical Cardiovascular Disease Risk in Young Women

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Cardiovascular disease (CVD) is the leading cause of death of women in the United States with more women developing CVD at younger ages. Mental health disorders, such as anxiety, contribute to CVD development and women are more prone to anxiety than men. While mental health disorders increase the risk of hypertension and obesity, both traditional risk factors for CVD, their influence on subclinical CVD risk factors are less explored, particularly in young women. **PURPOSE:** Investigate whether anxiety symptomology (AS) effects arterial stiffness in young women. **METHODS:** 70 young women (21±4 yrs) underwent an arterial stiffness assessment following an overnight fast (12 hrs). Arterial stiffness was measured in the carotid artery as β stiffness using a Doppler ultrasound and as aortic stiffness via carotid-femoral pulse wave velocity (cfPWV) using applanation tonometry. The women completed the General Anxiety Disorder-7 (GAD-7) to measure AS. The sample size for mild (scores of 5-9 on GAD-7; n=19), moderate (10-14 on GAD-7; n=5), and severe AS (≥15 on GAD-7; n=3) were not large compared to those with no symptoms (NS) (n=43) so severity categories were grouped together as presenting with AS. β stiffness and cfPWV between the AS group and NS group were compared using an ANCOVA test to control for depressive symptomology (DS) scores, as assessed by the Center of Epidemiologic Studies Depression Scale (CES-D). Independent sample t-tests were run for group differences in systolic and diastolic blood pressure (BP), GAD-7 and CES-D scores. **RESULTS:** GAD-7 score was higher in the AS group compared to the NS group, (8.7±4.4 vs 1.8±1.3; p < 0.001). CES-D scores were similar in the AS group and NS group (11.5±8.2 vs 9.0±8.0, respectively; p=0.224). NS and AS groups did not differ in systolic

BP (116±9 vs 119±11 mmHg, respectively; p= 0.190) and diastolic BP (74±8 vs 71±7 mmHg, respectively; p= 0.070). The NS group and AS group did not differ in β stiffness (3.3±0.9 vs 3.2±0.8 aU, respectively; p=0.672) or cfPWV (5.3±0.7 vs 5.4±0.5 m/s, respectively; p=0.904). Adjusting for CES-D had no effect on the lack of group differences in β and cfPWV measures. **CONCLUSION:** There was no difference between those with and those without AS for aortic or carotid stiffness. In this group of young women, mental health outcomes did not influence subclinical CVD risk.

Supported by NIH Grant 1R03MD011306-01A1

The Effect of Music Tempo on Muscular Endurance During the Bench Press

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Music is often utilized in athletic and recreational settings. Many athletes believe it is motivating and can improve performance. **PURPOSE:** To determine the effect of music tempo while performing repetitions to failure (RTF) on the bench press. **METHODS:** Five male and four female recreationally trained athletes (Age: 22.8 ± 1.1 yrs; Height: 173.8 ± 8.0 cm; Weight: 77.8 ± 10.0 kg; Body Fat: 21.6 ± 8.6%) participated in the study. One-repetition maximum (1RM) was measured on the bench press using National Strength and Conditioning Association guidelines. Individuals were asked to bench press 70% of their 1RM to volitional fatigue or failure while listening to one of the three music conditions in a counterbalanced design. The music conditions were control (white noise), low tempo (<90 bpm), and high tempo (120+ bpm) played on wireless headphones. Subjects selected music from a playlist the day of their trials to control for genre preference. Heart rate, blood lactate, and Ratings of Perceived Exertion (RPE) were assessed immediately post exercise. Repeated measure ANOVAs were used to explore for differences between music conditions. **RESULTS:** There were no significant differences between conditions (control, low tempo, high tempo) for RTF (16.8 ± 2.7, 16.9 ± 3.5, 17.9 ± 3.4; p = .720), post blood lactate (6.5 ± 2.4, 7.9 ± 3.8, 6.9 ± 2.7 $mmol \cdot L^{-1}$; p = .211), peak heart rate (128.6 ± 13.2, 136.2 ± 15.4, 131.2 ± 19.9 bpm; p = .379), or RPE (14.7 ± 2.7, 14.1 ± 3.4, 15.2 ± 2.2; p = .84). **CONCLUSION:** Music tempo did not significantly impact RTF during the bench press in a resistance trained population.

Supported by Lock Haven University's Health Science Department

Estimating Scapular Kinematics during Baseball Pitching using an Individualized Linear Model Approach

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Biomechanical analyses of pitching possess limitations in accurately measuring scapular kinematics and distinguishing between glenohumeral and scapulothoracic (ST) contributions to shoulder motion. Existing methods to estimate scapular motion, such as the acromion marker cluster (AMC) and electromagnetic sensors, may not be suitable for throwing as they produce larger errors for movements involving elevated humeral rotation and are particularly sensitive to soft tissue artifact. A new individualized linear model (LM) approach utilizing measurable humerothoracic (HT) orientation to estimate ST orientation has been validated across a wide range of HT elevations and humeral rotations during activities of daily living but has not been evaluated for throwing. **PURPOSE:** To develop a pitching-specific individualized LM and assess its ability to estimate ST orientation in static positions within a throwing motion by comparing it to palpation and against a currently recommended method (AMC). It was hypothesized that ST errors between the LM and palpation would be less than those of the AMC. **METHODS:** Orientations of the trunk and upper extremity segments of 14 Division III collegiate pitchers were measured with motion capture during a pitch. Each subject's arm was placed in six calibration positions representing the extremes of HT orientation throughout his pitching motion; three additional test positions were collected at intermediate arm postures within the throw. Real-time feedback with motion capture ensured that subjects recreated the HT postures at each position while ST orientations were determined by palpation. The LM used multiple linear regression on the calibration data to create equations that estimated ST angles from HT angle inputs. Angles estimated by the LM and AMC at the test positions were compared to palpation. **RESULTS:** The LM root mean square errors (RMSE) for test positions 1-3 were smaller than AMC RMSEs on ST upward rotation (LM: 5.1°, 4.6°, 6.3°; AMC: 5.5°, 5.1°, 10.4°), ST internal rotation (LM: 4.8°, 4.0°, 5.1°; AMC: 15.3°, 9.5°, 15.7°), and ST posterior tilt (LM: 3.0°, 2.9°, 2.8°; AMC: 12.5°, 9.4°, 15.8°). **CONCLUSION:** This study demonstrates the ability of a pitching-specific individualized LM to accurately estimate scapular orientation during pitching and improve upon existing methods.

Heart Rate Variability in Response to a 3-day Kumbhaka Pranayama Practice

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Pranayama is a breathing practice commonly utilized in yoga and meditation. Research has demonstrated that Pranayama may improve lung function in athletes and induce parasympathetic withdrawal as assessed via heart rate variability (HRV). The specific Pranayama practice of Kumbhaka functions to restrict and briefly retain the breath at the peak of inhalation and exhalation, respectively, to intentionally expose the respiratory system to increased stress/pressure. **PURPOSE:** The purpose of this study was to assess HRV in response to a 3-day Kumbhaka Pranayama intervention. **METHODS:** HRV was assessed in four healthy adults (2 males, 2 females; age: 34.0 ± 4.6 years; BMI: 21.9 ± 2.3 kg/m^2) while at rest in a supine position

for four minutes prior to and following a Kumbhaka Pranayama intervention for three consecutive days. Six HRV indices representing time and frequency domain measures were calculated from R-R interval data collected using a heart rate monitor. **RESULTS:** A main effect of time was found for the square root of the mean of squared differences between successive R–R intervals (RMSSD) revealing a decrease in RMSSD (pre: 40.7 ± 23.3 ms; post: 32.3 ± 14.9 ms) during the Kumbhaka Pranayama sessions ($p \leq 0.05$). No other significant differences in HRV indices were found ($p > 0.05$). **CONCLUSIONS:** The participants in this study experienced a decrease in RMSSD suggesting parasympathetic withdrawal in response to an acute Kumbhaka Pranayama session. No changes in HRV, however, were observed in response to the 3-day Kumbhaka Pranayama practice. More participants assessed over a longer period of time may provide additional insight regarding the long-term effects of Kumbhaka Pranayama on HRV.

The Physiological and Perceptual Responses of Thoracic Load Carriage During Walking

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Tactical occupations regularly work while wearing heavy equipment. **PURPOSE:** To investigate the physiological and perceptual responses of thoracic load carriage during walking. **METHODS:** Eight males and one female (age: 21.0 ± 1.4yr; height: 178.9 ± 5.8cm; mass: 86.1 ± 13.2kg; body fat: 20.2 ± 7.2%) without thoracic load carriage experience participated in the study. On separate days, each subject completed four 10 min walking trials on a motorized treadmill at a predetermined unloaded intensity equal to 4 METs. Testing sessions included an unloaded (UL) trial, which served as the control, and wearing a light load (LL; 24lb = 10.9kg), moderate load (ML; 48lb = 21.8kg) and heavy load (HL; 80lb = 36.4.kg) weighted vest. The testing order of the weighted vest trials was determined by counterbalanced assignment. Vest weights were selected to approximate common gear of tactical populations: law enforcement (LL), firefighter (ML), and military personnel (HL). Oxygen consumption (VO_2), energy expenditure (EE), heart rate and ratings of perceived exertion (RPE) were assessed during all trials. An average value from the last 2 min of exercise was calculated for VO_2, EE, and heart rate and used in a repeated measures ANOVA for statistical comparison. **RESULTS:** Relative VO_2 increased significantly with vest weight (UL = 12.38 ± 1.28, LL = 13.45 ± 1.26, ML = 14.78 ± 1.67, HL = 16.65 ± 1.76 $ml \cdot kg^{-1} \cdot min^{-1}$; $p<0.005$). When VO_2 was expressed relative to vest weight, no significant differences were observed across trials (LL = 8.8 ± 6.5, ML = 9.4 ± 5.4, HL = 10.0 ± 3.1 $ml \cdot kg^{-1} \cdot min^{-1}$; $p = 0.896$). Total EE for the walking bout was significantly higher during all LC trials compared to unloaded (UL = 46.9 ± 6.0, LL = 53.9 ± 8.0, ML = 59.2 ± 8.1, HL = 66.4 ± 7.7 kcals; $p \leq 0.001$). Heart rate during the HL trial (109 ± 13) was significantly higher than the other trials (UL = 91 ± 12, LL = 96 ± 12, ML = 101 ± 18; $p \leq 0.001$). Significant ($p \leq 0.001$) increases in RPE were observed during the ML (11.1 ± 4.0) and HL (13.8 ± 3.6) trials compared to UL (8.3 ± 2.2). **CONCLUSION:** Although all thoracic carriage loads

increased the physiological and metabolic burden of walking, a consistent increase in oxygen cost per kg of vest weight was observed in all trials. In addition, only loads greater than 10.9 kg (24lb) altered the perception of effort.

Supported by Lock Haven University's Small Campus Grant

Sleep and Dietary Habits in Undergraduate College Students

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Previous studies have found that insufficient sleep duration has a deleterious impact on the quality of food choices, such as increased consumption of calorie-dense foods. This likely contributes to weight gain and other negative cardiometabolic consequences. However, less is known about the association between dietary habits and other metrics of habitual sleep, beyond traditional sleep duration. **PURPOSE:** To characterize the association between habitual sleep timing and dietary habits in healthy undergraduate college students. **METHODS**: Sleep metrics, particularly sleep midpoint (halfway point between sleep onset and wake onset) was objectively measured on 30 young, healthy males and females (20.3 ± 0.2 years) via wrist-worn actigraphy for 14 consecutive days and nights. Food diaries were completed by each participant over a period of 3 days. **RESULTS**: Sleep midpoint was significantly associated with solid fat ($r=0.40$, $p<0.05$), saturated fat ($r=0.36$, $p<0.05$), and alcohol consumption ($r=0.44$, $p<0.05$). Sleep midpoint was also significantly associated with increased waist circumference ($r=0.41$, $p<0.05$) and trending towards significance with BMI ($r=0.35$, $p=0.06$). **CONCLUSION**: A healthier diet was associated with an earlier sleep timing in these participants. The results suggest that the later the sleep midpoint, the more likely an individual is to consume foods with high-fat calories, which may contribute to a higher BMI and waist circumference. These results support the usefulness of assessing sleep and diet as a potential approach to prevent obesity and possible CV disease risk in young adults.

Supported by NIH grant P20GM113125

The Effect of Acute Exercise on Mood Following a Cognitive Test Battery

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Research indicates that acute bouts of aerobic exercise improve mood. For example, research has shown that exercise may mitigate or reduce angry mood, reduce levels of anxiety, and improve measures of depression. However, most research in this area has assessed mood immediately after a bout of exercise. It is unknown how exercise affects mood when measured after a challenging cognitive test battery. **PURPOSE:** The purpose of this study was to determine if an acute bout of self-perceived hard cycling improves mood immediately after a cognitive test

battery. Moreover, we wanted to determine if sex mediated the effect of exercise on mood. **METHODS:** This was a within-subjects design that required college-aged students (n=19; 10 females) to visit the laboratory on two days, exactly one week apart. On day one, each participant completed either 20 minutes of exercise on a cycle ergometer or quiet seated rest in a counterbalanced order. On day two, participants underwent the other condition. Prior to exercise, rating of perceived exertion (RPE) was explained and subjects were told to exercise at an RPE of 15. RPE and heart rate were monitored every five minutes during exercise to ensure an RPE of 15 was being maintained. Upon completion of the exercise test or quiet seated rest, participants completed the Rey Auditory Verbal Learning Test (RAVLT) and a cognitive battery test in the Automated Neuropsychological Assessment Metrics (ANAM) Test System. The end of the cognitive portion of the ANAM test included Mood Scale II (assessing vigor, happiness, depression, anger, fatigue, anxiety, restlessness). Mood comparisons were made using a two-way ANOVA (exercise condition x sex). **RESULTS:** We observed no significant main effects of exercise condition (exercise vs. rest) or sex for any dependent variables of interest ($p>0.05$). We observed a trend toward a significant main effect of exercise for anger (rest = 12.67 ± 3.977; exercise = 19.44 ± 6.161; $p=0.08$) and anxiety (rest = 9.56 ± 2.04; exercise = 17.94 ± 4.84; $p=0.09$). **CONCLUSION:** Self-perceived hard cycling (RPE 15) does not significantly influence mood in college-aged males and females.

Correlation Between Q-Angle, Arch Index, and Weight Distribution Dependent on Supination and Pronation While Walking

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Supination and pronation are deviations from normal during walking in regard to when the heel hits the ground. Arch index is a measurement taken from the dimensions of a footprint that is used to determine the height of the arch of a foot. Weight Distribution is the difference in pressure put on each foot while standing comfortably. The Q-Angle is a line connecting the hip bone to the center of the knee, and the knee to the top of the shin. **PURPOSE:** The purpose of this study was to determine if there was relationship between the subject's static Q-angle, arch index, weight distribution and pronation and supination while walking. **METHODS:** Twenty-four female DeSales University students (19.8 ± 0.75 yrs) were recruited for this study. Footprints were obtained from the dominate foot of each subject and were used to measure the arch index. The subjects were recorded while walking on a treadmill to determine supination and pronation of the foot. Weight distribution was taken by having the subjects stand on two separate, identical scales. The subjects were photographed at waist height to measure Q-Angle. A Pearson Product Moment Correlation was used to determine if there was a relationship between the four variables. **RESULTS:** The Pearson Product Moment Correlation identified that there is significant association between Static Q-Angle and Static Pronation/Supination ($r=0.422$, $p<0.05$). The Pearson Product Moment Correlation identified that there is no significant

association between Walking Q-Angle and Static Pronation/Supination (r= 0.196, p>0.05), between Static Q-Angle and Arch Index (r= - 0.207, p>0.05), between Walking Q-Angle and Arch Index (r= -0.046, p>0.05), between Arch Index and Static Pronation/Supination (r= -0.220, p>0.05), between Weight Distribution and Static Pronation/Supination (r= -0.151, p>0.05), between Weight Distribution and Arch Index (r= -0.290, p>0.05) and between weight distribution and arch index (r = 0.378, p > 0.05). **CONCLUSION**: There was one relationship found between the static Q-Angle and Static Pronation/Supination indicating that one may affect the other. Further research may be required to determine if there are other relationships between the variables.

Association Between Large Elastic Artery Stiffness and Brain Integrity with Advancing Age

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Global brain tissue stiffness (GBS) declines with advancing age and has been associated with impaired cognitive function in older adults. In this regard, the large elastic arteries (i.e., the aorta and carotid arteries) stiffen with aging and may contribute to the decline in GBS via a diminished pressure-dampening effect that ultimately leads to a loss of neuronal tissue integrity. **PURPOSE:** To determine whether the association between age and GBS is mediated by arterial stiffening across the adult lifespan. **METHODS**: 24 healthy young through late middle-aged (MA) adult men and women (10 F/14 M; mean age: 43±14 y; age range: 22-69 y; (BMI: 27±4 kg/m^2; BP: 115±10/71±11 mmHg) were included in this study. GBS was assessed with magnetic resonance elastography (MRE), which uses a Siemens 3T Magnetom Prisma MRI scanner to image shear waves generated via a pneumatic actuator (Resoundant, Rochester, MN) at a 50Hz vibration frequency. Brain stiffness was estimated from the viscoelastic shear modulus derived from MRE displacement data using a nonlinear inversion algorithm. Large elastic artery stiffness was assessed as aortic pulse wave velocity (PWV) using applanation tonometry (SphygmoCor, AtCor Medical Inc.). The effect of age on GBS through PWV was tested with Path Analysis using Mplus software. This model controlled for mean arterial pressure (MAP), BMI and physical activity. **RESULTS**: Age was independently associated with GBS (b=-0.012, se=0.002, p<0.001) and PWV (b=0.063, se=0.014, p<0.001); however, the indirect effect of age on GBS via PWV was not significant (b=0.002, se=0.001, p=0.13). **CONCLUSION**: The age-related increase in large elastic artery stiffness does not appear to mediate the decline in brain tissue integrity in young and MA adults. Future studies should explore these associations across a wider age range that includes more elderly adults and individuals with mild cognitive impairment.

Supported by Center for Biomedical and Brain Imaging (CBBI) Pilot Grant P20GM103653 and Center of Biomedical Research Excellence (COBRE) Pilot Grant P20GM113125.

Moderate and High Intensity Exercise Differently Affect Arterial Stiffness and Related Circulating MicroRNAs in Men

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High intensity interval (HII) exercise may elicit greater changes in hemodynamics and other vascular stimuli compared to a matched duration or volume of moderate intensity continuous (MOD) exercise. The effects and underlying mechanisms of exercise intensity on arterial stiffness are not well established. Circulating microRNAs (ci-miRs) are potential contributing factors to the vascular effects of exercise. **PURPOSE:** We sought to determine the effects of a HII compared to a MOD exercise bout on arterial stiffness and vascular-related ci-miRs. **METHODS:** Ten young, healthy men underwent well-matched, 30-minute HII and MOD cycling exercise bouts. Arterial stiffness measures including carotid to femoral pulse wave velocity (cf-PWV), augmentation index (AIx and AIx normalized to 75 bpm (AIx75)), and carotid arterial β-stiffness and compliance were taken before, 10 minutes after and 60 minutes after exercise. RT-qPCR was used to determine the expression levels of seven vascular-related ci-miRs in serum obtained immediately before and after exercise. **RESULTS:** There was a numerical decrease in cf-PWV 60 minutes after HII exercise that did not reach statistical significance (-0.36±0.15 m/s vs. baseline, $p=0.06$), with no change following MOD exercise (+0.03±0.24 m/s, $p=0.85$). AIx75 increased 10 minutes after both HII (+10.1±4.5%, $p=0.02$) and MOD (+15.3±3.8%, $p=0.0007$) exercise, returning to baseline by 60 minutes. There was a numerical increase in carotid arterial compliance 60 minutes after HII exercise that did not reach significance (+0.14±0.07 AU, $p=0.06$), with no change following MOD exercise (-0.03±0.09 AU, $p=0.68$). Ci-miRs- 21-3p, 126-3p, 126-5p, 150-5p, 155-5p, 181b-5p increased after HII (58-261%, all $p<0.05$), but not MOD exercise, while ci-miR-221-3p did not significantly change with either bout. There were significant correlations between changes in individual ci-miRs and measures of arterial stiffness either 10 or 60 minutes after exercise ($r=[0.46-0.50]$, $p<0.05$). **CONCLUSION:** The results of this study support the hypotheses that arterial stiffness and ci-miRs are altered in an exercise intensity-dependent manner, and changes in ci-miRs may contribute to changes in arterial stiffness.

Supported by NIH R25HL092604 and R25AG045063 to J.M.H., UM Graduate School Summer Research Fellowship to R.M.S., UM Tier 1 award to S.M.R.

The Effect of a Placebo on the ROTC APFT Test and Performance Perception

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A placebo is a treatment without an active ingredient often used to study the psychological effects on the human mind and body. **PURPOSE:** To evaluate the effect varying doses of placebo has on the Reserve Officer Training Corps (ROTC) Army Physical Fitness Test (APFT). **METHODS:** Fourteen male and female individuals in the ages ranging from 19-21, who are enrolled in the ROTC program at Shippensburg University, volunteered to participate in this study. Subjects completed a standardized ROTC APFT under each condition (baseline (CON), single dose (P1), and double dose (P2) placebo) separated by one week. On placebo days, subjects were deceived and instructed to take a newly developed "pre-workout" supplement 30 minutes prior to the APFT test. The APFT included push-ups and sit-ups for 2 minutes each and a 2-mile run. A Performance Perception Questionnaire (PPQ) was also completed at the end of each day to assess the performance perception (PP) including anxiety, energy and strength. One-way ANOVA with repeated measures was used to compare repetitions for push-ups and sit-ups, 2-mile run time, and PP measures for three different conditions. **RESULTS:** No significant changes were observed in push-ups from the CON to P1 or P2 (67.1±14.8 vs. 68.1±12.1 and 67.9±17.1 repetitions, $p>0.05$). A modest increase in sit-ups scores were observed from the CON to P1 and P2 (65.7±10.0 vs. 71.3±11.0 and 67.7±13.3 repetitions, $p>0.05$). However, the differences were not statistically significant. Results from the 2-mile run test revealed that the run times were significantly improved at P1 when compared to CON (14.1±1.0 vs. 15.3±1.1 min, $p=0.001$), but not at P2 (15.6±0.6 vs. 15.3±1.1 min, $p=0.52$). When compared to CON, subjects felt significantly more anxious at P2 (1.0±1.8 vs. -0.1±2.6, $p=0.04$) but not at P1 (1.0±1.8 vs. 1.3±1.9, $p=0.7$). Similarly, perceived energy level was significantly higher at P1 when compared to CON (3.43±1.27 vs. 0.57±2.94, $p=0.01$) but not at P2 (2.00±2.45 vs. 0.57±2.94, $p=0.3$). Subjects felt that they had the most strength at P1 (3.7±1.6) when compared to CON (1.9±2.5) and P2 (2.0±2.5). However, these differences were not statistically significant. **CONCLUSION:** While the placebo had a positive influence on some of the performance measures as well as performance perception, P1 appeared to have the greatest effect.

Is Hormonal Contraceptive Use during Adolescence a Factor in Baseline Adult Muscle Mass and Function?

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Hormonal contraceptive (HC) use is common in adolescence and emerging adulthood, while fat-free mass (FFM) and muscle strength are still accruing. Accordingly, long-term sarcopenia and dynapenia risk may be affected by the timing of this hormonal exposure. **PURPOSE:** We set out to evaluate whether HC use and HC type were associated with muscle characteristics in undergraduate women. **METHODS:** Using an electronic survey, undergraduate women were surveyed on key characteristics, including current exercise frequency, menstrual history and HC use. A subsample of respondents participated in anthropometrics and grip strength tests. Height (cm) was measured via portable stadiometer. Bioelectric impedance analysis assessed total, lean

& fat mass (kg). Mid-upper arm circumferences and skinfold thicknesses (biceps, triceps, subscapular, suprailiac) were measured for use in arm muscle area (AMA) and %FFM calculations. Grip strength (kg) was measured via dynamometer. SPSS v24 was used to evaluate correlations among muscle outcomes and to perform ANOVA with covariates (α=0.05). Trends for associations were also noted ($p<0.20$). ANOVA tested for group differences in %FFM, arm muscle area and grip strength, evaluating HC use groups (nonHC vs. useHC) and type groups (nonHC; progesterone only=proHC; estrogen/progesterone=comboHC). Covariates included height, menstrual irregularity and current exercise frequency. **RESULTS:** Anthropometric and HC data were provided by n=76 (nonHC n=24, useHC n=52; proHC n=12, comboHC n=40). Left AMA correlated positively with grip strength (r=0.32, p=0.005). Grip strength was higher in useHC than nonHC (p=0.025). Contradictory trends were observed for %FFM and AMA, with lower %FFM in useHC than nonHC (p=0.105) and higher left AMA in useHC than nonHC (p=0.124). HC type trends included: greater left AMA in proHC vs. nonHC; greater grip strength & %FFM for comboHC vs. nonHC (ANOVA $p<0.09$, post-hoc $p<0.07$-0.14). **CONCLUSION:** It is unclear whether HC use affects musculoskeletal development during adolescence and emerging adulthood. Future research should evaluate these issues prospectively and look at long-term associations across the lifespan.

Supported in part by grants to Binghamton University from the following: Howard Hughes Medical Institute (HHMI) through the Precollege and Undergraduate Science Education Program, New York State Regional Economic Development Council, and SUNY Investment & Performance program.

Effects of a 6-week Low-Carbohydrate High-Fat Diet on Lipid Profiles in Competitive Recreational Distance Runners

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Low-Carbohydrate High-Fat (LCHF) diets have become very popular among athletes due to recent research suggesting performance and numerous health benefits. However, few studies have examined the chronic effects of LCHF diets on the blood lipid profile and other cardiovascular disease risk factors in athletic populations. **PURPOSE:** To examine the effect of a 6-week LCHF diet (69% kcals from fat, 6% carbohydrates), compared to a diet higher in carbohydrate and lower in fat (HCLF; 56% kcals from carbohydrate, 28% fat) on fasting lipids – triglycerides (TG), LDL-C, HDL-C, total cholesterol (TC), VLDL, TG/HDL-C Ratio, TC/HDL-C Ratio, glucose and glycated hemoglobin (HbA1c), in competitive recreational distance runners. **METHODS:** Seven male athletes (age 35.6 ± 8.4 years, height 178.7 ± 4.1 cm, weight 68.6 ± 1.6 kg; VO_{2max} 61.9 ± 6.1 ml/kg/min) consumed an ad libitum LCHF and ad libitum HCLF diet in a random order, each for 6 weeks in a crossover design. Plasma lipids where

measured on day 4, 14, 28, and 42 of each diet. **RESULTS:** The LCHF diet significantly increased TC (mean ± SD; LCHF 197.4 ± 26.3 mg/dl, HCLF 153.4 ± 1.3 mg/dl; %Diff = 25.1%; p = 0.001), LDL-C (LCHF 108.3 ± 20.6 mg/dl, HCLF 73.5 ± 2.8 mg/dl; %Diff = 38.3%; p = 0.001), HDL-C (LCHF 70.6 ± 3.5 mg/dl, HCLF 60.6 ± 2.1 mg/dl; %Diff = 15.3%; p = 0.015), and decreased TG (LCHF 73.9 ± 4.4 mg/dl, HCLF 97.0 ± 10.9 mg/dl; %Diff = 26.9%; p = 0.005), VLDL (LCHF 18.5 ± 3.5 mg/dl, HCLF 19.4 ± 2.2 mg/dl; %Diff = 4.9%; p = 0.004), TG/HDL-C Ratio (LCHF 1.1 ± 0.1 mg/dl, HCLF 1.8 ± 0.2 mg/dl; %Diff = 44.4%; p = 0.001) in relation to the HCLF diet. Changes in plasma glucose (LCHF 83.3 ± 4.0 mg/dl, HCLF 88.7 ± 2.4 mg/dl; %Diff = 6.3%; p = 0.107) and HbA1c (LCHF 4.9 ± 0.1%, HCLF 4.9 ± 0.1 %; %Diff = 0.2%; p = 0.821) did not differ between diets. **CONCLUSION:** Healthy well-trained male distance runners 20-50 years of age demonstrated an exaggerated hypercholesteremic response to a 6-week ad libitum LCHF diet. Despite high TC and LDL-C concentrations, the LCHF diet reduced TG, VLDL, TG/HDL-C Ratio, and increased HDL-C, suggestive of a lower risk of cardiovascular disease. This paradox of hypercholesterolemia in well-trained endurance athletes chronically consuming a LCHF needs to be further investigated to determine whether the blood lipid changes represent an increased or decreased risk of cardiovascular disease.

Supported by Grove City College Jewell, Moore, & McKenzie Fund

Effects of Cholecalciferol Supplementation on Vitamin D Status among Male and Female Collegiate Basketball Athletes

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Vitamin D is a fat-soluble micronutrient commonly found to be clinically deficient in a young, athletic, and otherwise healthy population. **PURPOSE:** to assess the prevalence of vitamin D insufficiency in a diverse sample of collegiate basketball athletes and to define the required dosage of vitamin D_3 supplementation in order to beneficially affect serum 25-hydroxyvitamin D (25(OH)D). **METHODS:** This was a quasi-experimental vitamin D intervention trial. Participants were allocated to one of three groups based on their baseline vitamin D status as follows: insufficient (<75 nmol/L) were allocated to 10,000 IU of vitamin D_3 daily, sufficient (75-125 nmol/L) to 5,000 IU of vitamin D_3 daily, and optimal (>125 nmol/L) to no supplementation. Demographics, body composition via dual x-ray absorptiometry, skin pigmentation via spectrophotometer and blood sampling for the assessment of serum 25(OH)D were completed. **RESULTS:** The majority of participants (n=13) were allocated to the high dose supplementation group (10,000 IU daily) vs. n=5 allocated to 5,000 IU daily and n=2 to no supplementation. Overall, 77% of participants allocated to the high dose supplementation group (10,000 IU daily) were male (p=0.005), with olive to dark skin tone (p=0.022), and 85% self-reported as African American (p=0.027). Differences among groups were noted for whole body BMD Z-score (p=0.027) and lean body mass (p=0.004). A dose-response emerged wherein the

10,000 IU daily group exhibited the greatest change in 25(OH)D concentrations (35.01± 26.96 nmol/L) vs. the 5,000 IU daily group (-9.34± 9.62 nmol/L) and the no supplementation group (-41.57± 11.66 nmol/L, $p<0.01$). A significant correlation between the change in 25(OH)D concentrations was observed with baseline 25(OH)D (r_s=-0.78, p=0.01) as well as with lean and fat mass percent r_s=0.83 and r_s=-0.80 respectively, p=0.01). **CONCLUSION:** A dosage of 10,000 IU of vitamin D_3 supplementation taken daily and allotted sufficient time to see marked improvement will help to mitigate the high prevalence of vitamin D deficiency among collegiate basketball players by beneficially impacting serum 25(OH)D levels.

Supported by George Mason University and the Frank Pettrone Center for Sports Performance

The Acute Effects of a Weighted Load on Glucose Metabolism

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Pre-exercise carbohydrate (CHO) intake has the potential to induce rebound hypoglycemia during aerobic exercise. **PURPOSE:** To evaluate the effects of pre-exercise CHO ingestion on blood glucose (BG) response during weighted-vest (40 lb. ruck) treadmill exercise. **METHODS:** Four males and one female member of Shippensburg University's Army Reserve Officer Training Corps (ROTC) participated in a protocol consisting of 4 experimental trials. Trials consisted of a 20-minute simulated ruck march at a continuous speed of 3.5 mph with grade alternating between 0% and 7% incline every 5-min. A control trial (CON), pre-exercise glucose trial (CON-GL), ruck control trial (R-CON), and ruck with pre-exercise glucose trial (R-GL) were performed in sequential order. Glucose trials were performed after a four-hour fast and involved consuming 300 ml of a 13.3% CHO solution, delivering 40 g of glucose. CHO was consumed 10 min prior to exercise. Dependent variables included BG, heart rate, oxygen uptake (VO_2), and respiratory exchange ration (RER). **RESULTS:** Blood glucose levels did not differ significantly between trials. However, RER was significantly different between CON-GL and R-GL (0.84 ± 0.02 vs. 0.90 ± 0.03; p = 0.042) and a trend (p=0.062) was present for CON vs. R-GL. VO_2 was different between CON and R-GL and R-CON (25.44 ± 2.9 vs. 32.90 ± 0.9 (R-GL) and 32.26 ± 1.4 $ml \bullet kg^{-1} \bullet min^{-1}$; p = 0.012 and .007, respectively); a trend (p=0.075) was also present for CON-GL VO_2 to be different from R-GL VO_2 (28.34 ± 0.8 vs. 32.9 ± 0.9 $ml \bullet kg^{-1} \bullet min^{-1}$). **CONCLUSION:** CHO intake immediately prior to moderate-to-vigorous exercise may influence CHO oxidation but was not found to adversely affect BG concentration or other physiologic measures. While timing of pre-ex CHO ingestion may be relevant if seeking to avoid rebound hypoglycemia, CHO consumed 10 min prior to ruck marching did not induce a hypoglycemic response.

The Cardiorespiratory Response of Caffeine Supplementation with Submaximal Exercise in College Students

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PURPOSE: The purpose of this study was to examine the effects of CAF supplementation on heart rate (HR) and oxygen consumption (VO_2) during submaximal exercise. **METHODS**: 13 healthy students (19.7 $\pm$ 1.2 yrs.) volunteered for the study, attended a familiarization, as well as two subsequent experimental sessions. During the familiarization session, informed consent was obtained, and treadmill speed for the experimental trials was determined from a protocol (2% grade, incremental speed increases) to obtain 60% of predicted HR_{max}. For the experimental sessions, the subjects reported to the lab one hour prior to submaximal testing and were administered a 6 $mg \cdot kg^{-1}$ BW bolus of CAF or placebo (PLA) of maltodextrin via gelatin capsule in a double-blinded, counterbalanced design. Following the absorption period, a 15-minute submaximal exercise session (2% grade, pre-determined speed) was completed with HR and VO_2 measured continuously and minute averages recorded. Additionally, a 2 (condition) x 15 (time) ANOVA was run for HR and VO_2, $p < .05$. **RESULTS**: The main effects of condition indicated that the ingestion of CAF vs PLA demonstrated no significant changes for HR (123.5 $\pm$ 4.5 and 128.4 $\pm$ 4.3 bpm, respectively, p=0.43) or VO2 (21.34 $\pm$ 2.0 and 19.87 $\pm$ 1.8 ml/kg/min, respectively, p=0.60). The main effect of time across the 15 minute submaximal exercise bout showed a lower HR for the first minute (117.7 $\pm$ 11.4 bpm) compared to the second minute (122.2 $\pm$ 14.8 bpm). The HR significantly progressed higher throughout the exercise session from the second minute (122.2 $\pm$ 14.8 bpm) to (130.4 $\pm$ 16.5 bpm) during minute 15. In addition, the VO2 during the first minute (18.9 6.4 ml/kg/min) was lower compared to the steady state exercise for the remainder of the exercise bout, ranging from (20.8 $\pm$ 6.9 to 22.3 $\pm$ 8.4 ml/kg/min). There were no interaction effects found for condition x time. **DISCUSSION:** Caffeine did not produce an ergogenic or ergolytic effect for exercise performance when performing a bout of submaximal aerobic exercise.

Effects of an Eight Week Periodized Resistance Program in Adolescents

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Resistance training has been shown to positively affect muscular fitness measures in adolescents. However, the effects of periodized approaches in this population are limited. **PURPOSE:** To examine the effects of an eight week periodized resistance program in adolescents. **METHODS:** Fifteen (12 male, 3 female) subjects, aged 14.0±1.5 years and BMI of 24.1±5.0 kg/m^2 participated in the study. Testing measurements were assessed pre and post and included body fat percentage, lean body mass (LBM), Functional Movement Screening (FMS), broad jump, single leg hops (SLH), limb symmetry, bench press reps at 25% of body weight, leg press reps at

100% of body weight, and pro-agility. Limb symmetry was calculated from SLH scores and used to assess muscular imbalances in lower limb power. Training programs were individualized to each subject based on sport and pre-testing results. Training sessions were three days per week and lasted 90 minutes each including a 5-minute warm up, 50 minutes of resistance training, 25 minutes of agility training, and 10 minutes of flexibility training. A linear periodization approach was utilized by progressing from endurance to hypertrophy to strength/power training over 8 weeks. **RESULTS:** Paired-sample T tests showed significant increases in FMS scores from 16.5±1.9 to 17.7±2.1 ($p=0.003$), left leg SLH from 48.8±12.3 to 52.9±11.2 inches ($p=0.034$), limb symmetry from 88.7±9.6 to 93.3±5.1% ($p=0.037$), and leg press from 35.2±28.9 to 51.9±36.3 reps ($p=0.03$). Body fat percentage, LBM, broad jump, right leg SLH, bench press reps, and pro-agility times showed no significant changes ($p>0.05$). C**ONCLUSION:** Improvements in FMS, left leg SLH, and limb symmetry show potential reduction in injury risk. No change in LBM shows that neurological adaptations may be responsible for the significant improvements in lower limb power, strength, endurance, and symmetry in this population.

Satellite Cell-Derived Extracellular Vesicles as a Therapeutic for Muscle Disease

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Satellite cells (SC) are muscle-specific stem cells that play a central role in muscle repair and regeneration, and represent a promising source for novel therapies. Numerous studies suggest the therapeutic potential of stem cells may largely be due to the release of paracrine factors. Previous work by our lab and others demonstrates that extracellular vesicles (EVs), phospholipid particles released from cells, effectively deliver molecular cargo to myotubes. Since SCs are known to play a central role in muscle growth and repair, the EVs released from satellite cells (SC-EVs) may be an effective therapeutic for a variety of muscle diseases and pathologies. **PURPOSE:** Since our lab and others have previously shown that oxidative stress and mitochondrial dysfunction are central to a host of muscle pathologies, the purpose of this study was to assess the extent to which SC-EVs restore mitochondrial function in myotubes following oxidative injury and in an *in vitro* model of Duchenne muscular dystrophy (DMD). **METHODS:** SCs from healthy mice were isolated and cultured. EVs were collected from the healthy SCs and quantified using nanoparticle tracking analysis. Mitochondrial function was compared between myotubes damaged with H_2O_2 and myotubes that received a subsequent treatment with SC-EVs following oxidative injury. Mitochondrial function was assessed by analyzing oxygen consumption rate (OCR) of the myotubes. Likewise, mitochondrial function was measured in primary myotubes from a mouse model of DMD, with and without SC-EV treatment. Three independent experiments were performed and data from each experiment were compared using a t-test with $p<0.05$. **RESULTS:** Each SC released $2.00 \times 10^5 \pm 8.04 \times 10^3$ EVs in the first 24 hours of culture. Myotubes exposed to H_2O_2 demonstrated a 38.4% decrease in OCR, which was completely reversed with subsequent treatment with SC-EVs. Similarly, SC-EVs improved

mitochondrial function in dystrophic myotubes. **CONCLUSION:** SC-EVs reverse oxidative stress-induced mitochondrial dysfunction in myotubes and may provide therapeutic benefit for a variety of myopathies.

Supported by NIH R01 NS102157, NIH P20 GM113125, NIH P20 GM103446, NIH R03 HD094594

African American and Caucasian Endothelial Cells Exhibit Different Inflammatory Responses to the Influenza Vaccine

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Endothelial tolerance to inflammatory stimuli is impaired in African American (AA) individuals compared with Caucasian Americans (CA), and this may contribute to the increased risk of vascular diseases in AA. MicroRNA (miR) are post-transcriptional regulators of gene expression that regulate endothelial health and inflammation. The influenza vaccine induces acute inflammation in humans, but its specific effects on inflammatory responses in AA and CA endothelial cells are unclear. **Purpose:** To determine vaccine-induced inflammatory gene and miR responses in AA and CA endothelial cells. **Methods:** Human umbilical vein endothelial cells from healthy AA and CA individuals (n=3 of each race, experiments repeated 3 times each) were cultured in basal media with 250 ng/ml vaccine (VAX) or without. Cells and conditioned culture media were harvested for quantification of mRNA and miR using real-time PCR. IL-6 protein concentration was measured in media using ELISA. **Results:** There were no differences between races in the basal condition. In response to VAX (data presented as percent change), AA had significantly increased release of IL-6 (24±9%, $p=0.02$), while CA did not (-5±8%, $p=0.58$). ICAM1 mRNA increased only in AA (40±19% ($p=0.02$) vs. -3±21 ($p=0.88$) in CA). There were no changes in the expression of NF-kB, VCAM1, or intracellular miRs 146a or 150 in response to VAX (all $p>0.05$). Intracellular levels of miRs 221 and 222 numerically increased in CA (72± 68% ($p=0.04$) and 52±83% ($p=0.06$)), but not AA (64±52% ($p=0.17$) and 34±32% ($p=0.32$)). Both AA and CA significantly decreased the release of miRs 146a (-50±10% ($p=0.003$) and -41±12% ($p=0.004$)), 221 (-53±6% ($p=0.001$) and -52±33 ($p<0.001$)), and 222 (-60±11% ($p=0.02$) and -38±29 ($p=0.047$)) in response to VAX, while the release of miR-150 was significantly decreased only by AA (-30±9% ($p=0.03$) vs. -4±11% in CA ($p=0.79$)). **Conclusion:** AA and CA had different responses in both intracellular and extracellular inflammatory markers. AA exhibited a heightened inflammatory response to vaccine compared to CA. Additionally, the decreased release of miR-150 by AA endothelial cells, coupled with no change in intracellular expression, or its indirect target NF-kB, suggests a paracrine/endocrine role in regulating inflammation.

Supported by Tier 1 (University of Maryland - College Park) to S.M.R.

The Effects of a 50k Ultramarathon on Plasma IL-6 and Rectus Femoris Muscle Thickness

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IL-6 is a cytokine that can act in an autocrine manner to facilitate many immunologic and metabolic processes. IL-6 may play a role in the inflammatory muscular response to prolonged running but studies attempting to link plasma IL-6 to in vivo measures of muscle inflammation are limited. **PURPOSE**: to assess plasma IL-6 concentrations and muscle thickness (MT) using ultrasound imaging throughout and after a 50-kilometer race and to determine the relationship between changes in IL-6 and changes in MT. **METHODS**: Men and women (n=11) age 39 ± 7 years participated in a 50k trail race consisting of five 10k laps. Ultrasound imaging was performed on the rectus femoris at rest (passive) and during isometric contraction before the race, within 60 minutes of completing the race, and 24-hrs post-race. To maintain consistent ultrasound probe placement, the probe was outlined at baseline testing. Images were analyzed using ImageJ, and the % change in MT from passive to isometric contraction was calculated. Blood was drawn 30 minutes following consumption of a pre-race meal, 10k into the race, within 60 minutes of completion of the race and 24 hrs post-race. Plasma IL-6 was assessed using an enzyme-linked immunosorbent assay (ELISA). **RESULTS**: Change in MT from passive to isometric contraction increased from a pre-race value of 9.1 ± 2.7% to 14.1 ± 2.6% post-race although this did not reach statistical significance (P= 0.256). Compared to pre-race values, change in MT increased significantly 24 hrs post-race (9.1 ± 2.7% vs. 17.8 ± 1.7%; P=0.021). IL-6 concentrations increased from pre-race levels of 0.37 ± 0.25 pg/mL to 3.1 ± 0.86 pg/ml at 10k (P=0.008) and to 29 ± 3.3 pg/mL post-race (P<0.001). Twenty-four-hour follow-up testing revealed a return of IL-6 levels to pre-race values (0.59 ± 0.3 pg/mL; P=0.488). The mean change (post-pre) in IL-6 inversely correlated with the mean change in MT (r= -0.685, P=0.02). **CONCLUSIONS**: Ultramarathon running leads to an acute but substantial increase in plasma IL-6 which precedes changes in MT. The relationship between changes in IL-6 and MT pre- and post-race indicates a potential role for IL-6 in the delayed exercise-induced inflammatory response with prolonged running.

Supported by Towson University Summer Undergraduate Research Institute, University of Maryland College Park, and the Baltimore Veterans Affairs Medical Center

Effects of 12 Weeks of an Individualized Exercise Program in Cancer Survivors

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Cancer survivor is defined as any person from the time of initial diagnosis until the end of life. Research in exercise oncology has shown exercise is not only safe for cancer survivors, but also has benefits on certain aspects of health and fitness. **PURPOSE:** To examine the effects of a 12-week individualized exercise program in cancer survivors. **METHODS:** Twelve (Females, n=6; Males, n=6) subjects aged 62.7 ± 8.3 years were assessed at baseline and after 12-weeks. Types of cancer present varied (Breast, n= 3; Prostate, n=1; Colorectal, n=2; Kidney, n=1; Ovarian, n=1; Thyroid, n=1; Neuroendocrine, n=1; Melanoma, n=1; Pancreatic, n=1; Multiple, n=1). Stages I-IV of cancer were present as well as various forms of treatments (Chemotherapy, n=6; Surgery, n=11; Radiation, n=3; Combination, n=6). Exercise sessions included individualized balance, resistance, and aerobic exercises. Assessments included resting HR and BP, Modified Clinical Test of Sensory Interaction in Balance, waist circumference, body fat %, lean body mass, hand grip, 30s Chair Stand (30CS), Timed Up and Go (TUG), peak power output (PO_{peak}) and peak time ($Time_{peak}$) on a ramped cycle ergometer test. Exercise sessions were one to three days per week and lasted 60 minutes each for 12 weeks. Average adherence rate was 76.4 ± 13.4%. **RESULTS:** Paired-samples T tests showed significant increases from pre to post testing in 30CS (12.8 ± 5.8, 17.1 ± 5.5 reps; p=0.003), TUG (9.7 ± 1.8, 8.2 ± 1.8 mins; p=0.006), PO_{peak} (125.9 ± 40.5, 139.7 ± 44.8 watts; p=0.024), and $Time_{peak}$ (10.6 ± 2.5, 12.4 ± 2.7 mins; p=0.004). No statistical significance was observed in any other measure. **CONCLUSION:** Twelve weeks of individualized exercise in cancer survivors showed increases in lower body endurance, mobility and aerobic fitness. Overall, 12 weeks of an individualized exercise program positively affected musculoskeletal and cardiorespiratory health and fitness in cancer survivors.

Ultra-processed Food Consumption and Vascular Health

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Ultra-processed (UP) foods are ready-to-eat foods formulated from industrial sources of dietary energy and nutrients, containing little or no whole foods. These products are typically high in saturated fats, added sugar, salt, and food additives, and low in protein, fiber, and micronutrients. UP foods are associated with an increase in energy intake (EI), weight gain, obesity, and cardiovascular disease. **PURPOSE:** To test the hypothesis that UP food consumption is associated with increased blood pressure (BP), arterial stiffness, and pressure wave reflection. **METHODS:** Habitual dietary intake was assessed via 3-day food records in 22-45 year old non-hypertensive adults. Food items were categorized to non-processed and/or minimally processed (NP) and UP groups by using the NOVA system of food classification. Bivariate and partial Pearson correlation was used to identify relations between NP and UP foods with systolic (SBP) and diastolic BP (DBP), pulse wave velocity (PWV), and augmentation index normalized for heart rate at 75 beats per minute (AIx75). Subjects were defined as low or high UP food consumers if they consumed less or more UP foods than the US average (58% daily EI). **RESULTS:** Thirty healthy subjects (11M, 19F; 28±5 yrs; BMI 23.8±3.5 kg/m²) were included in

the study. Average UP food consumption was 45±16% of daily EI. When controlled for BMI, UP food consumption was positively correlated with PWV (r=0.42, p=0.03) and AIx75 (r=0.51, p=0.01), whereas NP food consumption was negatively correlated with PWV (r=-0.42, p=0.02) and AIx75 (r=-0.51, p=0.01). When controlled for BMI, UP food consumption was positively associated with SBP (r=0.56, p=0.02) and DBP (r=0.50, p=0.04) in women, and AIx75 in men (r=0.69, p=0.03). There were no associations with UP food consumption and BP, PWV, or AIx75 when subjects were categorized as low and high UP food consumers. **CONCLUSION:** These findings suggest that UP food consumption is associated with increased BP, arterial stiffness, and pressure wave reflection in healthy individuals.

Supported by NIGMS P20GM113125

Diabetes Prevention Program: An Investigation of Lifestyle Coaches' Habits and Motivations

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The Diabetes Prevention Program (DPP) was created after a 27-center randomized clinical trial was conducted to determine if lifestyle intervention alone, or combined with pharmacological therapy could prevent or delay the onset of Type 2 Diabetes (T2DM). Lifestyle intervention decreased the incidence of T2DM by 58% compared with a 31% reduced incidence in the pharmacological group. A key component of the DPP are lifestyle coaches (LC). LC deliver curriculum intended to initiate and promote lifestyle change to individuals at risk for T2DM. Little is known about the behaviors of the LC. **PURPOSE:** The purpose of this study was to investigate the habits and motivations of LC to elucidate their motivations for coaching. **METHODS:** A sixteen item electronic survey was emailed to LC. Data was analyzed using descriptive and qualitative analyses, as well as chi-square tests. **RESULTS:** Sixty-three participants (60 female, 3 male) (Age range = 18-75+) responded to the survey. Descriptive analyses indicated that the majority of responding coaches worked in healthcare fields (59.65%) and achieved ≥ 150 minutes of physical activity (PA) per week (68.42%). Qualitive analyses indicated two types of motivation for coaching: internal (N=19) and external motivation (N=36). External motivation further included two sub-themes external-others (N=11) and external-self (N=25). Additional chi-square analyses revealed that those with bachelor and master's degrees, and working full time in healthcare occupations reported significantly less incidence of diabetes ($p<.05$) and higher instances of achieving 150 minutes or more PA per week ($p<.05$). **CONCLUSION:** These results suggest that lifestyle coaches are employed mainly in healthcare fields and are motivated to coach by external factors. The results indicate coaches may serve as appropriate role models in the adoption of PA behaviors and could help with training, delivery, and recruitment efforts for future coaches.

Supported by Health Promotion Council (HPC) Grant.

Increased Adenosine Monophosphate Degradation Impairs Mitochondrial Function

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Atrophied skeletal muscle has enhanced fatigability due at least in part to a reduction of mitochondria content. Since mitochondrial biogenesis is regulated by the transcriptional coactivator PGC-1□, which in turn is activated by AMP-activated protein kinase, lower levels of AMP might be expected to lower mitochondrial content. Supporting this idea, AMP degrading enzyme AMP deaminase 3 (AMPD3: AMP → IMP +NH_3) is highly induced during muscle atrophy. **PURPOSE:** Determine whether increased degradation of cellular AMP will decrease maximal mitochondrial oxidative capacity. **METHODS:** Cellular AMP levels were decreased through overexpressing adenoviruses encoding for AMPD3, AMPD1, and 5'nucleotidase (5'NT: AMP → adenosine + P_i). Adenoviruses were administered to C2C12 myotubes for either a 1- or 5-day period. An adenovirus encoding for GFP was used as the negative control. Oxygen consumption rate (OCR) was assessed using an extracellular flux analyzer. Oligomycin, FCCP, and a mix of antimycin A and rotenone were injected to measure respiration. All values were normalized to the basal GFP. IMP content was also measured via UPLC to assess AMP deaminase activity. **RESULTS:** Repeated measures ANOVA was used to compare the AMP degrading adenoviruses to the control. For the five-day adenovirus, 5'NT significantly decreased maximal respiration from 2.997 to 2.523 ($p = 0.045$) and ATP linked respiration from 0.8534 to 0.7231 ($p = 0.026$). AMPD3, under the five-day adenovirus transduction, decreased maximal respiration from 2.997 to 2.571 ($p = 0.147$), ATP linked respiration from 0.8534 to 0.7314 ($p = 0.092$), and H^+ leak from 0.1509 to 0.1093 ($p = 0.094$). 5'NT also tended to decrease spare respiratory capacity for both the one-day ($p = 0.0587$) and five-day ($p = 0.0918$) adenovirus transduction (from 2.091 to 1.677 and 1.997 to 1.682, respectively). No changes were seen in the one-day adenovirus transduction. AMP deaminase activity was significantly increased with the addition of both the AMPD3 and AMPD1 adenovirus, although, AMPD3 activity was 96 times greater than AMPD1. **CONCLUSION:** AMPD3 and 5'NT were effective long-term regulator of maximal mitochondrial respiration. However, AMPD1 was not able to decrease respiration, suggesting a need for a substantial amount of AMPD to elicit a decrease in respiration.

Supported by NIH Grant R01 AR070200

Pressure Wave Reflection Magnitude is Reduced Following Peak Exercise in Young and Older Adults

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Increased wave reflection magnitude (RM) and early return of reflected pressure waves augment pulsatile load, waste left ventricular effort, and are associated with cardiovascular events. Lower body aerobic exercise decreases RM and reflected wave transit time (RWTT) in young adults (YA). Due to age-related changes in arterial structure and function, older adults (OA) experience increased magnitude and earlier return of the reflected pressure wave at rest compared to young adults. OA have decreased cardiopulmonary fitness and increased blood pressure responses to peak exercise; however, it is unknown how peak exercise influences RM and RWTT, and whether OA respond differently than YA.

Purpose: To test the hypothesis that, at peak exercise, the reduction in RM would be attenuated in OA whereas the reduction in RWTT would be augmented in OA compared to YA.

Methods: Radial artery pressure waveforms and aortic blood flow velocities were acquired at baseline and immediately post peak exercise on a supine cycle via applanation tonometry and echocardiography, respectively, in 19 YA (25±5 yrs) and 14 OA (66±5 yrs). Central pressure waveforms were synthesized from radial waves using a generalized transfer function. Pressure-flow relations were established offline to perform wave separation analysis. This provided a comprehensive assessment of ventricular-arterial interactions for the determination of the relative amplitude and timing of forward (Pf) and backward (Pb) pressure waves, yielding RM (Pb/Pf) and RWTT.

Results: Consistent with previous literature, OA exhibited greater baseline RM (YA: 38±7 vs. OA: 46±5%, $p<0.05$) and a faster RWTT compared to YA (YA: 182±27 vs. OA: 144±28ms, $p<0.05$). RM was reduced at peak exercise, but the reduction was not different between YA and OA (ΔYA: -8±5 vs. ΔOA: -11±5%, $p>0.05$). RWTT was also reduced at peak exercise, but contrary to our hypothesis this reduction was attenuated in OA compared to YA (ΔYA: -37±25 vs. ΔOA: -10±17ms, $p<0.05$).

Conclusion: RM was reduced at peak exercise but was not different between YA and OA suggesting similar peak exercise-induced changes in the Pb/Pf ratio. RWTT was also reduced suggesting that the timing of wave reflection is altered at peak exercise. The smaller decline in RWTT in OA may be due to a floor effect as it was lower at rest in OA compared to YA.

Supported by ACSM Foundation Doctoral Student Research Grant

Hormonal Contraceptive Use and Bone Accrual Rates in Adolescent Females

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Exogenous hormone exposure in adolescence may affect lifetime fracture risk, as ~30% of bone mass is accrued from menarche to peak bone mass. **PURPOSE:** We investigated associations of hormonal contraceptive (HC) use with bone accrual rates from circum-menarche (MEN) to peak bone mass (PBM) in gymnasts (GYM) and non-gymnasts (NON). **METHODS:** A 20-year prospective longitudinal study of bone accrual in GYM vs. NON yielded annual DXA data for

bone mineral content (BMC) and areal bone mineral density (BMD) at key sites: 1/3 radius (1/3), ultra-distal radius (UD), lumbar spine (LS) and femoral neck (FN). A subset of data was analyzed to evaluate annualized BMC and BMD gains from MEN (-1.0 to +1.0 yrs post-menarche) to PBM (+4.0 to +6.67 yrs post-menarche). Inclusion criteria were ≥1 qualifying scan per site during each maturity stage (MEN & PBM) and self-reported data on HC use for the inter-scan interval. HC use from MEN to PBM was categorized as no HC use, ≤2 yrs HC use or >2 yrs HCuse. Multiple regression analysis evaluated GYM status and HC use as factors in site-specific BMC and BMD gains; covariates were entered based on correlation matrix results. Standardized β (stβ) and significance are presented (SPSS v24: α= 0.05). **RESULTS:** From a total sample of 211, eligible sample size was n=78. Weak negative trends were observed between HC use and annualized gains in FNBMD (stβ= -0.156, p = 0.157), LSBMD (stβ= -0.172, p = 0.102) and LSBMC (stβ= -0.160, p = 0.153), but no clear associations were seen between HC use and UDBMC, UDBMD, 1/3BMC, 1/3BMD or FNBMC (stβ= -0.083 to +0.114, p= 0.330 to 0.865). Gymnastic exposure at MEN (GYM n= 39; NON n= 39) was associated with weak trends for lower annualized gains in FNBMD (stβ = -0.156, p = 0.157), LSBMD (stβ = -0.172, p = 0.102) and LSBMC (stβ = -0.160, p = 0.153). **CONCLUSION:** Non-significant trends, with small effect sizes, suggest higher FNBMD and LSBMD accrual rates from MEN to PBM for non-users vs. HC users and for non-gymnasts vs. circum-menarcheal gymnasts. Lower accrual rates in GYM vs. NON, from MEN to PBM, may be due to potential inter-scan decreases in GYM loading, increases in NON loading, and/or to the possibility that, by MEN, GYM had already maximized bone loading gains via pre-menarcheal loading. Future studies should evaluate interactions between exercise loading doses and HC use using a larger sample size.

Supported by funding from: NIH/NIAMS (R03 AR047613-03; R01 AR54145-05); the Orthopaedic Research & Education Foundation; SUNY Upstate Medical University; University of Wisconsin-Madison (Department of Orthopedic Surgery; 233-PRJ87IH Bridge Funding-University of Wisconsin-Madison School of Medicine & Public Health; Ballantine Orthopedic Surgery Research Professorship); Grants to Binghamton University (Howard Hughes Medical Institute (HHMI) through the Precollege and Undergraduate Science Education Program; New York State Regional Economic Development Council; SUNY Investment & Performance program).

Exercise's Effect on Reaction Time and Answer Accuracy During Memory Recall

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Short and long-term memory recall can be improved by regular exercise, based on rat and human brain studies. Regular exercise, by promoting brain blood flow, has been shown to decrease the rate of decline of memory consolidation and recall in adults. Acute exercise can cause an immediate increase of blood flow to the brain thus potentially increasing oxidative supply for

memory encoding. Conversely, a hyperglycemic state may interfere with memory encoding. **PURPOSE:** To determine the effects of light exercise (LEC), heavy exercise (HEC), and exogenous glucose (GLU) on reaction time and response accuracy during a computer-based memory recall test. **METHODS:** 15 subjects (20.80±1.26 yr) completed four trials: resting control (CON), low-intensity cycling (LEC), heavy cycling (HEC), and resting glucose (GLU): a 25% glucose solution supplied at 1g/kg of body mass followed by a 25 min rest. For each trial, subjects observed 75 images prior to the assigned treatment and were then asked to recall the images after the treatment. During the post-test, 25 images were replaced with new images; subjects were then asked to recall whether the images had been viewed during the pre-test. Accuracy and reaction time (RT) were assessed. Exercise trials (20 min) were conducted using 20% (LEC) and 40% (HEC) of Wingate anaerobic test work rate. Blood lactate, glucose, and heart rate were collected at specific time points throughout. **RESULTS:** Mean HR was significantly increased during LEC and HEC (117 ± 14.4 bpm and 161 ± 16.5 bpm, respectively) ($p < 0.05$) vs. CON (68.0±9.4 bpm) and GLU (67.8±7.7 bpm). Blood glucose was significantly increased during GLU ($p < .001$) and blood lactate significantly increased during HEC ($p < .001$) vs. all conditions. Despite these physiologic alterations, no main treatment effects were observed for reaction time (RT), or accuracy. However, RT was significantly faster for correct responses (1005.10 ±22.0 ms) compared to incorrect responses (1328.2±46.5 ms) across all treatments vs. CON ($p < .001$). **CONCLUSION:** Based on the study results, different physiologic stressors resulting from acute exercise or hyperglycemia elicited no positive or adverse effects on short-term memory recall. Though, treatments were associated with a greater RT in selecting correct responses.

Effect of Creatine Supplementation on Muscle Oxygen Saturation

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Data have indicated that creatine supplementation can result in an increase in lower leg anterior compartment pressure at rest and post exercise. Although the increased pressures seen during these studies were not pathological, this and additional factors associated with creatine supplementation could possibly influence skeletal muscle oxygen concentration (SmO_2) during exercise and recovery. **PURPOSE:** To determine the effects of acute creatine monohydrate supplementation on SmO_2 during treadmill exercise. **METHODS**: 21 male, physically active participants were randomized in a double-blind fashion to placebo (PL) (n=10, 23±2 yrs.) or creatine (CM) (n=11, 21±2 yrs.) groups. Subjects received 0.3 g/kg/day creatine monohydrate or placebo in gelatin capsules for 7 days. The subjects performed submaximal exercise tests (10 minute treadmill activity at 3.7 mph and 9% incline) at baseline and on day 7 of the study. During exercise SmO_2 and lower leg pain (LP) were monitored utilizing near infrared spectroscopy and an analog visual scale, respectively. The % change in SmO_2 was defined as:

((Baseline SmO_2 – peak exercise SmO_2)/baseline SmO_2)*100. Pre- and post-exercise lower leg pain thresholds (PTH) were determined using a digital force gage. **RESULTS:** There was a significant group effect (P<0.03) but no significant effect of supplementation (P>0.05) on the % change in SmO_2 during the exercise tests (CM: pre 66.49 ± 30.54; post 59.61 ± 23.87 vs. PL: pre 39.87 ± 16.72; post 38.51 ± 26.95 % change SmO_2; M ± SD). No significant effects of supplementation were seen between the groups for PTH (P>0.05) or peak LP during exercise (P>0.05). **CONCLUSIONS:** Using a randomly controlled, double-blind trial with validated measurements of SmO_2, acute creatine supplementation does not appear to impact skeletal muscle oxygen saturation during exercise in young, otherwise healthy males.

The Effects of Beetroot Juice Consumption on Cerebrovascular Function during an Orthostatic Stressor

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Beetroot juice (BRJ) consumption improves peripheral vascular function by increasing nitric oxide bioavailability and reducing sympathetic nerve activity. However, it is currently not known if BRJ consumption can improve altered cerebrovascular function during an orthostatic stressor. **Purpose:** We tested the hypothesis that BRJ consumption would improve altered cerebrovascular function during lower body negative pressure (LBNP) in healthy participants. **Methods:** Five healthy participants (3 Females, Age: 24±2) completed a 5 min baseline followed by 7 min of LBNP at 40 mmHg. LBNP was performed pre (PRE) and three hours after consumption of 500 mL of BRJ (BRJc). Participants breathed a hypercapnic gas (3% CO_2, 21% O_2, 76% N_2) during baseline and LBNP. Breathing a hypercapnic gas acutely impairs cerebrovascular function. Heart rate (HR; ECG), mean arterial pressure (MAP; photoplethysomography), middle cerebral artery blood velocity (MCAv; transcranial Doppler) and end tidal carbon dioxide tension ($PETCO_2$; capnography) were continuously recorded. Cerebral vascular conductance (CVC) was calculated as the quotient of MCAv and MAP. Data were analyzed at baseline and at Min 1, 3, 5, and 7 of LBNP and reported as the change from baseline (Δ). **Results:** Baseline HR (PRE: 62±9 vs BRJc: 63±10 bpm; P=0.49), $PETCO_2$ (PRE: 47±2 vs BRJc: 48±3 mmHg; P=0.24), CVC (PRE: 0.92±0.20 vs BRJc: 0.89±0.14 cm/s/mmHg); P=0.17) were not different between conditions. Baseline MAP (PRE: 95±6 vs BRJc: 92±5 mmHg; P=0.06) and MCAv (PRE: 88±18 vs BRJc: 82±13 cm/s; P=0.03) were lower with BRJc. During LBNP, BRJc resulted in a greater increase in ΔHR at Min 1 (5±6 vs 10±8 bpm; P=0.04) and Min 3 (11±4 vs 15±6 bpm; P=0.06), an attenuated decrease in ΔMAP at Min 3 (-6±3 vs -4±4 mmHg; P=0.07) and Min 7 (-5±3 vs -2±4 mmHg; P=0.07) and a greater decrease in ΔCVC at Min 3 (-0.02±0.08 vs -0.07±0.11 cm/s/mmHg; P=0.08) and Min 7 (-0.04±0.07 vs -0.09±0.10 cm/s/mmHg; P=0.06). There were no differences between PRE and BRJc during LBNP for

$\Delta PETCO_2$ (P=0.54) and ΔMCAv (P=0.33). **Conclusion:** These preliminary data indicate the consumption of BRJ in healthy participants does not improve altered cerebrovascular function during an orthostatic stressor.

Aortic Blood Pressure is Lowered During Active Pill Phase of Oral Contraceptives in Young Females

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Young healthy females using oral contraceptives (OCP) have higher resting blood pressure but similar muscle sympathetic nerve activity as compared to naturally menstruating females (NOCP). Previous research has reported no differences in central and large artery stiffness in OCP versus NOCP. However, limited data exist regarding blood pressure and wave-reflection measures throughout different hormone phases of OCP and NOCP. **PURPOSE:** To evaluate the effects of the high hormone phase (OCP: active pill, NOCP: mid-luteal) and low hormone phase (OCP: placebo pill, NOCP: early-follicular) on resting blood pressure and wave-reflection. **METHODS:** 6 OCP (age= 23 ± 2 years) were tested during the active and placebo pill phases. 5 NOCP (age=22 ± 1 years) were tested during mid-luteal and early-follicular phases. Aortic blood pressure, wave-reflection indices: augmentation index (AIx); augmentation index normalized to a heart rate of 75 (AIx75) and wave-separation indices: forward pressure wave (Pf) and backward pressure wave (Pb) were recorded using brachial artery cuff-based tonometry. **RESULTS:** Aortic systolic blood pressure (aSBP), aortic diastolic pressure (aDBP) and aortic mean arterial pressure (aMAP) were significantly lower during the active pill phase as compared to placebo pill phase (100.3 ± 2.5 vs. 104.1 ± 3.4 mmHg, p=0.03; 67.1 ± 1.4 vs. 73.1 ± 2.7 mmHg, p=0.01 and 79.5 ± 1.6 vs. 84.8 ± 3.2 mmHg, p=0.03 respectively). However, there were no significant differences in aSBP, aDBP and aMAP between phases in NOCP (100.2 ± 1.1 vs. 99.8 ± 2.4 mmHg, p=0.88; 69.2 ± 2.9 vs. 71 ± 2.4 mmHg, p=0.43; 81.6 ± 2.5 vs. 82.8 ± 2.3 mmHg, p=0.63 respectively). Additionally, there were no significant differences in the brachial artery SBP, DBP and MAP, nor AIx or AIx75 throughout the two hormone phases of both OCP and NOCP. Pf was numerically greater during active pill phase (28.2 ± 2.2 mmHg) as compared to placebo phase (26.1 ± 1.5 mmHg) but was not statistically different (p=0.07). There was no difference in Pf between phases (26.8 ± 0.9 mmHg and 25.4 ± 1.2 mmHg, respectively) in NOCP (p=0.4). **CONCLUSION:** These data suggest that resting aortic blood pressure fluctuates significantly between phases in OCP, while remaining stable across the menstrual cycle of NOCP.

The Acute Effect of a Five Repetition Maximum on Vertical Jump Performance at Different Time Intervals

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The post activation potentiation theory and previous studies have indicated that a loaded squat of up to 65% 1 repetition maximum (RM) may help to improve short-term jump performance up to four minutes' post-squat. Other studies have found that increasing the load of the squat further increased subsequent vertical jump performance. **PURPOSE:** Thus, this study attempted to see how an 80% of 1-RM squat warm-up and post-squat rest-time intervals of up to 5 minutes would affect vertical jump performance. Blood lactate, ground reaction force, acceleration, and jump height (estimated based on flight time) were collected. **METHODS:** Subjects that participated in this study were 15 (6 male, 9 female) Shippensburg University (SU) division II aerobically-trained-athletes (age: 20 ± 1.26 years). Participants completed 4 days of exercise testing. The first testing day was used to estimate each subject`s 1-RM value for the squat. On the subsequent 3 testing days, subjects completed 1 set of 5 repetitions of squats using 80% of their predicted 1-RM. Subjects then completed 3 countermovement jumps on a force plate after a rest-period of 1 (R1), 3 (R3) or 5 (R5) minutes. In addition, 3 control countermovement jumps were performed without a squat warm-up (CON). Blood lactate levels were taken at rest, post squat, and pre-jump. Two-way ANOVA with repeated measure was used to compare dependent variables at multiple time points across different conditions. **RESULTS:** Ground reaction force (GRF), maximum jump velocity and jump height were extrapolated using force plate data. No significant differences existed in maximum (p=0.34) or average force (p=0.29) production across all conditions. Maximum jump velocity (mean values) was significantly greater in the R1 compared to CON (2.37±0.29 vs. 2.32±0.27 $m \cdot sec^{-1}$, p = 0.009). Jump height (estimated by flight time) was also significantly higher in R1 compared to CON (26.9±6.5 vs. 25.7±6.1 cm, p = 0.014) but not R3 or R5. No significant differences were seen in blood lactate levels across post-squat conditions. **CONCLUSION:** This study found that R1 produced the greatest improvement in vertical jump performance when using an 80% of 1-RM squat warm-up. This protocol may be useful for anaerobically trained power athletes; however further study should be completed to help optimize the protocol.

Impact of Exercise Frequency on ET-1 Responses in Postmenopausal Women

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Age-related declines in endothelial function can be reversed with habitual exercise (HEx) in older men by attenuating the vascular effects of endothelin-1 (ET-1), attributable in part to enhanced ETA receptor (ETAR) activity. We have recently demonstrated that ET-1 contributes to age-related endothelial dysfunction in postmenopausal women (PMW) via the ETB receptor (ETBR), however, the impact of HEx on ET-1 receptor responses in PMW has yet to be established.

PURPOSE: To test the hypothesis that ET-1 receptor responses are attenuated in HEx PMW. **METHODS:** In a retrospective analysis, 30 PMW were grouped by self-reported weekly exercise. We measured vasodilatory responses to local heating of the skin (laser Doppler flowmetry) during microdialysis perfusions of lactated Ringer's (Control), ETBR blockade (BQ-788, 300nM), and ETAR blockade (BQ-123, 500nM) in 15 low (LEx: 2.5±1.7 days/week, 57±4 yrs) and 15 high (HEx: 6.0±0.8 days/week, 60±5 yrs) frequency exercisers. Cutaneous vascular conductance (CVC) was calculated during the plateau phase of local heating (42°C), and normalized to maximal vasodilation achieved by perfusion of sodium nitroprusside (28mM) and heating to 43°C. A two-way ANOVA was performed to compare the impact of weekly exercise frequency on vasodilatory responses to ETAR and ETBR antagonists compared to control. **RESULTS:** Groups were well-matched for body mass index (LEx: 25±4 vs HEx: 24±2 kg/m^2, P=0.31), resting heart rate (LEx: 60±8 vs HEx: 54±9, P=0.14), and resting mean arterial pressure (LEx: 90±10 vs HEx: 90±8, P=0.96). Microvascular vasodilation was similar between LEx (87±9 %CVC_{max}) and HEx (88±6 %CVC_{max}, P=0.86). ETBR blockade increased vasodilatory capacity to local heating in LEx (control: 87±9 vs. BQ-788: 93±7 %CVC_{max}, P=0.01) but not in HEx (control: 88±6 vs. BQ-788: 91±7 %CVC_{max}, P=0.11). ETAR blockade did not impact vasodilation in either HEx women (control: 88±6 vs. BQ-123: 92±6 %CVC_{max}, P=0.11), or LEx (control: 87±9 vs. BQ-123: 90±9 %CVC_{max}, P=0.24). **CONCLUSION:** ETBR blockade improved vasodilation in LEx, but not in HEx PMW. Additional studies are needed to examine the impact of habitual exercise on ET-1-mediated vasodilation among sedentary PMW by direct assessment of cardiorespiratory fitness and exercise training intervention.

Supported by NIH R01 HL 146558, P20 GM 113125, AHA 16SDG30700015, and University of Delaware Research Foundation.

Respiratory muscle training for aerobic endurance performance at 3,658m altitude.

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Increased ventilation is one effect of altitude hypoxia. This increases the work and energy cost of ventilation. Therefore, during sustained aerobic exercise this may lead to respiratory muscle fatigue and secondary locomotor muscle fatigue. **PURPOSE:** Determine if resistive or endurance respiratory muscle training (RRMT and ERMT, respectively) vs. sham RMT (SRMT) improves exercise performance during acute exposure at 3,658 m. We hypothesize that ERMT would augment time to exhaustion more than RRMT and SRMT. **METHODS:** Twenty four subjects (age: 24±3 y; body fat: 16±6 %; $\dot{V}O_{2max}$: 38±6 mL·kg·min^{-1}) cycled to exhaustion (55% $\dot{V}O_{2max}$) in a hypobaric chamber at a 3,658 m before and after four weeks of respiratory muscle training (RMT). Prior to training, subjects completed a $\dot{V}O_{2max}$, pulmonary function, and respiratory endurance tests (RET). Subjects were randomly assigned to SRMT (n=8), RRMT (n=8), or ERMT (n=8). All RMT consisted of three, 30-min training sessions per week for four weeks. The SRMT group completed a 5-sec inspiration, 5-sec breath hold, and 5-sec expiration every 30-sec. The RRMT group completed a maximal inspiration and expiration against 60% of maximal inspiratory

(P_{Imax}) and expiratory pressure (P_{Emax}) every 30-sec. The ERMT breathed into bag that maintained isocapnia continuously for 30 min (bag volume=55% vital capacity; breath frequency=0.60*maximal voluntary ventilation/bag volume). **RESULTS:** There were no differences in pre-RMT anthropometrics, pulmonary function, $\dot{V}O_{2max}$, or cycle time to exhaustion between groups (all $p>0.05$). There were no changes in forced vital capacity after RMT ($p=0.85$). The RRMT group increased P_{Imax} and P_{Emax} after RMT ($p=0.009$ and $p=0.04$, respectively). The ERMT group increased RET after RMT ($p=0.04$). There was no difference in $\dot{V}O_{2max}$ after RMT in any group. There was no difference in cycle time to exhaustion after RMT ($p=0.14$) or between groups ($p=0.4$) **CONCLUSION:** Despite selectively improving pulmonary function, four weeks of RRMT and ERMT did not improve cycle time to exhaustion at 3,658 m simulated altitude.

Supported by Naval Sea Systems N00024-17-C-4316-P00002

The Effects of the Natural and Contraceptive Menstrual Cycle on Autonomic Function in Trained Females

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PURPOSE: The purpose of this pilot study was to test the hypothesis that endurance trained (ET) women with natural menstrual cycles (NT) would have higher post-exercise heart rate variability (HRV) and an accelerated heart rate recovery (HRR) in the low hormone phase (LH) compared to the high hormone phase (HH) and this difference would be exaggerated compared to ET women taking oral contraceptives (OC). **METHODS:** 6 ET females participated in this study (2OC, 21.5±0.7; 4 NT, 28.5±9.0yrs). In NT subjects, menstrual phase was determined using urinary ovulation kits with the LH and HH phases defined as 4-7 days after onset of menstruation and 5-10 days after ovulation respectively. In OC subjects, menstrual phase was defined as the time period where subjects took the placebo pills (LH) and the time period in which they took the pills with the highest estradiol and/or progesterone concentration (HH). All subjects performed an incremental ramp protocol on the treadmill on an arbitrary day for determination of VO_2max. During the LH and HH testing visits, participants completed a State-trait anxiety inventory (STAI Form Y-1) to assess objective stress levels. Resting HRV was collected for 10 minutes prior to a 30-minute treadmill run at a heart rate corresponding to 80% of their VO_2max. HRV was collected for 10 minutes immediately post exercise. Participants repeated the entire protocol in the opposite phase. **RESULTS:** Participants exhibited greater autonomic activity in HH versus LH phase, indicated by the root mean square of successive differences between normal heart beats (RMSSD, HH: 6.9±0.7 vs LH:4.8±0.7ms, $p<0.05$) and the standard deviation of the distance of each point from the y=x axis on the Poincaré plot (SD1, HH: 4.9±0.5 vs LH: 3.4±0.5ms, $p<0.05$). Participants in the NT group exhibited greater sympathetic activity post exercise than the OC group based on the SD1/SD2 ratio (NT 4.2±0.15 vs OC 3.5±0.2, $p < 0.05$). HRR measured as % change from end exercise to 30-seconds post

tended to be faster in the OC group vs NT (5.3±0.5 vs 3.7±0.3%; p=0.05). With these preliminary results, it is unclear which group/phase are causing these differences. **CONCLUSION:** The hormonal fluctuations during NT and OC menstrual cycles effect autonomic activity post-exercise in trained females.

Predicting Gross Motor Skills in Children: Data from the 2012 NHANES National Youth Fitness Survey

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Gross motor development may be influenced by physical activity and fitness, and obesity thus making it an important component of overall health. However, difficulties in assessing gross motor skills highlight the benefit of predicting performance via measures of body composition and strength/fitness in children. **PURPOSE:** Determine if birth weight, body composition, and core strength are significant predictors of gross motor skills (GMS) in children 3-6 years old. **METHODS:** Data from 177 boys and 178 girls from the 2012 National Health and Nutrition Examination Survey National Youth Fitness Survey were used for this analysis. BMI, sum of skinfolds (SF), and waist-to-height ratio (WHR) were calculated and used to assess body composition, core strength was assessed via a timed plank test, and locomotor (LOC) and object control (OC) skills were evaluated through the Test for Gross Motor Development-2 (TGMD-2). Gross motor quotient (GMQ) was calculated from the sum of LOC and OC. Separate linear regression models for birth weight, SF, WHR, BMI, and core strength were used to predict TGMD-2 scores. Age, race/ethnicity, annual household income (AHI), and height were used as co-variates in the models. **RESULTS:** Core strength was a significant predictor of LOC (β=0.311, p<.001) and OC (β=0.301, p<.001) skills and the GMQ in girls (β=0.450, p<.001). Furthermore, when adjusted for age and AHI, the GMQ was significantly predicted by birth weight in girls (β=0.184, p=.022). After adjustment for AHI, WHR in girls was a significant predictor for LOC (β=-0.230, p=.001) and OC (β=-0.177, p=.033) skill scores. For girls, SF was a significant predictor of OC skills when co-varying for factors influencing development (β=-0.183, p<.001). Birth weight, SF, WHR, and BMI were not significant predictors of GMS in boys; however, core strength was a significant predictor of both LOC (β= 0.325, p<.001) and OC (β=0.278, p<.001) skills and the GMQ (β=0.375, p<.001). **CONCLUSION:** In girls, birth weight, WHR, and SF were significant predictors of scores on the constructs of the TGMD-2 suggesting that body composition measures can be used as predictors of gross motor development. Additionally, core strength is a significant predictor of TGMD-2 scores in both boys and girls 3-6 aged years.

Effect of Different Exercise Modalities on Executive Function in College-Aged Individuals

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Despite the well-documented neurophysiological effects of exercise, most Americans, specifically college-aged individuals, do not meet the recommended level of physical activity. Thus, it is important to investigate other interventions that may have neurophysiological effects similar to exercise. Mechanical whole-body vibration (WBV) is one technique that has been shown to elicit similar physiological effects as aerobic exercise; however, the effects on the brain are not well documented. **PURPOSE:** The aim of this study is to compare the effects of different exercise modalities on executive function. **METHODS:** Seventeen subjects (11 females and 6 males; age 19.59 ± 1.21 years; height 171.15 ± 5.0 cm; weight 84.48 ± 39.5 kg) completed a randomized, cross-over study that consisted of exercising on a recumbent bicycle and treadmill, WBV, and a control session. Before and immediately after each session, subjects completed a series of computerized cognitive tests that measured attention, response inhibition, visuo-spatial working memory and reaction time. Each exercise session consisted of a 5-minute warm-up and 20 minutes of moderate (40-59% of heart rate reserve) intensity exercise on the designated modality (recumbent or treadmill). The WBV session consisted of subjects standing barefoot on a vibrating platform with an oscillating vibration of 30Hz for 20 minutes. The control session consisted of subjects sitting quietly in the laboratory for 20 minutes. **RESULTS:** An acute bout of recumbent cycling significantly decreased attention (pre: 70.50 ± 1.26 s; post: 69.69 ± 1.49 s; p=.049) and reaction time (pre: 121.99 ± 9.44 s; post: 128.03 ± 8.40 s; p=.026) when compared to an acute bout of exercising on a treadmill and WBV. A single session of WBV significantly decreased visuo-spatial working memory (pre: 43.29 ± 10.49 s; post: 47.95 ± 11.64 s; p=.008) when compared to an acute bout of exercising on a treadmill and recumbent bicycle. A significant interaction for main effect of group occurred in response inhibition (F=3.117, p=.041). **CONCLUSION:** A single session of exercising on a recumbent bicycle and WBV impaired executive function in college-aged individuals, whereas exercising on a treadmill did not impair executive function.

Supported by Grove City College Jewell, Moore, & McKenzie Fund

Individual Factors Influencing Performance on The Tandem Gait Test in Healthy, Physically Active Adults

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Gait and balance abnormalities are common following concussion. The tandem gait test, which is part of the Sport Concussion Assessment Tool 3 (SCAT3), assesses lower body coordination and dynamic balance deficits after a suspected concussion. To improve clinical decision making, it is imperative to determine factors that may influence performance on the test. **PURPOSE:** To

determine the effect of age, sex, level of physical activity, and concussion history on performance on the tandem gait test in healthy, physically active adults, and to determine if participants' performance improved across trials. **METHODS:** 59 healthy participants (22 males, 37 females, age = 20.49 ± 1.79 years, height = 165.60 ± 14.18 cm, weight = 67.56 ± 15.07 kg, 23 with a history of concussion and 36 without a history of concussion) completed a demographic questionnaire and the tandem gait test. The demographic form included a self-reported number of previous concussions, hours of vigorous and moderate activity per week, and days of resistance training per week. For the tandem gait test, times from the first four passed trials were recorded for analysis, and the best time was considered the tandem gait test score. Failed trials, in which the participant had a separation between their heel and toe, stepped off the line, or touched an object, were excluded from analyses. **RESULTS:** There were no statistically significant relationships between tandem gait test score and age ($p=0.39$), hours of moderate activity per week ($p=0.86$), hours vigorous activity per week ($p=0.24$) or days of resistance training per week ($p=0.31$). There was no significant difference between males (15.38 ± 2.76 s) and females (15.38 ± 2.76 s) on tandem gait test score ($t_{57}=-1.99$, $p=0.051$), or between those without a history of concussion (16.19 ± 2.89 s) and those with a history of concussion (16.39 ± 2.49 s) on tandem gait test score ($t_{57}=-0.28$, $p=0.78$). Participants performance improved over time with better performance on each trial compared to trial 1 (trial 1: 18.95 ± 4.15 s, trial 2: 17.75 ± 3.29 s, trial 3: 17.08 ± 2.85 s, trial 4: 16.87 ± 2.91 s; $F_{3,174}= 24.84$, $p<0.005$). **CONCLUSION:** General findings demonstrate that there is no effect of age, sex, level of physical activity, or concussion history on performance of the test. Performance on the test improves across trials.

High-fat Diets and Exercise Modulate Colon Inflammation and Proliferative Status in Male and Female Mice

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Increased abdominal adiposity and diets high in total fats are risk factors for colorectal cancer (CRC) and inflammatory bowel disease (IBD) development. In contrast, aerobic exercise has shown to significantly reduce the risk of CRC development in both men and women as well as attenuate symptoms associated with IBD. **PURPOSE:** We aimed to examine the impact of a high-fat diet (HFD) and exercise on predictors of CRC and IBD, which include proliferation index (PI) and colon inflammation. **METHODS:** 56 (n=7/group) 6-week old C57BL/6NTac male and female mice were weighed and randomly assigned to one of 4 groups: (1) control-diet sedentary (CDS, 10% fat diet, Research Diets); (2) very high-fat diet sedentary (VHFS, 60% fat, Research Diets); (3) control-diet exercise (CDX); and (4) very high-fat diet exercise (VHFX) for 12 weeks. Mice had *ad libitum* access to food and water. Exercised mice had free access to a

running wheel in their cages. Food intake was monitored every other day and body weights once per week. After 12 weeks animals were sacrificed and colon sections were prepared for immunohistochemistry for cyclooxygenase-2 (COX-2), a marker of inflammation; F4/80, a marker of tissue-resident macrophages; and proliferating cell nuclear antigen (PCNA), a marker of proliferation. PI was calculated as the ratio of immunoreactive nuclei for PCNA to total nuclei counted per crypt. F4/80 stained cells were counted and normalized to total area of mucosa measured. Comparisons were made using one and three-way ANOVAs. **RESULTS:** COX-2 expression was increased in VHFS animals and reduced in both exercised (CDX and VHFX) groups in males and females. Both female VHF diet groups (VHFS and VHFX) reduced F4/80 counts compared to CDX (p=0.057, 0.045). VHF fed animals (male and female) had a significant decrease in F4/80 cells compared to CD fed animals (0.782 vs 1.283, p=0.023). Female mice had a 7.6% lower PI compared to males (44.4 vs 51.9, p=0.046) and sedentary mice had a 17.9% higher PI compared to exercised mice (58.9 vs 41.0, p=0.000). **CONCLUSION:** Exercise attenuates HFD-induced colon inflammation in male and female mice. HFDs may modulate the expression of murine macrophage populations in female mice only. Since a higher PI is indicative of disease risk, our results suggest that females have a lower risk of CRC while being sedentary increases it.

Hot Head-Out Water Immersion Acutely Impairs Cerebral Autoregulation in Healthy Participants

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Recurring hot head-out water immersion enhances peripheral vascular function and cerebral blood flow during non-immersion conditions. However, it is not known if an acute bout of hot head out water immersion (HOWI) improves cerebral autoregulation versus thermoneutral HOWI. **PURPOSE:** We tested the hypothesis that dynamic cerebral autoregulation is greater during and following an acute bout of hot (HOT) vs. thermoneutral (TN) HOWI. **METHODS:** Seven healthy participants (age: 23±2 y, 2 females) completed two randomized trials consisting of 30 min HOT (39°C) or TN (35°C) HOWI. Beat-to-beat blood pressure (MAP), middle cerebral artery blood velocity (MCAv), and end-tidal partial pressure of CO_2 ($PETCO_2$) were recorded continuously. After 5 min of resting baseline, participants breathed through a respiratory impedance device for 5 min to assess cerebral autoregulation using Fourier transformation. Cerebral autoregulation testing was completed pre, 25 min into immersion (during), and immediately post HOWI. **RESULTS:** MAP, MCAv, $PETCO_2$, gain, and phase were not different between HOT and TN at pre (P>0.14for all). MAP was different between HOT and TN during (77±6 vs 91±9 mmHg; P<0.01) and post (81±9 vs 92±12 mmHg; P=0.03). MCAv was not different between HOT and TN during (63±8 vs 65±11 cm/s; P=0.28) or post (58±10 vs 62±11 cm/s; P=0.22). $PETCO_2$ was different between HOT and TN during (42±2 vs

44±4 mmHg; P=0.04) but was not different at post (39±3 vs 40±4 mmHg; P=0.13). Gain was different between HOT and TN during (1.0±0.2 vs 0.9±0.2 cm/s/mmHg; P=0.04) but was not different post (1.0±0.2 vs 0.9±0.2 cm/s/mmHg; P=0.15). Gain increased from pre in HOT during (P=0.03) but was not elevated post (P=0.15). Gain was not different from pre in TN during (P=0.95) or post (P=0.95). Phase was not different between HOT and TN during (12±7 vs 12±5°; P=0.48) or post (8±12 vs 11±7°; P=0.30). Phase was not different from pre in HOT or TN during (HOT: P=0.79 or TN: P=0.70) or post (HOT: P=0.70 or TN: P=0.74). **CONCLUSION:** These preliminary data indicate that the ability of the cerebral vasculature to buffer changes in blood pressure during hot HOWI is impaired compared to non-immersion conditions and thermoneutral HOWI in healthy participants.

Supported by Office of Naval Research Award N00014-17-1-2665

Can Non-Exercise Science Majors Direct an Exercise Program for Children with HFASD?

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PURPOSE: This study assessed the feasibility of offering a high intensity exercise program for high-functioning children with autism spectrum disorder (HFASD) by clinicians not pursuing a degree in the exercise sciences. **METHODS:** Children with HFASD participated in 1-hr exercise sessions 2d/wk for 5 wks instructed by clinicians pursuing non-exercise science degrees. To prepare for the exercise program, clinicians underwent a 40-hour training week, completed a written evaluation with 100% accuracy, and led a practice exercise session with at least 90% fidelity. Fidelity of implementation was assessed in 90% of sessions by research assistants not involved in the delivery of exercise treatment that session. Inter-rater reliability of the fidelity assessment was used throughout. Staff satisfaction questionnaires were given at the end of the program to evaluate the strengths and weaknesses of the program. The questionnaire consisted of 8 questions using a likert scale of 1-7 (1 = strongly disagree; 7 = strongly agree) and an open-ended question regarding comments on the program. **RESULTS:** Satisfaction questionnaires indicated the staff strongly agreed to recommend this experience to others (*M*:6.56 ±0.53), and the overall feeling about the program was positive (*M*:5.67 ±0.71). During training week, the program was administered by the clinicians very accurately (93.7%) and fidelity implementation remained consistent throughout the 5 weeks (93.8%). Inter-rater reliability was very high through the program (*M*:99% ±1.69). Although the clinicians instructed the program with high accuracy, both quantitative and qualitative data indicates that the non-exercise science majors would like more support (*M*:3.78 ±1.79). **CONCLUSION:** It is feasible to train non-exercise science majors to run a high-intensity exercise program for children with HFASD.

Blood Lactate Levels are Correlated with an Increase in Minimal Pain Threshold

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Prescription pain medication is often times addictive and can have long-term health consequences. Alternative pain-relieving strategies are becoming increasingly sought after. Exercise is known to have a pain-relieving effect which is thought to be mediated through the dopaminergic system. **PURPOSE:** To correlate minimum pain threshold with blood lactate levels following acute exercise in college aged students. **METHODS:** Eight college aged students (age = 21.2 ± 0.3) underwent 30 minutes of exercise on a cycle ergometer. Following 5 minutes of light cycling each subject underwent 20 minutes of cycling at 8 METS followed by a 5-minute cooldown. Blood lactate was collected as a measure of relative exercise intensity both before exercise and during the cooldown. The minimal pain threshold was measured using a "Pain Test" algometer on the extensor carpi radialis of each subject both before and after exercise. Data was quantified using a Student's T-Test. **RESULTS:** Following exercise pain threshold was increased by 114% ± 6.1 ($P<0.05$). Blood lactate increased from an average 1.6 ± 0.6 mmol/L at baseline to 4.1 ± 0.3 mmol/L following exercise. There was a positive linear correlation between pain threshold and lactate threshold ($R^2=0.71$; $P < 0.01$). Thus, indicating that greater blood lactate levels were related to increased minimal main thresholds. **CONCLUSION:** There was a relationship between blood lactate levels and increased pain threshold following exercise. This may suggest that anaerobic based cycling may be a more potent modality when compared to aerobic cycling in relation pain management.

The Effect of Dietary Sodium Intake on Blood Pressure in Healthy Young Adults

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Americans consume excess dietary sodium. High dietary sodium consumption can increase blood pressure (BP) in some, but not all, individuals. **Purpose:** We assessed dose-response relations between dietary sodium and BP in males and females, and hypothesized that females would be more impacted by increasing levels of dietary sodium. **Methods:** Twenty-eight adults (16M/12F; age: 26±6 yrs; BMI: 24.6±3 kg/m^{2,} Mean±SD) participated in a controlled feeding study. To assess dose-response relations between sodium and BP, participants consumed ten days of low- (LS: 1.0 g sodium/day), medium- (MS: 2.3 g sodium/day), or high- (HS: 7.0 g sodium/day) sodium diets, in random order separated by at least a month (crossover design). Laboratory brachial BP was assessed with an upper arm cuff placed on the dominant arm (Dash 2000, GE medical system). Data were analyzed using two-way repeated measures ANOVAs (Sex*Diet). **Results:** Twenty-four hour sodium excretion increased in male ((LS: 64±90, MS:

73±30, HS: 227±117 mmol/24 hours) and in female (LS: 51±32, MS: 106±57, HS: 248±85 mmol/24 hours) participants with no differences between the sexes (Diet: P<0.0001, Sex: P=0.43, Interaction: P=0.55). There was a significant interaction effect (P=0.02) for mean BP where female participants had a modest increase in mean BP (LS=74±5 mmHg, MS= 75±8 mmHg, HS= 79±7 mmHg) with increasing levels of dietary sodium. In male participants, mean BP (LS=82±7 mmHg, MS= 79±8 mmHg, HS= 80±5 mmHg) was not different. **Conclusion:** These preliminary data suggest a sex difference in the BP response to increasing levels of dietary sodium.

Supported by NIH Grant 1R01HL128388

Validity and Reliability of the Two-Point Method for Estimating Squat and Bench Press One-Repetition Maximums

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Purpose: To assess the validity and reliability of the two-point method for estimating one repetition maximums (1RM) in the squat and bench press exercises with varied pairs of loads. **Methods:** Thirteen resistance-trained men (age: 21.7 ± 0.4 years; height 1.74 ± 0.07 m; mass: 82.9 ± 9.5 kg; 1-repetition maximum (1RM) back squat: 149.9 ± 20.7 kg; 1RM bench press: 114.8 ± 18.5 kg) performed three trials of squat and bench press using the following percentages of 1RM: 20, 30, 40, 50, 60, 70, 80%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell during the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon; 200 Hz). Varied loading pairs (20% & 80%, 30% & 70%, 40% & 50%, 40% & 70%,) were selected and regression equations were created to estimate 1RM. Analysis of variance was used to compare differences between the measured and estimated 1RMs for the squat and bench press. Coefficients of variation (CV%) and intra-class correlations (ICC) were calculated to determine the reliability of the two-point method in both exercises. **Results:** No significant differences were found (p>0.05) between estimated and measured 1RMs despite large range of mean differences in the squat (MD: 6.5 – 27.5 kg) and bench press (MD: 1.1 – 4.3 kg). A large range of CV%s (squat CV%: 6.5 – 30.1%; bench press CV%: 3.2 – 5.5%) and ICCs (squat ICC: 0.14 – 0.82; bench press ICC: 0.85 – 0.97) were found across the four loading pairs. **Conclusion:** The two-point method represents a useful means of estimating 1RM during the back squat and bench press exercises without inducing the fatigue associated with directly measuring 1RM. However, selection of loading pairs is important as low reliability was displayed depending on the choice of loads. Individualized force velocity characteristics should be considered when utilizing the two-point method for estimating a 1RM.