Board 1

THE RELATIONSHIP BETWEEN BODY COMPOSITION AND DYNAMIC AND STATIC BALANCE TESTING OF COLLEGE-AGED INDIVIDUALS

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Past research has examined the relationship between postural stability and body mass index with foci on athletic or obese populations. PURPOSE: The purpose of this study was to determine the relationship between BF% and both dynamic and static postural stability in college-aged individuals. METHODS: 49 healthy individuals (n_m = 14, n_f = 35, age = 20.7 ± 1.4 y, height = 1.69 ± 0.08 m, weight = 70.75 ± 12.51 kg) with no history of vestibular deficits or lower extremity injury within the previous 6 weeks participated in this study. In a single session, participants completed a body fat assessment via air displacement plethysmography. Participants then completed 4 practice trials of a Y-balance test in 3 directions (anterior [A], posterolateral [PL], posteromedial [PM]), followed by 3 recorded trials in each direction. After a 5 min rest period, participants completed 3 static, 20 second single limb stance balance trials on a force plate. All tests were completed with the dominant leg. For static balance, the dependent variables were Center of Pressure - Velocity (COPV; cm/s) and Center of Pressure 95% Area Ellipse (COPA-95; cm^2). Y-balance reach distance (cm) was normalized to leg length, then for all balance tests, the average of 3 trials was used for analysis. The relationship between BF% and each postural stability variable was analyzed using separate Pearson correlations. RESULTS: There was no significant relationship between BF% and COPV (r = -0.178, p = 0.227), COPA-95 (r = 0.273, p = 0.063), Y-balance test in the A direction (r = -0.230, p = 0.115), or Y-balance test in the PL direction (r = -0.217, p = 0.063). There was a significant negative correlation between BF% and Y-balance test in the PM direction (r = -0.307, p = 0.034). Furthermore, as BF% increased, participants decreased postural stability in the PM direction for dynamic balance testing. CONCLUSION: There was a significant negative relationship between postural stability and BF% in the PM direction, therefore, future research on body composition and balance should be focused here. Additionally, since past research has reported that the posteromedial direction is the most indicative of postural stability deficits, this correlation may have important clinical implications for injury prevention in obese or overweight populations.

Board 2

NUTRITION KNOWLEDGE BETWEEN HEALTH AND NON-HEALTH MAJORS IN COLLEGE-AGED UNDERGRADUATES: A PILOT STUDY

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Nutrition is an important aspect in contributing to overall health; however, many individuals have a limited knowledge and/or are misinformed about nutrition. These factors may negatively influence one’s nutrition quality and therefore increase possible health risks. PURPOSE: To examine the general nutrition knowledge between two health majors and two non-health majors in undergraduate students and determine any factors leading to significant differences. METHODS: Researchers distributed the General Nutrition Knowledge Questionnaire obtained from the University College London website and a consent form in health major (Exercise Science and Public Health) courses and non-health major (Marketing and English) courses. Seventy-seven participants completed these four section, 20-minute questionnaires. Additionally, demographic information such as sex, age, weight, height, year in school, and major were collected. Data was analyzed using independent samples t-test with an alpha level set at 0.05. RESULTS: A significant difference was found between health and non-health majors in section 2 (food groups and their nutrients; health; 70.4±10.9%, non-health; 64.2±10.4%; p=0.013) and section 4 (health problems or diseases related to diet and weight management; health; 72.2±12.8%, non-health;64.1±14.2%; p=0.011). Health majors scored higher than non-health majors on these two questionnaire sections, but were very similar within the other two sections. Although, females scored higher than males in all four questionnaire sections, this difference was not significant. Additionally, no significant difference was found in body mass index (BMI) between the majors, overall average BMI fell into the overweight category (25.4±5.4 kg/m^2) when looking at both majors. CONCLUSIONS: Undergraduate health majors scored significantly higher than non-health majors in questionnaire sections, yet no difference was found in BMI. Therefore, our findings may suggest that although health majors may have a greater understanding about nutrition, the application of this knowledge may be lacking. Study limitations include a larger ratio of females (n=53) to males (n=24), and a large difference in the number of participants representing each year in school.
Adolescent aesthetic athletes, such as gymnasts and dancers, are partly evaluated based on physique and become aware of this emphasis at a young age often beginning as early as 3 years old. Therefore, it is common to observe unhealthy behaviors in an attempt to achieve this physique placing young athletes at risk for improper growth, injury and psychological stress. **PURPOSE:** The purpose of this study was to assess differences between adolescent gymnasts and dancers’ body image perception, body composition and dietary intake. **METHODS:** Gymnasts (n=18; age 11±2 yr) and dancers (n=13; age 10±4 yr) visited the Human Performance Laboratory with a parent to complete questionnaires on health history, body image perception and dietary intake (24-hr food recall). Body composition was assessed using dual energy x-ray absorptiometry (Hologic Horizon) to obtain measures of bone mineral density (BMD) and lean mass (LM). **RESULTS:** The majority of gymnasts and dancers (89%, 100% respectively; p=0.16) “felt pretty” and were “happy with the way their body looked”. Although no differences were observed between groups, gymnasts and dancers were of healthy weight (G: 40.2±13.8 kg, D: 36.2±15.2 kg) and BMD (G: 0.8±0.2 g/cm², D: 0.7±0.2 g/cm²). However, 22% of gymnasts and 15% of dancers were found to be either at risk for low BMD or have low BMD for chronological age. Gymnasts approached a significantly higher rate of stress fractures or fractures when compared to dancers (p=0.06). Gymnasts and dancers did not differ in total calories (G: 2,086±547 kcal, D: 1862±900 kcal; p=0.40), protein (G: 2.2±0.8 g/kg/d, D: 2.2±1.0 g/kg/d; p=0.84), carbohydrate (G: 7.3±3.8 g/kg/d, D: 7.5±3.4 g/kg/d; p=0.90), or calcium (G: 1,002±432 mg/d, D: 830±455 mg/d; p=0.29). **CONCLUSION:** While the majority of adolescent aesthetic athletes reported high body image perception, dietary intake could be optimized as calcium intake fell below the recommended daily value (1000mg/d). Although not significantly different between groups, it is physiologically important to recognize that gymnasts reported more skeletal injuries and were at higher risk for low BMD. This indicates the need for further dietary and body composition assessment of adolescent aesthetic athletes to prevent overall health and performance decrements during critical growth stages.

Supported by University of Idaho Summer Undergraduate Research Fellowship

**EXERCISE IS MEDICINE®: PHYSICAL ACTIVITY PRESCRIPTIONS AND BEHAVIOR DURING PREGNANCY**

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Physical activity (PA) is beneficial to the health of both pregnant mother and unborn child, particularly when current PA guidelines are met (e.g., 150 min/week of moderate-intensity PA). The impact of PA prescriptions given by prenatal physicians, following the Exercise is Medicine® program, is currently unclear. **PURPOSE:** This study examined the relationship between healthcare provider PA prescriptions given at two prenatal healthcare visits and subsequent PA behavior of pregnant women. **METHODS:** Prenatal healthcare providers in Cabarrus County, North Carolina assessed physical activity days/week and minutes/day among all prenatal patients (N=965) at two prenatal visits (V1: 20 weeks gestation; V2: 28 weeks gestation). Minutes/week of physical activity were calculated, and providers were trained to provide physical activity prescriptions if the patient was not meeting current guidelines. Wilcoxon-Mann-Whitney tests were used to determine the association between healthcare provider PA prescription and self-reported physical activity from V1 to V2. **RESULTS:** The frequency of PA assessment at visits decreased as pregnancy progressed (V1=82.1%; V2=45.9%). Median PA minutes reported increased from V1 (25.0 min/wk) to V2 (60.0 min/wk). Likewise, the percentage of pregnant women receiving a PA prescription decreased from visit to visit (V1=68.6%; V2=56.3%). Women who received a PA prescription reported a greater increase in PA from V1 to V2 (117 min/wk) compared to women who did not receive a PA prescription (72 min/wk) (p<0.001). However, only 18.1% of PA prescriptions were consistent with current PA guidelines at prenatal visits. **CONCLUSION:** PA among pregnant women appears positively influenced by PA prescriptions provided by healthcare providers. Further training of healthcare providers is needed to increase the prevalence of prenatal exercise prescriptions consistent with PA guidelines.
Pregnancy-related anxiety (PRA) is experienced by many women, given the physical and psychosocial challenges common during pregnancy and the prospect of childbirth. Some health behaviors, such as physical activity and quality of sleep (QS), are related to decreased PRA, but their joint influence is unclear. PURPOSE: We examined the individual and joint influences of physical activity behaviors and QS on PRA among pregnant women at two locations. METHODS: Third-trimester pregnant women (N=33) participated in a series of measurements between 28-36 weeks gestational age. Participants answered questions recalling their moderate and vigorous physical activity (min/wk) for prepregnancy, in the first and second trimesters, and concurrently. Moderate to vigorous physical activity (MVPA) was calculated for prepregnancy and for each trimester. Participants also wore a validated physical activity monitor (Modus StepWatch) for one week, and average steps/day were calculated. QS was evaluated with the Pittsburgh Sleep Quality Index (PSQI), calculating a global score. The Pregnancy Related Anxiety Questionnaire (PRAQ-R) was used to assess women’s anxiety regarding childbirth and the health of the baby. Median split was used to categorize PRA as “high” [≥15.0 PRA scale] or “low” [<15.0]. Mann-Whitney U-tests were used to compare the distribution of MVPA for all timepoints, steps/day, and also QS between high and low PRA participants. Hierarchical logistic regression determined the joint influence of MVPA and quality of sleep on PRA. RESULTS: Mann-Whitney U-tests showed lower PRA participants had significantly superior third trimester global QS scores [p=0.048]. Likewise, global QS scores were related to increased odds of high PRA [β=1.34, 95% CI: 0.99-1.80]. Average steps/day and self-reported MVPA prior to pregnancy and at all pregnancy timepoints were not related to PRA. Hierarchical analyses did not reveal an interactive effect of steps/day and QS or MVPA and QS on PRA as hypothesized. CONCLUSION: Lower QS is related to higher PRA during the third trimester of pregnancy. Physical activity was not related to PRA and interactive effects with QS on PRA were not found. Larger samples are needed to confirm these findings.
THE EFFECTS OF SOCIAL STRESS ON VOLUNTARY RUNNING BEHAVIOR IN FEMALE MICE
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PURPOSE: Regular physical activity (PA) is well known to positively impact physical and mental health outcomes. However, there is a reciprocal relationship between these variables wherein stress significantly reduces healthy levels of routine PA. We showed previously that voluntary running behavior of male mice essentially ceases following exposure to a resident-intruder social stress that models human post traumatic stress outcomes. Here we sought to determine whether stress-induced inhibition of habitual voluntary running occurs in female mice. METHODS: Five week old, C67BL/6J female mice were divided into four groups (n=8/group); sedentary/control, voluntary running/control, sedentary/stress and voluntary running/stress. Voluntary running groups were given 24 hr unlimited access to a running wheel in the home cage for 9 weeks. Mice ran a nightly average of 6.86 ± 2.5 km. During the 9th week, stress groups were exposed to a single, 6 hr bout of a female specific, resident-intruder social stress. RESULTS: Plasma corticosterone significantly increased following stress (34.56 ± 13 ng/ml basal to 330.5 ± 95 ng/ml immediately post stress) while nightly running dropped significantly to 1.72 ± 0.9 km. Unlike male mice where running levels were slow to recover, voluntary running in these female mice returned to near normal levels by the second night (5.01 ± 2.5 km). CONCLUSION: This study shows the sensitivity of habitual running behavior to stress exposure and suggest the utility of this mouse model in exploring the means by which stress negatively impacts routine PA.

ACUTE PERSISTENCE OF INTRAOCULAR PRESSURE REDUCTION FOLLOWING CARDIOVASCULAR EXERCISE
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Intraocular pressure (IOP) is the fluid pressure within the eye. It is one of the greatest risk factors for developing glaucoma, which is the second leading cause of vision loss. Although there is no cure, IOP is the main treatable risk factor for glaucoma. Research has shown promising benefits of exercise on IOP; however, there is a lack of research regarding the effects of varying exercise intensities on IOP and the persistence of IOP change. PURPOSE: To investigate the acute effects of exercise intensity on IOP and the persistence of IOP change. METHODS: Eight healthy adults (3 male, 5 females; 19.78 ± 0.97 years of age; 170.64 ± 16.68 cm stature; 68.49 ± 11.47 kg mass) with normal IOP (17.27 ± 4.51 mmHg) completed the study. Baseline measurements of heart rate (HR), blood pressure (BP), and IOP were taken prior to exercise. Participants completed the Queen’s College Step Test to estimate VO2 max. This was used to prescribe treadmill speeds for 65% (moderate intensity) and 95% (high intensity) of VO2 max. In a counterbalanced design, participants ran for 2.0 km at each intensity. HR, BP, and IOP were measured before, immediately after exercise, and in 10 min intervals for 60 min. Time 0 IOP data was used for analysis. A repeated measures one-way ANOVA with post hoc tests analyzed the differences between the exercise intensities. RESULTS: The high intensity reduced IOP (13.35 ± 6.41 mmHg) compared to baseline (p=0.017), and produced lower IOP compared to the moderate intensity (p=0.009). The moderate intensity did not reduce IOP compared to baseline (17.02 ± 4.58 mmHg, p=0.255). The reduction in IOP persisted for 15.64 ± 7.29 min following the high intensity exercise until returning to baseline. To be considered baseline, IOP needed to be within 12% of individual baseline values. CONCLUSION: High intensity exercise was the only condition associated with a reduction in IOP, agreeing with previous research which suggests that higher intensities produce the greatest reduction in IOP. Unlike previous studies, we documented the persistence of IOP reduction and found that IOP remained low for 15.64 ± 7.29 min following the high intensity exercise. Therefore, high intensity exercise may be necessary to elicit significant, although transient, reductions in IOP. Future research should investigate the effect of chronic exercise programs on IOP.

Supported by Pacific University Research Grant.
EXERCISE-INDUCED ELEVATIONS IN SKELETAL MUSCLE HISTAMINE CONTRIBUTES TO INCREASED POST-EXERCISE CAPILLARY PERMEABILITY

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Histamine, an endogenously released molecule in immune and inflammatory responses increases local vasodilation, blood flow, and capillary permeability. During exercise, histamine is produced within exercising muscle and contributes to an elevated post-exercise blood flow. The histamine-induced post-exercise vasodilation is contained within previously exercised muscle as histamine concentrations are not elevated in non-exercised muscle (i.e. arms during leg exercise). It is unknown if intramuscular histamine also contributes to elevate capillary permeability following exercise. PURPOSE: To compare capillary permeability of the leg before and after prolonged unilateral knee-extension exercise under normal conditions and when histaminergic signaling is blocked. It was hypothesized that H1/H2 receptor antagonists would decrease capillary permeability following exercise in an exercised leg but not in a resting leg. METHODS: Six (2F) volunteers performed 60 min of unilateral knee-extension exercise at 60% of peak power after consuming either Placebo or histamine (H1/H2) receptor antagonists (Blockade). A capillary filtration coefficient (CFC) reflecting the rate of change in limb girth per rise in venous pressure was calculated using venous occlusion plethysmography. A CFC was calculated prior to (PRE) and following (POST) exercise in both the exercised leg (EL) and the resting leg (RL). Data were analyzed with a 3-way RM ANOVA and presented as Means±SEM. RESULTS: On average, CFC increased 161±90% (PRE: 2.5±1.0 to POST: 6.6±2.3 μg·100g−1·min−1·mmHg−1) in the EL and 38±31% (PRE: 4.8 to POST: 6.5 μg·100g−1·min−1·mmHg−1) in the EL during Placebo. Blockade attenuated the exercise-induced rise in CFC in the EL to 13±41% (PRE = 4.3±1.3 to POST = 4.9±1.8 μg·100g−1·min−1·mmHg−1) and in the RL 2±45% (PRE: 3.8±1.4 to POST: 3.8±1.7 μg·100g−1·min−1·mmHg−1). Due to the high variability in the measures there was a trend for CFC to increase with exercise (P=0.161), for Blockade to attenuate the rise in CFC (P=0.363), and for a leg by drug interaction (P=0.289). CONCLUSION: These initial data suggest that exercise-induced histamine production contributes to the elevated CFC within exercised limbs.

Support provided by: ACSM NW Student Research Award; O’Day Fellowship; Carol Carver Pay-it-Forward Thesis Grant

THE EFFECT OF VENTED HELMETS ON HEAT STRESS DURING WILDLAND FIREFIGHTER SIMULATION

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Uncompensable heat strain from Wildland firefighter (WLFF) personal protective equipment (PPE) decreases the physiological tolerance one can endure while exercising in the heat. PURPOSE: This study compares heat accumulation at simulated working conditions while wearing standard non-vented WLFF helmets (H) versus a vented helmet (VH). METHODS: Ten male subjects with a VO2max of 59.8 ± 3.6 ml/kg/min completed two trials. Following a 10 minute acclimation period, subjects walked for 180 minute (at 3.5 mph, 5% grade) in a heat chamber (35°C and 30% relative humidity) with three intervals of 50 minutes of exercise and 10 minutes of rest. Separated by two weeks, subjects randomly performed the opposing helmet trial. Each trial measured physiological strain index (PSI), visual analog scale (VAS), helmet temperature and relative humidity (Th, Rh), rating of perceived exertion (RPE) and heart rate (HR). Data was analyzed using a 2X6 repeated measures ANOVA. RESULTS: All subjects finished all trials. At the end of the 3 hour trial HR (146.8±17.2 bpm H, 144.3±17.9 bpm VH), PSI (6.08±1.45 H, 5.89±1.24 VH), RPE (14.2±1.7 H, 13.3±1.7 VH), Th (35.52±4.7°C H, 35.75±5.0°C VH), and Rh (45.6±5.1% H, 41.0±5.9% VH) showed a significant effect of time (p<0.05) but were not significant between trials. There were trends for significant trial and interaction effects on RPE, helmet humidity, and VAS (p≤0.08). CONCLUSION: While these physiological variables (HR, VAS, PSI, RPE, Th, and Rh) did not reach trial significance, trends for RPE, helmet microenvironment, and VAS suggest greater heat dissipation and comfort with the vented helmet. This suggests the standard unvented WLFF helmet may contribute to heat gain over time, which may contribute to work output and safety in the field.

Supported by the USFS (18-CR-11138100-005).
Previous studies have demonstrated that backward walking may be implemented in training programs due to its lower impact on the joints of the lower extremity and benefit on cardiopulmonary system. However, little research has studied the impact of backward walking (BW) on ventilatory threshold (VT) and subsequent training responses. PURPOSE: To compare cardiovascular responses between forward and backward walking. METHODS: Participants (n=22, m=15, f=7) completed two graded treadmill walking tests to exhaustion in a repeated randomized crossover design. The first test was completed with the participants walking forward (FW), and the second test with the participants walking backward. Tests were performed at least 72 hours apart. Both tests were started at a self-selected speed at 3% grade, with grade increasing 1% every minute until an RER of 1.0 or greater was achieved for three consecutive readings, at which point speed increased 0.2 mph and grade 1% every 30s until exhaustion. Heart rate (HR), oxygen uptake, RPE, and expired gases were recorded throughout the tests. VT was determined using a combination of the V-slope method and identifying rise in VE/VO2 with no change in VE/VCO2. Paired t-tests were used to compare difference between tests. RESULTS: There were no difference in VT as a % VO2peak (FW=68.06%±6.1%, BW=69.91%±10.2%, p= 0.52). There were significant differences between tests for VT (FW=38.06±6.4 ml/kg/min, BW=28.6±5.5 ml/kg/min, p<0.001), HR at VT (FW=161±13.1 bpm, BW=152±10 bpm, p=0.0009), and HR at VO2peak (FW=188±8.5 bpm, BW=180±14.2 bpm, p = 0.003). CONCLUSIONS: Interestingly, these results suggest that mode of exercise alters oxygen uptake at VT, and HR at VT but not VT as %VO2peak. These findings may be applied to threshold training at a lower heart rate with BW resulting in less impact than forward walking.
EFFECTS OF HELMET VENTS ON PERFORMANCE IN SIMULATED WLFF WORKING CONDITIONS

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Uncompensable heat gain from wildland firefighter (WLFF) personal protective equipment decreases the physiological tolerance one can endure while exercising in the heat. PURPOSE: To identify performance differences in simulated working conditions wearing traditional non-vented WLFF helmet (H) compared to a vented helmet (VH). METHODS: Ten male subjects with a VO\textsubscript{2max} of 59.8 ± 3.6 ml/kg/min walked for two 180-minute trials (at 3.5 mph, 5% grade) in a heat chamber (35°C and 30% relative humidity). Trials started with a 10 minute chamber acclimation period, followed by three intervals of 50 minutes of exercise and 10 minutes of rest, followed by a performance test to exhaustion. Subjects were provided with 5 ml of water/kg of body weight every 30 minutes. Separated by a two-week washout, subjects repeated the trial with randomly ordered helmets. Each trial measured % dehydration, sweat rate, and performance (PKJ). Peak helmet temperature, perceived head heat (PVAS), helmet humidity (PHH), heart rate, physiological strain index, rating of perceived exertion, core temperature (PT\textsubscript{c}), and skin temperature were collected during the performance test. Paired samples t-tests compared differences between the H and VH trials. RESULTS: All 10 subjects were able to finish both trials. Sweat rate nor percent dehydration did not differ between trials. Performance was significantly greater in VH (95.9±10.3 KJ H vs. 109.3±8.5 KJ VH), PHH (47.3±1.4% H vs. 45.0±1.3% VH) and PVAS (108.8±9.2 mm H vs. 91.5±9.9 mm VH) were all significant (p<0.05) between trials. A trend in PT\textsubscript{c} (38.3±0.1°C H vs. 38.1±0.1°C VH; p<0.08) existed. CONCLUSION: These data (PHH, PVAS, and PKJ) suggest that a vented helmet could result in greater performance for wildland firefighters. While PT\textsubscript{c} did not reach significance, a statistical trend suggests that a vented helmet could improve heat dissipation for the body. The current design of the WLFF helmet may contribute to heat gain, reduced performance, and heat related illnesses for the working WLFF.

Supported by the USFS (18-CR-11138100-005)

SELF-SELECTION OF RECOVERY TIME BETWEEN REPEATED WINGATES

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There is limited information on how individuals select recovery times and the subsequent impact on performance. PURPOSE: To investigate subjects’ ability to self-select a rest time that maintains sprint performance and identify physiological cues used in the evaluation of recovery. METHODS: A counterbalanced, repeated-measures design was used. 12 male subjects (21 ± 1.21 yr) completed experimental (S) and control (C) trials, consisting of two consecutive Wingate tests (W1, W2) on a cycle ergometer with a predetermined recovery time of 3 min (PDT) or a self-selected recovery time (SST). Ventilation, heart rate, blood pressure and blood lactate were measured at rest, after W1, and at the end of recovery (PDT or SST). RESULTS: When subjects indicated they were ready for W2, breathing frequency (BF, 23.70 ± 7.84 breaths/min) was not different from rest (18.90 ± 4.11 breaths/min, p=.670), however, tidal volume (V\textsubscript{t}, 1.73 ± 0.61 L) was still elevated above rest (0.95 ± 0.25 L, p<.001). The SST (341.67 ± 28.47 s) was longer than the PDT of 3 min (p=.001). After a recovery time of 295.42 ± 69.18 s, peak power (PP) in W2C (784.90 ± 129.91 W) was lower than W1C (911.29 ± 168.94 W, p=.008). However, after a recovery time of 453.33 ± 89.18 s, the PP in W2S (843.22 ± 175.21 W) was not different from the PP in W1S (931.22 ± 190.80 W, p=.093). The percent change in V\textsubscript{t} from rest to recovery best explained the %Δ in PP (%Δ PP = -23.913 + .120 (V\textsubscript{t}), F(1,10)=39.960, p=.000, R\textsuperscript{2}=.800). CONCLUSION: Subjects appeared to have monitored BF by waiting for it to return to rest before indicating they felt recovered, however, it did not prove to be an effective indicator of recovery because the selected recovery time corresponded to a decrease in sprint performance. Conversely, V\textsubscript{t} may be a better indicator of recovery due to its relationship with %ΔPP and its ability to take into account differences between subjects more so than time alone. Tidal volume was still elevated at the selected recovery time, suggesting incomplete recovery and the potential to be monitored when evaluating recovery.
Deep touch pressure (DTP) intervention has been shown to increase feelings of relaxation and magnitude of recovery from anxiety inducing events by way of autonomic nervous system (ANS) coordination. Moderate intensity aerobic exercise (MIAE) and anxiety have similar physiological manifestations mediated by the ANS such as heart rates (HR) over 100 bpm, increases in electrodermal activity (EDA) and decreased heart rate variability (HRV). PURPOSE: To determine if DTP using a weighted blanked improves recovery of HR, EDA, and low frequency (LF) and high frequency (HF) HRV measures following MIAE. METHODS: Subjects (n=20: female=10, male=10; age=21±1 yr.) completed the study over two visits, each consisting of 10 min. of supine rest (the last 5 min. averaged for baseline values), 8 min. of steady state exercise maintaining a HR of 135±5 bpm on a cycle ergometer (the last 5 min. averaged for exercise values), followed by 5 min. of supine recovery under a weighted (W) or unweighted (UW) blanket on separate visits. The order of W or UW blanket intervention in recovery was randomized. Following the protocol, subjects completed a survey to report subjective feelings of relaxation on a scale of 1 to 5. Survey data was compared between conditions with a dependent t-test. Recovery of HR and EDA were determined as a percentage recovery from exercise values back toward baseline (i.e. 100% recovery indicates return to baseline). These data, as well as measures of LF/HF, were compared between conditions at 1, 3 and 5 min. of recovery with a RM-ANOVA. Significance was set at p<.05. RESULTS: Percent recovery of HR and EDA were similar between recovery conditions at all timepoints (5 min. values presented: HR: W= 81.4 ± 9.4%, UW=79.9 ± 10.6% p=.642, EDA: W=31.9 ± 22.3%, UW=5.4 ±142.9%, p=.601). LF/HF were not different at any point in recovery between conditions (5 min.: W: LF/HF=13.8 ± 19.9, UW: LF/HF=9.7 ±15.7, p=.475). Subjective relaxation scores were higher following weighted blanket recovery (W=4.6 ± 0.5 vs. UW=3.9 ± 0.9, p=.008). CONCLUSION: DTP use in recovery from MIAE does not affect ANS coordination, as indicated by recovery of HR, HRV, and EDA. Evidence of the physiological effects of DTP are limited, however greater subjective relaxation scores with DTP indicate it could be an effective psychological relaxation modality.

A dynamic warm up serves a variety of purposes from activating muscle groups, increasing mental preparedness, and raising muscle temperature to ideal conditions for increased firing rates. Handheld percussion devices have become increasingly popular tools, often used in warm up routines for many athletic populations. The effectiveness handheld percussion devices in promoting dynamic warm up benefits has not been evaluated. PURPOSE: To examine the differences in vertical jump height after administration of lower body handheld percussion treatment, compared to passive rest. METHODS: Adult trained males (N=12, 21 ± 2 yr., 84.25 ± 12.19 kg, 188 ± 7.59 cm) volunteered for this study. On Day 1, participants were randomly assigned to an experimental group or a control group. All participants completed a 15-minute dynamic warm up consisting of light jogging, calisthenics, plyometrics, and dynamic stretching. After the warm up, the experimental group received five minutes of treatment from a handheld percussion device before performing a vertical jump test. Treatment via the device was concentrated on lower body muscle groups: gluteals, quadriceps, calves, and hamstrings. The control group was asked to passively rest for 5 minutes prior to performing a vertical jump test. Vertical jump height was assessed using an electronic jump mat. The best of three jumps was recorded. The next day, participants returned for a second assessment of vertical jump height. Participants who completed the experimental protocol on Day 1, completed the control protocol on Day 2 and vice versa. A Student’s paired t-test was used to compare vertical jump height with and without treatment. RESULTS: Vertical jump height without treatment was 70.61 ± 6.78 cm compared to 70.36 ± 6.66 cm with treatment. Six participants increased in vertical jump height after treatment, while six participants decreased in vertical jump height after treatment. Vertical jump height for all participants was not increased with administration of treatment (p=0.85). CONCLUSION: Handheld percussion treatment does not affect vertical jump height in this sample population. Larger sample sizes are needed to determine the effects of handheld percussion on lower body power and its benefits to dynamic warm up routines.

Equipment for this research was provided by TheraGun.
Stretching Antagonist Musculature Can Improve Movement Economy

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Current research indicates stretching, and concomitant increase in range of motion (ROM), negatively affects performance. However, in many cases, those studies stretched the agonist muscle responsible for the movement. Few studies have isolated the antagonist musculature for the stretching intervention, while focusing on agonist performance for the dependent variable. **PURPOSE:** Determine if increased antagonist muscle ROM affects agonist muscle economy. **METHODS:** 14 participants (5 male, 9 females; 168.32 ± 7.63 cm stature; 65.00 ± 7.28 kg mass) completed baseline active ROM (AROM) and passive ROM (PROM) measurements. The experimental design required participants to complete two 5 min trials of seated hip abduction movement, one pre-stretching (baseline PROM) and one trial post-stretching (criterion >15% PROM). Each trial required participants to abduct (and adduct) both legs to 90% of AROM (55 per min) repeatedly for 5 min. The task was performed with no external resistance, only dependent upon ability of agonist to perform the movement while overcoming resistance of the antagonist musculature being lengthened. Using principles of indirect calorimetry, steady-state VO\textsubscript{2} and VCO\textsubscript{2} were used to calculate energy expenditure (kJ·min\(^{-1}\)). Paired t-tests compared energy expenditure of the stretching and non-stretching trials. **RESULTS:** The experimental design was predicated upon a participant having different ROM when completing the two trials. The stretching regimen accomplished that goal, verified by stretched trial having higher PROM and AROM as compared to non-stretched trial (140.36 ± 16.9° vs. 118.75 ± 16.4°, p < 0.05; 115.36 ± 15.6° vs. 104.07 ± 14.3°, p < 0.05, respectively). Compared to the control condition (non-stretched trial), the stretched condition had a lower energy expenditure associated with the seated leg abduction task (non-stretched = 10.84 ± 2.10 kJ·min\(^{-1}\), stretched trial = 10.27 ± 2.13 kJ·min\(^{-1}\), p < 0.05). **CONCLUSION:** Increased antagonist ROM led to decreased energy expenditure of a novel movement task. External work performed was held constant between the two trials; thus, a decrease in energy expenditure indicates improved movement economy. These findings show targeted stretching of antagonist musculature can improve movement economy.

Supported by Pacific University Research Grant.
CONCLUSIONS:

Vigorous, but not moderate PA or walking, was negatively associated with stress. Further, students meeting PA guidelines (i.e., ≥150 min/week of moderate or 75 min/week of vigorous PA) reported significantly lower stress (15.0 ± 6.6) than those not meeting guidelines (20.4 ± 7.4). Vigorous PA was negatively associated with stress independent of age, sex, and hours worked per week (β = -0.28, R² = 0.13, p = 0.03) but not vigorous PA (p = 0.06). Moreover, students meeting PA guidelines (i.e., ≥150 min/week of moderate or 75 min/week of vigorous PA) reported significantly lower stress (15.0 ± 6.6) than those not meeting guidelines (20.4 ± 6.0; p < 0.001).

CONCLUSIONS: Vigorous, but not moderate PA or walking, was negatively associated with stress. Further, students meeting PA guidelines reported lower stress. These results suggest PA, particularly vigorous PA, may be important related to graduate student’s stress. Additionally, time spent in SB while reading and completing computer work was positively associated with stress, suggesting that this may be an important factor in graduate student’s stress levels. Future research may benefit from a longitudinal study design and objective measures of PA to overcome current study limitations and determine whether manipulating PA and SB effects stress levels.
FORAMEN OVALE AND IMPAIRED PULMONARY GAS EXCHANGE EFFICIENCY AT REST AND DURING EXERCISE: SIZE MATTERS

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The patent foramen ovale (PFO) is a source of right-to-left intracardiac shunt. Previous studies have not studied the association of PFO size on pulmonary gas exchange efficiency at rest and during exercise. PURPOSE: To quantify differences in pulmonary gas exchange efficiency between individuals with a large PFO and those with a small PFO and/or no PFO. METHODS: 25 subjects (7 large PFO, 5 small PFO and 13 no PFO) were recruited and screened for presence and size of PFO utilizing saline contrast echocardiography. Large PFO was defined as ≥ Grade 3, small PFO as ≤ Grade 2 and no PFO as absence of saline contrast bubbles. Subjects exercised at 5 submaximal workloads (70-190 Watts). Arterial blood was taken from a radial arterial catheter pre-exercise and during the final 30 seconds of each workload and immediately analyzed for pH, PaCO₂ and PaO₂. Alveolar PO₂ was calculated using the alveolar gas equation and the alveolar-to-arterial oxygen difference (gold standard measure of pulmonary gas exchange efficiency) was quantified. Comparisons were made using a 2 way ANOVA (group x time) with Bonferroni correction for pairwise comparisons, with significance set at p<0.05. RESULTS: The presence of large PFO was associated with significantly decreased pulmonary gas exchange efficiency, compared to those subjects with a small PFO and no PFO with a specific pairwise difference at 160W (19.0 ± 2.8 vs 10.7 ±1.6; (mean ± SEM)). CONCLUSION: The presence of a large PFO is associated with impaired pulmonary gas exchange efficiency pre-exercise and during moderate sub-maximal workloads.

Support: American Heart Association (A.T. Lovering); Department of Defense (W81XWH-11-2-0040 TATRC to R.C. Roach and W81XWH-10-2-0114 to A.T. Lovering)

Effect of PFO Size on Gas Exchange Efficiency

![Graph showing the effect of PFO size on gas exchange efficiency](image-url)
A NOVEL APPROACH TO DISTINGUISH HUMAN MYOSIN HEAVY CHAIN ISOFORM DURING SINGLE MUSCLE FIBER DISSECTION

University of Oregon, Eugene, OR

Due to the important impact of myosin heavy chain (MHC) isoform on contractile and metabolic characteristics, it is advantageous to distinguish MHC isoform during cellular-level experimentation of skeletal muscle. While animal models offer conveniently homogenous samples by anatomical muscle group, human skeletal muscle is far more heterogeneous with respect to MHC distribution within single samples. **PURPOSE:** The aim of our study was to develop an effective approach for distinguishing “slow-contracting” MHCIIA/MHCIIX fibers from “faster-contracting” MHC-I fibers during mechanical dissection. **METHODS:** Single fibers were dissected from bundles of ~100 fibers on multiple occasions. Fiber type predictions were based on elasticity of fibers during extraction from the bundle and fiber length compared to the bundle length following extraction. Fibers were then allocated to one of two groups: 1) stiff (maintained length similar to bundle length during extraction) or 2) compliant (stretched beyond bundle length). Stiff fibers were categorized as MHC I, while compliant fibers were considered to be “Not MHC I” (MHC types IIa and IIx) based on known associations between passive stiffness and the predominant MHC isoform in skeletal muscle fibers. Sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) was used to determine the MHC isoform of categorized fibers. Receiver Operating Characteristics and a Confusion Matrix were used to determine estimate accuracy. **RESULTS:** In total, 65 fibers were dissected, assigned a group, and assessed for MHC isoform via SDS-PAGE. Our stiffness-based estimates of fiber types yielded Sensitivity of 0.55, Specificity of 0.86, and Accuracy of 0.75. **CONCLUSION:** Our findings demonstrate the feasibility of early efforts to distinguish human skeletal muscle fibers by MHC isoform during mechanical dissection, thus reducing the temporal and sample resource burden of conducting skeletal muscle analyses that benefit from a homogenous MHC population.

SINGLE LEG SQUAT TEST AS A TOOL TO PREDICT LOWER EXTREMITY INJURIES IN ADOLESCENT ATHLETES

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A goal of pre-participation sports physical examinations is to identify athletes at an increased risk for musculoskeletal injury. The single leg squat test (SLS) is a biomechanical screening tool that is simple, easily reproduced, and has been validated with three dimensional motion analysis. A positive SLS test used in frontal plane analysis may be suggestive of poor lower extremity mechanics, reduced core strength, and/or hip abductor weakness thus placing the athlete at higher risk of a lower extremity injury. **PURPOSE:** To determine the predictive value of the SLS test in predicting lower extremity injuries in adolescent, high school athletes with prospective injury data collected by athletic trainers over a one year period. **METHODS:** Two hundred and sixty-two high school athletes from central Oregon were evaluated while performing an SLS test during the first week of formal team practice at the school or during pre-participation physicals in August before school. These athletes participated in sports with a high risk for lower extremity injury, which commonly included cutting, running and landing movements. The specific sports included soccer, basketball, football, wrestling, and track and field. Injuries sustained while playing sports during the following academic year were reported to each of the respective high school’s certified athletic trainer (ATC). At the time of the injury, the ATC input the injury data into an electronic database. Sensitivity, specificity, and negative predictive value (NPV) were calculated for the SLS test in relation to lower extremity injuries. **RESULTS:** The sensitivity, specificity, and NPV of the SLS test in predicting lower extremity injuries were 50%, 37% and 92%, respectively. **CONCLUSION:** The SLS test is a biomechanical tool with good negative predictive value that can be used to evaluate high school athletes for potential injury risk. Given the simplicity of this screening tool, the SLS test can easily be incorporated into high volume pre-participation sports physical exams for high-risk athlete populations.
Masters Student Oral Presentations
Saturday 2nd March 2:30 - 3:15 PM, CD Room

Presentation 1

**Physical Activity Is Associated With Grit and Resilience in College Students: Is Intensity the Answer?**

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Physical activity (PA) has been positively associated with academic performance; however, as students transition from high school to tertiary education their PA levels often decrease. The transition to tertiary education is a substantial life event, requiring a combination of academic and social determinants to succeed. Little research has investigated the associations between PA and determinants of academic success, such as grit and resilience. PURPOSE: To determine the associations among PA, grit and resilience in undergraduate students. METHODS: Undergraduate students (n=244; 165 females, age 21.1±2.9 years) participated in an online survey. Self-reported PA was collected using the International Physical Activity Questionnaire. Grit was measured using the Short Grit Scale and resilience was determined with the Connor-Davidson Resilience Scale. Linear regression analyses were used to determine associations among grit, resilience, and PA. One-way ANOVAs were used to determine differences in grit and resilience across tertiles of PA. RESULTS: Vigorous PA was positively associated with resilience (β=0.17, p=0.01) and the perseverance of effort grit domain (β=0.19, p=0.004), while being negatively associated with the consistency of interest grit domain (β=-0.22, p=0.001). Moderate PA was associated with both grit domains (p≤0.03) but not resilience (p=0.38). Further, resilience (tertile 1: 34.1±5.5 vs. tertile 2: 36.8±4.9, p=0.005) and the perseverance of effort grit domain (tertile 1: 4.1±0.7 vs. tertile 3: 4.4±0.5, p=0.01) were significantly higher with increased vigorous PA. Consistency of interest grit domain scores (tertile 1: 2.9±0.9 vs. tertile 3: 2.6±0.8, p=0.04) were lower with higher levels of vigorous PA. There were no differences in grit and resilience across tertiles of moderate PA (p=0.05). CONCLUSIONS: Vigorous PA was positively associated with the perseverance of effort grit domain and resilience but negatively associated with the consistency of interest grit domain. Moderate PA was also associated with grit but not resilience in this cohort. The findings suggest that intensity of PA may play a role in grit and resilience levels in students. Future research may be beneficial to determine if participation in vigorous PA can increase grit or resilience in college students.

Presentation 2

**Thermoregulatory and Cardiovascular Response to Acute Passive Heat Exposure in Low-Level Spinal Cord Injury**


1University of Oregon, Eugene, OR; 2University of Colorado Boulder, Boulder, CO

Spinal cord injury (SCI), which impacts both the afferent and efferent pathways of the thermoregulatory system and impairs sympathetically mediated blood flow redistribution, may compromise the thermoregulatory and cardiovascular response to heat stress. However, because the magnitude of these impairments is related to the level of injury, heat stress may be well tolerated in individuals with low-level SCI. PURPOSE: To compare the thermoregulatory and cardiovascular adjustments to acute passive heat exposure (APHE) in individuals with low-level SCI and able-bodied (AB) individuals. METHODS: Four individuals (1F) with low-level SCI (T8-T11) and 8 AB individuals (4F) completed a one-hour APHE session in 40°C water. Skin red blood cell (RBC) flux, rectal temperature (T_r), cardiac output (Q) (open circuit acetylene uptake), and brachial mean arterial pressure (MAP) were measured during baseline rest and throughout APHE. RBC flux, measured at two sites on the ventral forearm (laser Doppler flowmetry), was divided by MAP to calculate cutaneous vascular conductance (CVC). Local heating to 44°C was performed following APHE, and data are presented as a percentage of maximal CVC (% CVCmax). Data are reported as mean ± SEM. Statistical analyses were conducted via unpaired t-tests. RESULTS: CVC was similar between groups at baseline (SCI: 11 ± 6% CVCmax and AB: 9 ± 2% CVCmax, P = 0.54) and was similarly increased by 60 min APHE (both SCI and AB: 48 ± 4% CVCmax, P = 0.94). T_r was similar between groups at baseline (SCI: 36.98 ± 0.31°C and AB: 37.36 ± 0.11°C, P = 0.17) and after 60 min APHE (SCI: 38.45 ± 0.19°C and AB: 38.54 ± 0.08°C, P = 0.63). Q, was similar between groups at baseline (SCI: 5.92 ± 0.35 L·min⁻¹ and AB: 5.31 ± 0.24 L·min⁻¹, P = 0.17) and was similarly increased by 60 min APHE (SCI: 8.70 ± 0.95 L·min⁻¹ and AB: 9.80 ± 0.51 L·min⁻¹, P = 0.29). MAP was similar between groups at baseline (SCI: 85 ± 3 mmHg and AB: 85 ± 2 mmHg, P = 0.95) and was similarly reduced throughout heating (SCI: 74 ± 3 mmHg and AB: 77 ± 4 mmHg by 60 min APHE, P = 0.63). CONCLUSION: Individuals with SCI and AB individuals initiate similar increases in skin blood flow above the lesion level and cardiac output in response to whole-body heat stress, allowing both groups to maintain T_r and MAP within safe ranges during a one-hour APHE session.

American Heart Association 16GRNT31330014
Presentation 3

TOTAL ENERGY INTAKE AND SELF-SELECTED MACRONUTRIENT DISTRIBUTION DURING WILDLAND FIRE SUPPRESSION
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Wildland firefighters (WLFF) are required to work long hours in extreme environments resulting in high daily rates of total energy expenditure (TEE) (Ruby, 2002; Cuddy, 2015). Increasing the number of eating episodes throughout the workshift and/or providing rations that better promote convenient nutrient delivery (Cuddy, 2007; Montain, 2008) has been shown to augment self-selected work output on the fireline. Regular consumption of supplemental carbohydrate (CHO) has also demonstrated enhanced work output, particularly during the shifts’ latter hours (Cuddy, 2007). However, it remains unclear how current feeding strategies of WLFF compare to more frequent nutrient delivery. PURPOSE: The aim of the current study was to determine the self-selected field total energy intake (TEI), composition and patterns of WLFF feeding during wildland fire suppression shifts. METHODS: 86 WLFF (16 female, 70 male; 27.5±6.4 yrs) were deployed to 12 different wildland fire assignments across six regions of the US during the 2018 fire season. Pre- and post-shift food inventories were collected at WLFF basecamp and provided item-specific nutrient content (calories [kcal], CHO, fat, protein). Workshift nutrient consumption (TEI, feeding frequency [total number of and interval between feeding episodes), feeding episodic composition) was monitored in real-time by field researchers on the fireline via observational data capture in mobile tablets. RESULTS: Workshift length averaged 14.0±1.2 hr, with a TEI of 1523±639 kcal (51±10, 37±9, 14±5 % for CHO, fat, and protein, respectively). The total number of eating episodes was 4.3±1.7 with an average interval of 117±76 min. Eating episodes averaged 346±311 kcal and included 44±38 g CHO. Using similar intake metrics, TEI was 893±353 and 1356±560 kcal for breakfast and dinner, respectively. CONCLUSION: The present workshift TEI approximates 34% of the TEE compared to our prior doubly labeled water studies (Ruby, 2002; Cuddy 2015). These data also demonstrate that WLFF consumption patterns using current rations may not deliver adequate nutrients for the occupational demands of WLFF. Future work should elucidate the impact of workshift provisions on overall patterns of self-selected work output.

Supported by National Technology & Development Program, USDA Forest Service

Presentation 4

KNOWLEDGE OF HEART DISEASE AND INDICES OF PHYSICAL ACTIVITY IN HEALTH AND NON-HEALTH BASED MAJORS
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Cardiovascular disease (CVD) is the leading cause of mortality and is associated with modifiable lifestyle factors, such as physical activity (PA). Research has examined CVD knowledge (CVDK) and PA level in undergraduate students; however, no research has examined the relationship between CVDK and PA in this group. PURPOSE: To examine differences in CVDK and indices of PA between sex and major (health (HB) or non-health (NHB) based) and potential associations between CVDK and PA. METHODS: Students (N=241) completed an online survey including the 30-item Heart Disease Knowledge Questionnaire and 7-item International Physical Activity Questionnaire. Twenty-four outliers were removed prior to statistical analyses (n=217; 21±1.2 yrs; 145 females, 141 HB majors). Independent samples t-tests were conducted to test for differences in total (TK), dietary (DK), epidemiological (EK), medical (MK), risk factor (RFK), and symptom (SK) knowledge, as well as weekly frequency and duration of moderate PA (MPA), vigorous PA (VPA), and total MET-min/week of MVPA between sex and major. Alpha was adjusted for multiple comparisons. Pearson’s r was used to test for linear associations between TK and PA indices. RESULTS: Sixty-seven percent of students met recommended PA guidelines with a minimum of 500 MET-min/week of MVPA. Females had greater RFK than males (4.6±1.6 vs. 4.0±1.6, p=0.006). HB majors had significantly higher TK (18.4±5.0 vs. 15.3±5.3, p<0.001), DK (3.7±1.7 vs. 3.1±1.9, p=0.007), EK (2.8±1.1 vs. 2.4±1.2, p=0.006), MK (4.4±1.5 vs. 3.3±1.4, p<0.001), and RFK (4.6±1.6 vs. 3.9±1.5, p=0.002) than NHB majors. There were no significant differences in SK between majors (p>0.05). Males reported significantly higher levels of MVPA than females (2300.7±2377.7 vs. 1441.9±1348.6 MET-min/week, p<0.01). There were no associations between TK and any PA index (p>0.05). CONCLUSION: HB majors had greater knowledge than NHB majors in all areas except SK; however, there were no differences in PA levels between majors. This suggests that CVDK may not translate to increased PA levels in undergraduates. Future research should investigate relationships between CVDK and risk reduction behaviors in this population.
Presentation 1

**COMPARISON OF MULTI-FREQUENCY BIOELECTRICAL IMPEDANCE ANALYSIS AND AIR DISPLACEMENT PLETHYSMOGRAPHY FOR ASSESSMENT OF BODY COMPOSITION**

University of Idaho, Moscow, ID

Multi-frequency bioelectrical impedance analysis (MF-BIA) is widely used for body composition assessment; however, few studies have assessed the accuracy of MF-BIA. **PURPOSE:** To examine the agreement between MF-BIA and air displacement plethysmography (BOD POD) for the assessment of body fat percentage (BF%), fat mass (FM) and fat free mass (FFM) in middle- and older-aged adults. **METHODS:** 28 women (age 52.4 ± 9.2 y; body mass index 25.7 ± 4.6 kg·m⁻²) and 15 men (age 50.1 ± 12.4 y; body mass index 25.5 ± 4.1 kg·m⁻²) participated in the study. BF%, FM and FFM were estimated using MF-BIA (InBody 770) and BOD POD. Agreement was assessed using intraclass correlation coefficients (ICC) and Bland–Altman analyses. One-sample t-tests and linear regressions were used to evaluate systematic and proportional bias, with limits of agreement defined as standard deviation multiplied by 1.96. **RESULTS:** ICC demonstrated there was a strong relationship between the methods for BF% (men ICC = 0.86; women ICC = 0.96), FM (men ICC = 0.94; women ICC = 0.99), and FFM (men ICC = 0.92; women ICC = 0.90, p<0.01 for all). Bland-Altman analyses indicated acceptable agreement between MF-BIA and BOD POD; however, there was significant systematic bias. On average, MF-BIA underestimated BF% (2.0%, 95% CI[1.2 to 2.8]) and FM (1.5 kg, 95% CI[0.8 to 2.1]), and overestimated FFM (-1.5 kg, 95% CI[-2.2 to -0.9]). There was significant proportional bias in FFM (β = -0.41, p < 0.01), indicating as FFM increased, the difference between methods decreased. There was a significant trend for the differences of FFM in men (β = -0.61, p = 0.02); whereas in women, significant trends existed for %BF (β = -0.40, p = 0.04) and FM (β = -0.40, p = 0.03). **CONCLUSION:** Overall, there was acceptable agreement between MF-BIA and BOD POD for all body composition parameters. However, there was significant proportional bias, with differences between men and women. These findings indicate that MF-BIA may be a suitable alternative for assessment of body composition. Future research should utilize a larger sample size to confirm these results.

Supported by InBody USA.

Presentation 2

**ANTIHISTAMINES INCREASE LEG BLOOD FLOW DURING EXERCISE**

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Histamine mediated vasodilator pathways elevate microcirculatory blood flow during inflammation and immune responses as well as skeletal muscle blood flow following endurance exercises. During exercise, intramuscular histamine concentration increases, however, the contribution of histamine to exercise hyperemia is unknown. The production of intramuscular histamine is reported to be positively correlated with exercise intensity and duration. Therefore, elevations in intramuscular histamine may contribute to skeletal muscle blood flow as exercise increases in intensity and duration. **PURPOSE:** To compare limb blood flow during a ramped increase in exercise intensity before and after prolonged exercise under normal conditions and when histamine signaling is blocked. It was hypothesized that H₁/H₂ antagonists would decrease limb blood flow and the effect would be greater at high exercise intensities and following prolonged exercise. **METHODS:** Sixteen (7F) volunteers performed unilateral knee-extension exercise after consuming either Placebo or histamine (H₁/H₂) receptor antagonists (Blockade). The exercise consisted of two incremental ramp protocols at 20, 40, 60, and 80% of peak work rate, which were separated by 60 min of knee-extension exercise (60% of peak). Femoral artery blood flow (Logiq e9, GE Medical Systems) was measured during each exercise intensity and every 10 min during the 60 min of prolonged exercise. Data were analyzed with a 3-way RM ANOVA and are presented as Means±SEM. **RESULTS:** Femoral artery blood flow increased with exercise intensity from 1676±57, 2008±68, 2272±75, to 2660±97 ml/min at 20, 40, 60 to 80% of peak work rate during Placebo (P<0.05). Blood flow was further elevated with Blockade 1750±79, 2155±88, 2542±88, to 2836±124 ml/min (P<0.05) but was not different before versus after the 60 min exercise bout (P=0.129). Femoral blood flow was constant over the 60 min of knee-extension exercise in both Placebo (2533±43 ml/min) and Blockade (2823±32 ml/min) but was significantly elevated with Blockade over Placebo (+291±26 ml/min)(P<0.05). **CONCLUSION:** Contrary to the hypothesis, these results suggest that blocking histamine’s actions during exercise, regardless of the intensity or duration, increased skeletal muscle blood flow.

Support provided by: The Eugene & Clarissa Evonuk Memorial Graduate Fellowship
Regional body fat deposition, particularly visceral fat, may be an important mechanistic link between sedentary behavior and cardiometabolic disease risk with advancing age. **PURPOSE:** To examine the associations of sedentary behavior and screen time with total, visceral, and segmental body fat in middle- to older-aged adults. **METHODS:** 71 adults (mean±SD: age 52.9±10.6 y; body fat 29.2±10.3%; men 35.2%) self-reported sedentary behavior and moderate-to-vigorous physical activity (MVPA) using the Sedentary Behavior Questionnaire and International Physical Activity Questionnaire, respectively. Leisure screen time was defined as television viewing, video games and computer games. Total, visceral, and segmental body fat were estimated with the InBody770 multi-frequency bioelectrical impedance analyzer. Waist circumference was measured at the top of the iliac crest. Multiple regression was used to assess the associations of sedentary behavior and screen time with total and regional fat distribution, controlling for covariates. **RESULTS:** Average sedentary time was 7.3±2.3 h·d⁻¹ with 1.3±0.9 h·d⁻¹ reported as screen time. Sedentary time was associated with total fat mass (R²=0.14, β=0.28, p=0.02), visceral fat (R²=0.16, β=0.27, p=0.02), trunk fat (R²=0.13, β=0.31, p<0.01), leg fat (R²=0.19, β=0.25, p=0.03) and waist circumference (R²=0.23, β=0.34, p<0.01) independent of age and sex. When MVPA was added to the model, trunk fat (R²=0.13, β=0.28, p=0.03) and waist circumference (R²=0.24, β=0.29, p=0.02) remained significant. Screen time was associated with total fat mass (R²=0.13, β=0.25, p=0.03), visceral fat (R²=0.15, β=0.25, p=0.03), trunk fat (R²=0.11, β=0.29, p=0.01) and waist circumference (R²=0.22, β=0.32, p<0.01) independent of age and sex, with the associations of total fat mass and visceral fat attenuated after accounting for MVPA. **CONCLUSIONS:** Our findings suggest self-reported sedentary behavior and screen time are independently associated with the accumulation of excess total body fat, visceral fat, and fat within the trunk in middle- to older-aged adults. However, the association between sedentary behavior and visceral fat was attenuated by MVPA, indicating MVPA may be important for preventing the accumulation of visceral fat.

Supported by InBody USA.

**BILATERAL LOWER EXTREMITY ASYMMETRIES IN INDIVIDUALS POST-ACLR DURING HIGH-RISK TASKS**

**J.A. Ter Har¹, JJ Hannigan², C.D. Pollard¹,²**

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Individuals who undergo anterior cruciate ligament reconstruction (ACLR) are approximately 15 times more likely to suffer a second anterior cruciate ligament injury, but the underlying reason for this phenomenon is unclear. Recent research has shown that individuals post-ACLR exhibit kinematic limb asymmetries during running and various hop tests. However, few studies have assessed limb asymmetry post-ACLR during a high-risk task such as cutting and drop-landing. **PURPOSE:** To assess kinematic asymmetry between ACLR and healthy limbs during a cutting and drop-landing task. **METHODS:** Subjects consisted of 12 individuals post-ACLR (seven females and five males) who were cleared by their orthopedic surgeon to return to full activity. Subjects ran down a 7-meter runway and performed a 45-degree cutting maneuver in the direction opposite to their planting limb. This task was performed for the right and left limb. Subjects then performed a drop-landing task by dropping down off a box and then immediately performing a maximal effort vertical jump. Four successful trials of each task were collected using an 8-camera 3D motion analysis system (250 Hz) and software was used to calculate joint kinematics. Paired t-tests compared kinematics between limbs for both tasks (α = 0.05). **RESULTS:** During the cutting task peak hip flexion was significantly greater in the non-surgical limb (p = 0.029), and a trend for greater peak knee flexion was found in the non-surgical limb (p = 0.068). Sagittal plane excursions were also greater at the hip (p < 0.01), knee (p = 0.041), and ankle (p = 0.019) in the non-surgical limb. During the drop-landing task there was a trend for greater sagittal plane excursion at the knee (p = 0.08) and ankle (p = 0.055) in the non-surgical limb. Combined sagittal angle excursion of the hip, knee, and ankle were greater for the non-surgical limb during the cutting task (p < 0.01) and a similar trend was seen during the DVJ task (p = 0.057). **CONCLUSION:** These findings support that asymmetries exist between ACLR and healthy limbs after returning to full activity, especially during a cutting task. The magnitude of the asymmetries seems to be single-limb task specific. This avoidance behavior of the surgical limb suggests that further rehabilitation is necessary in these ACLR individuals in an effort to reduce their risk of re-injury.
UNDERGRADUATE STUDENT PRESENTATIONS

Board 1

ACCURACY OF A WRIST-WORN ACTIVITY MONITOR DURING RESISTANCE TRAINING EXERCISES AT DIFFERENT MOVEMENT SPEEDS

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Speed of movement can affect the accuracy of objective physical activity (PA) monitors. It is likely that speed of movement could affect the accuracy of accelerometer-based PA monitors during other types of exercise. PURPOSE: To assess the ability of the Atlas Wearables Wristband2, an accelerometer-based PA monitor developed specifically for resistance training (RT), to identify the individual RT exercise type and count repetitions during RT exercises at various movement speeds. METHODS: Male and female participants (n=50) aged 18-55 yrs were recruited for this study. Each participant wore an Atlas Wearables Wristband2 on his/her left wrist. Participants completed seven sets of ten repetitions for five different upper/lower body RT exercises (barbell bench press, dumbbell (DB) bent-over row, DB calf raise, DB overhead triceps extension, and DB bicep curl) using a self-selected, light weight. The speed of each set was randomized and completed at a different metronome-paced cadence ranging from a slow cadence of 4 s/rep to a fast cadence of 1 s/rep (sets differed by 0.5 s/rep increments). Percentage of correct activity type identification and repetition counting were calculated. In addition, mean absolute percent error (MAPE) and bias were calculated for repetition counting. One-way ANOVAs were used to compare the actual exercise type/number of repetitions between the seven different speeds. RESULTS: For each exercise, there tended to be significant difference between the slower speeds and the fastest speed for activity type identification and repetition counting (p<0.05). Overall across all exercises, the highest accuracy for activity type identification and repetition counting and the lowest MAPE and bias occurred during the 1.5 s/rep speed (the second fastest speed tested). CONCLUSIONS: The accuracy of the Atlas Wearables Wristband2 to identify exercise type and count repetitions varied based on the speed of movement during RT exercises. Overall, the exercise type and repetition count accuracy tended to improve as the speed of movement increased up to 1.5 s/rep. The results of this study suggest that researchers using this device should train participants to complete prescribed exercises at specific speeds for the highest accuracy in identifying exercise and counting repetitions during RT exercise.

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FUNCTIONAL MOVEMENT SCREEN NORMATIVE VALUES IN DIVISION III COLLEGIATE ATHLETES

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While much data is available regarding Functional Movement Screen (FMS) scores in corrective exercise programs and injury prevention, limited data exists regarding comparisons between movement patterns in various sports. Having normative data on a variety of functional movement patterns can allow coaches to properly assess their team’s strengths and weaknesses in movement to tailor training programs accordingly. PURPOSE: the purpose of this study was to review FMS scores to find any mobility and stability differences between several NCAA Division III varsity teams. METHODS: 83 healthy student-athletes (63 males: 20.04 ± 1.4 years, 81.7 ± 14.9 kg, 179.2 ± 26.6 cm; 20 females: 19.4 ± 1.3 years, 64.1 ± 13.7 kg, 167.8 ± 19.1 cm) from 4 different NCAA Division III varsity teams were recruited as participants. Men’s and women’s basketball (MBB, WBB), women’s lacrosse (WLAX), and baseball (BB) performed a battery of tests to measure physical capabilities prior to the beginning of their competitive season. All players were injury-free during the time of testing. All participating student-athletes performed the FMS, which is a tool used to gauge fundamental movement patterns including range of motion, stability and balance, to measure movement asymmetries and limitations consisting of seven low-intense bodyweight movements. Scores for individual screens were recorded and an analysis of variance was utilized to determine differences between teams and genders. RESULTS: Between genders, male student-athletes scored significantly higher than females in the average composite scores (p < 0.01); Both women’s teams scored higher in hip mobility than MBB only (p < 0.01). Between the male teams only, BB displayed significant higher average composite scores compared to MBB (p < 0.01). Between the female teams, WLAX scored significantly higher only in the rotary stability screen than WBB (p = 0.01). CONCLUSION: this study provides normative data concerning movement quality in select NCAA Division III student-athletes. The data comparing the men’s and women’s teams was atypical. The data presented can provide coaches with standards for movement to guide individualized exercise programs as well as general knowledge regarding movement patterns between different sports teams.
Postural interventions, such as a power pose, have been shown to elicit both physiological and psychological responses including elevated testosterone, decreased cortisol, as well as increased confidence and risk-taking behavior. Previous studies have shown that increases in testosterone may lead to greater force production in muscle. PURPOSE: This study investigated whether postural intervention, specifically a power pose, could increase isometric force production. METHODS: 21 males, 18 to 22 years old, participated. During their first visit to the lab, subjects were familiarized with the isometric mid-thigh pull (IMTP) protocol which consisted of three six-second IMTPs each separated by 60 seconds rest. During their second and third visits to the lab, subjects were shown an example of a postural intervention (either a power pose (PP) or a neutral pose (NP)), then asked to hold that pose for one minute after which they immediately completed the IMTP protocol. The order of postural intervention was counterbalanced between the second and third visits to the lab. All IMTP protocols were performed on a force platform recording vertical ground reaction force. Peak force (PF) was the highest recorded force value during each six-second IMTP, average force (AF) was the mean force produced during each IMTP and explosiveness (EXP) was determined by the slope of the force increase in the initial 0.2 seconds of each IMTP. PF, AF, and EXP were averaged from the three IMTPs for each subject for each condition. A paired samples t-test compared PF, AF, and EXP between the two postural interventions. A repeated-measures ANOVA determined if an order/learning effect existed for the three visits regardless of intervention. (IBM SPSS v24, significance at p<0.05). RESULTS: No significant differences were found between the two conditions for PF (PP: 1042.5±318.7 N vs. NP: 1046.6±350.5 N, p=0.837), AF (PP: 874.8±315.2 N vs. NP: 885.2±320.8 N, p=0.560), or EXP (PP: 2903.7±1379.2 N/s vs. NP: 2917.4±1543.2 N/s, p=0.938). There was no order/learning effect for PF, AF, or EXP (p=0.949, p=0.963, p=0.833, respectively). CONCLUSION: While power posing might affect a person psychologically, the current study provides no evidence that postural intervention leads to increased isometric force production.

Bikram yoga has seen a new wave of popularity in recent years, claiming that it improves fitness. While several studies have investigated potential health benefits of hot (HOT) and room-temperature (RT) Bikram yoga, variables such as range of motion (ROM), heart rate (HR), blood pressure (BP) and blood lactate have not been directly compared between Bikram and RT yoga. PURPOSE: The purpose of this study was to investigate the physiological effects of Bikram yoga compared to RT yoga in healthy young adults. METHODS: 7 males and 6 females participated in this study. The participants completed 2, 45-minute sessions of an instructor led standardized Bikram yoga video, one week apart, in random order. One session was performed in a hot environment (~41°C), and the other in a RT (~20°C) environment. Immediately prior to and following each yoga session, ROM of the quadriceps and hamstrings, HR, BP, and blood lactate were measured ROM of the hamstrings and quadriceps were measured with an inclinometer. HR and BP were measured with an automated sphygmomanometer. Blood lactate was measured with a handheld lactate analyzer. All dependent measures were compared using separate 2 x 2 repeated measures ANOVA tests. RESULTS: No significant differences for HR and BP were observed for condition x time (p > 0.05). There were no significant differences for quadriceps ROM, hamstrings ROM between conditions (p > 0.05). However, there were significant pre- to post-intervention improvements in both conditions for quadriceps ROM (F(1,12) = 17.375, p = 0.001; HOTpre: 160.64 ± 8.98°; HOTpost: 166.67 ± 9.30°; RTpre: 156.32 ± 10.36°; RTpost: 162.42 ± 10.18°) and for hamstring ROM (F(1,12) = 17.034, p = 0.001; HOTpre: 108.80 ± 21.63°; HOTpost: 117.80 ± 18.80°; RTpre: 107.40 ± 15.89°; RTpost: 117.44 ± 18.17°). Additionally, there was a significant interaction for condition x time for BL (F(1,12) = 8.893, p = 0.011) with significant pre-post increases in BL observed for HOT (HOTpre: 1.88 ± 0.70 mmol/L, HOTpost: 3.45 ± 1.97 mmol/L; p = 0.019), but not for RT (RTpre: 2.53 ± 1.73 mmol/L, RTpost: 2.63 ± 0.99 mmol/L; p = 0.789). CONCLUSION: HOT and RT Bikram yoga elicited similar physiological responses, with the exception of BL. However, the small sample sizes, presence of confounding variables, and limited evidence for yoga-BL effects warrant further research in this area.
BIOMECHANICAL FACTORS ASSOCIATED WITH INJURY DURING A 6-WEEK TRANSITION TO MAXIMAL SHOES – A CASE SERIES  
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Over the course of a research study examining the effect of a 6-week transition to maximal shoes on running biomechanics, two female participants withdrew due to injury: one with Achilles tendinopathy (AT), the other with Medial Tibial Stress Syndrome (MTSS). PURPOSE: To examine the biomechanical factors at initial testing that may have led to injury and subsequent withdrawal from the study. METHODS: For the larger study, running biomechanics were examined prior to and following a six-week transition to maximal shoes in twenty-eight recreational runners. Ankle kinematics and vertical ground reaction forces (vGRF) were examined using an 8-camera three-dimensional motion capture system and two force platforms in two shoe conditions: maximal footwear (rearfoot: 37 mm, forefoot: 33mm) and traditional footwear (rearfoot: 33 mm, forefoot: 23 mm). Two participants were unable to complete the full study due to injury during the six-week transition. One participant (MTSS, 38 years old) described “tightness in shins and ankles” while wearing the maximal shoe within the first week, which progressed to sharp pain in the right medial tibia during the fourth week. The other participant (AT, 46 years old) began experiencing an “ache” in their left Achilles tendon in week one, and by week five, could no longer run or walk without pain while wearing the maximal footwear. RESULTS: Both cases demonstrated prolonged eversion during stance phase in the maximal shoe (AT & MTSS: 99% of stance phase), which was longer than in the traditional shoe (AT: 80% of stance phase; MTSS: 95% of stance phase). Further investigation of vGRF data revealed the loading rate of the participant with MTSS (82.75 BW/s) was slightly lower, while that of the one with AT (59.78 BW/s) was significantly lower than the average for the healthy participants (85.85 BW/s), further implicating prolonged eversion as a factor for injury. CONCLUSION: Prolonged eversion has been previously cited as a risk factor for developing both AT and MTSS. Because prolonged eversion was higher in the maximal shoe for both participants who developed these injuries, it is possible the maximal shoe was a contributing factor for injury. Further research on the relationship between maximal footwear and injury is warranted.

Research supported by Oregon State University - Cascades Campus

THE EFFECTS OF BALNEOTHERAPY ON EXERCISE RECOVERY  
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Previous research has mixed results on the effects of balneotherapy on the basis of exercise recovery. PURPOSE: To determine if balneotherapy effects performance of either a 20-minute Functional Threshold Power (FTP) test or 20-minute run test. METHODS: A study comprising 16 participants ranging from 19-45 yrs. was conducted. Participants completed either an FTP cycling test or a 20-minute maximal effort running. Testing was performed in a heat chamber at temperature 27.4±1.61℃ and humidity 25.3±4.626%. After exercise testing, subjects were given either a placebo (PLA) or a proprietary blend (PB) of minerals and essential oils to soak. Subjects returned the following day and repeated the exercise testing. The process was then repeated in a crossover design after a minimum 3 days of recovery. Treadmill and cycling group changes in PLA (ΔPLA) distance (miles) pre vs post soak were compared with changes in PB (ΔPB) distance pre vs post soak using a paired t-test. RESULTS: There were no differences in distance for treadmill group between ΔPLA (-0.058±0.317 mi) and ΔPB (0.015±0.116 mi, p=0.686). Additionally, there were no differences in distance for cycling group between ΔPLA (0.020±0.084 mi) and ΔPB (0.200±0.520 mi, p=0.438). CONCLUSION: Balneotherapy does not increase performance over a placebo when completing back to back exhaustive FTP or 20-minute run tests. Future research should consider longer work periods and increased length of study.
THE RELATIONSHIP BETWEEN MUSCLE ACTIVATION AND HANDWRITING QUALITY WITH DIFFERENT GRIP STYLES

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PURPOSE: This study aimed to evaluate differences in handwriting characteristics when using the four primary handwriting grip styles: dynamic quadrupod (DQ), dynamic tripod (DT), lateral quadrupod (LQ) and lateral tripod (LT). It was hypothesized that different writing styles would alter muscle recruitment, writing legibility, and consistency. METHODS: Thirty-four 18-22-year-old subjects underwent three protocols involving tests of handwriting legibility, consistency, and metrics. The legibility test was conducted on paper. The consistency and metrics protocols included surface electromyography (EMG) to measure the activity of 6 muscles involved in handwriting and were performed on a digital writing tablet. The tablet was used to measure stroke duration, length, velocity, and pen pressure. Subjects used each grip style with all protocols, and scores were normalized to their native grip scores. Grip styles were compared using RM ANOVA, t-tests, and correlations to evaluate relationships (p<.05 was significant, p>.10 was considered a trend). RESULTS: Females had a lower range in legibility scores than males by 3.483% ± 1.676% (p=.046), but grip style did not impact legibility. The upper trapezius (UT) was more active in the lateral grips compared to DT by 15.9% ± 5.2% and by 14.6% ± 3.7%, respectively (p=.028, p=.004, respectively). DT had more extensor carpi ulnaris activity than LT by 9.7% ± 3.3%, (p=.011). CONCLUSION: Females are likely to be able to use any grip style with little effect on legibility, but males’ legibility scores may drop more. This implies that in rehabilitation, females may be able to adapt to any grip style, but males may benefit from using dynamic grip styles rather than laterals. As suggested by elevated UT activity, lateral grip styles involve more whole-arm, stabilizing movements, suggesting that in rehabilitation, a patient with little gross muscle activation, such as the UT, may benefit from a dynamic grip style to regain handwriting ability or use lateral grip styles to build muscle tone. Increased ECU activity implied that dynamic grip styles require fine dexterous movements. In rehabilitation, patients with poor dexterity may be advised to avoid DT or use it to improve precision. The characterization of the primary grip styles provides useful information for patient rehabilitation.

DIETARY INTAKE OF COLLEGIATE NCAA FOOTBALL PLAYERS: DIVISION I VS. DIVISION III.

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Poor nutrition in college football players may lead to an increased risk of metabolic syndrome associated conditions. The institution may influence dietary choices. PURPOSE: The purpose of this study was to compare the dietary intake of in season division I (DI) and III (DIII) collegiate football players. METHODS: A total of 31 players, 15 DI (19, 19 - 23 yr) and 16 DIII (19, 19 - 20 yr) completed testing in the fall. Variables collected for this study included height, weight and a 24-hour diet recall. A 5-pass interview method was used to collect nutrition data which was processed using the ESHA Food Processor program. Data were compared using an independent t-test. A Pearson r correlation test was used to examine relationships between variables. This study was approved by the Linfield College Institutional Review Board. RESULTS: There were no significant differences between body mass index (BMI, DI: 28.08 ± 4.53, DIII: 28.36 ± 3.36 kg/m²), total caloric intake (DI: 4708 ± 1662, DIII: 4530 ± 1695 kcal), carbohydrate, fat, water, fiber, or micronutrient intake. However, DI players were taller (DI: 1.87 ± 0.07, DIII: 1.82 ± 0.05 m, p = 0.04) and consumed a higher percentage of calories from protein (DI: 21.04 ± 4.74, DIII: 17.54 ± 3.53 % kcal, p = 0.03). Using BMI, 67% of DI and 81% of DIII players were classified as overweight, specifically, 19% of DI and 40% of DIII players were classified as obese. Additionally, 75% of all players were overweight while 30% were classified as obese. There was a significant negative correlation of BMI with both fiber intake (36.16 ± 18.16 g, r = -0.442, p = 0.02) and relative protein consumption (2.34 ± 1.26 g/kg, r = -0.554, p < 0.001).

DISCUSSION: There were no differences based on institution. All players met or exceeded the Dietary Reference Intakes (DRI) for macronutrients and micronutrients except for carbohydrate and potassium. Of concern, is the amount of cholesterol and sodium in the players diets. Some of the data suggests that higher BMI is correlated with poor diet choices. BMI alone is not an accurate measure for health risk in football players and future analysis will include body composition. Regardless of division classification, athletes should work with coaches, trainers, and registered dietitians to maximize performance and decrease metabolic syndrome associated health risks.

Supported by Linfield College Student Faculty Collaborative Research Grant.
Resistance training (RT) is an important part of the 2018 Physical Activity Guidelines for Americans. Until recently, methods to objectively assess RT exercises have been limited. The Atlas Wearables Wristband2 is an accelerometer-based activity monitor that is capable of identifying individual RT exercises and detecting the number of repetitions, but its inter-monitor reliability has not been investigated. PURPOSE: To determine the inter-monitor reliability of the Atlas Wearables Wristband2 monitor for exercise type identification and repetition counting and to assess the impact that various participant characteristics may have on the inter-monitor reliability. METHODS: Male and female participants (n=62) aged 18-55 yrs were recruited for this study. Each participant wore two Atlas monitors on the left wrist and performed 12 repetitions of 14 different resistance training (including dumbbell, machine, and body weight) exercises using self-selected weight. Inter-monitor reliability was assessed by calculating the percent agreement for each exercise type and for number of repetitions measured between both monitors. Sub-analyses were also completed for reliability by gender, RT experience, and height. Percent agreement and mean absolute percent error were calculated for each activity. Independent t-tests were conducted to assess subgroup comparisons. RESULTS: Overall, the inter-monitor reliability between the two monitors was 80.4±1.3% agreement for exercise type and 59.6±2.2% agreement for number of repetitions. Mean absolute percent errors for repetition counting were low (<1.5 reps) for all 14 exercises. Overall, there were no significant differences in exercise type identification or repetition counting when the data were assessed by gender, RT experience, or height. CONCLUSION: The inter-monitor reliability of the Atlas Wearables Wristband2 was high for exercise type agreement. However, the agreement between monitors when measuring repetitions was slightly lower. The lack of differences in reliability by gender, RT experience, height is encouraging as it suggests similar device reliability across different populations.

PURPOSE: It is of interest to determine if companionship during exercise decreases perceived exertion (RPE) and increases performance. METHODS: Twenty-one subjects completed two 20-minute bouts of stationary biking exercise at 75% of their age-predicted max heart rate. Blood pressure (BP), heart rate, RPE, and distance were measured before, during, and after each trial. Solo and companion trials were separated by at least 24 hours. Differences in RPE, distance traveled, and BP were compared between trials using paired t-tests. Repeated measures ANOVA analyses were used to assess changes in RPE at different points within each trial and between trials. RESULTS: There were no significant differences for RPE (p = .200) or total distance traveled (p = .933) between the companion (8.2 ± 2.6 km) and solo (8.2 ± 2.4 km) trials. Although not significant, RPE during the companion trial decreased over time (12.6 ± 1.8) for the females and increased for the males (11.0 ± 1.7), but during the solo trial, males decreased (11.6 ± 1.0) and females increased (12.7 ± 1.3). Post-exercise Activation-Deactivation Adjective Checklist (AD-ACL) scores for energy and tiredness were not significant overall, but females reported post-exercise AD-ACL tiredness scores that were higher during the companion trial (p = .047, 1.8 ± 0.6) while males reported post-exercise AD-ACL energy scores that were higher during the companion trial (p = .015, 3.1 ± 0.4). CONCLUSION: Contrary to the initial hypothesis, the presence of an exercise companion while exercising was neither a positive or negative psychological distraction, as there was no overall significant change in exercise performance or RPE between the trials, although subtle relationships existed within the data to suggest that exercising with a companion felt easier for females and harder for males.
ASSESSMENT OF SPEED, POWER, FLEXIBILITY, STRENGTH AND MUSCLE MASS IN COLLEGIATE BASKETBALL PLAYERS
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Speed, agility, strength and power are key factors to success in collegiate basketball. Coaches, trainers, staff, and players design training and practice sessions to maintain fitness and peak during conference competition. PURPOSE: To assess how practice and in-season competition affect overall fitness and body composition in men and women collegiate basketball players. METHODS: Adult male basketball players (N=12; 21 ± 0.71 yr; 74.25 ± 3.54 in; 84.25 ± 12.69 kg) were assessed on hand grip strength (HGRI: 47.39 ± 6.8, HGLO: 50.52 ± 9.00 kg) using a portable hand dynamometer, agility (TT: 8.37 ± 0.49 s) using a t-test, flexibility (VS: 4.17 ± 2.72 in) using a v-sit test, vertical jump height (VJ: 27.8 ± 2.80 in) using an electronic timing mat, and estimation of muscle mass using limb girths and skinfolds (MM: 6.99 ± 1.24, MMQuad: 46.66 ± 8.25 kg) after four weeks of a conditioning (T1). At the same time, adult female basketball players (N=11; 20.36 ± 1.63 yr; 71.91 ± 10.12 in; 71.91 ± 10.12 kg) were assessed for identical measures (HGRI: 38.27 ± 3.71 kg, HGLO: 3.66 ± 2.46 kg, TT: 11:11 ± 0.62 s, VJ: 19.35 ± 2.22 in, TT: 5.32 ± 0.97 s, MM: 35.47 ± 6.36, MMQuad: 41.52 ± 3.21 kg). All participants were re-assessed for each variable after 4 weeks of regular practice sessions (T2). A repeated measures ANOVA was used to compare T1 to T2 within genders. In addition, a matrix correlation was calculated between all variables within gender groups. RESULTS: Male participants experienced a decrease in body weight 84.25 ± 12.69 kg vs. 80.71 ± 12.11 kg (p<0.00) from T1 to T2. Female participants decreased in TT 11:11 ± 0.62 vs. 10:46 ± 0.49 s (p=0.03) and increased in flexibility (p= 0.04) in T1 vs. T2. All other variables for both genders remained unchanged. As expected, data analysis revealed a strong relationship between MM, MMQuad, height and weight for both genders. VJ height was correlated with flexibility in males (r=0.84) at T1. No other strong relations were revealed for any gender at either T1 or T2. CONCLUSION: These data are part of a larger assessment that will re-evaluate these measures post-season. As men and women training programs were unique, differences between groups during assessment periods cannot be compared. A similar in-season training and competition schedule may reveal possible gender differences between groups.

REduced PEAK FLOW and VO2 MAX in INDIVIDUALS WITH EXERCISE INDUCED ASTHMA
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Exercise Induced Asthma (EIA) is the narrowing of the airways due to smooth muscle contractions and mucus build-up initiated by inflammatory mediators during exercise. PURPOSE: To examine the peak flow and maximum amount of oxygen uptake (VO2 max) in individuals with EIA compared to healthy individuals. METHODS: Participants with EIA (n=3) and healthy controls (n=3) participated in a 1.5 Mile Cooper Run Test. All tested individuals were female, college students (18-22 years old), who are currently or had previously participated in collegiate athletics. Participants’ peak flow and heart rate (HR) were measured pre-run and post-run. Data was collected from a questionnaire which included age, sex, height, weight, EIA diagnosis, and the last time their inhaler had been taken. VO2 data was collected using an equation that accounted for sex, weight (kg), and run time (mins). RESULTS: Individuals with EIA on average had a decrease in peak flow from pre-run (360.3 l/min) to post-run (348.7 l/min) compared to healthy individuals with an average increase in peak flow pre-run (489.3 l/min) and post-run (526.7 l/min). The EIA individuals had a averaged decreased in VO2 max (43.17 mlO2/kg*min) compared to healthy individuals (47.36 mlO2/kg*min). CONCLUSION: Our findings indicate that individuals with EIA have a decrease in peak flow during vigorous exercise and a lower VO2 max compared to healthy individuals. EIA participants had a lower peak flow than the normative value for their age, sex, and height due to the narrowing of airways while healthy individuals fell within or above normative values. VO2 max was lower in EIA participants due to a variety of reasons caused by a decrease of oxygen uptake in the body. Further research should aim to evaluate the use of β-agonists anti-inflammatory mediators (rescue inhalers) or other medications and their effect on peak flow prior to and after vigorous exercise.
THE INFLUENCE OF SOCIAL CONDITION ON EXERCISE PERFORMANCE
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Previous studies have shown that exercising with a companion increases intensity and duration during single exercises. PURPOSE: To compare the effects of a group workout versus an individual workout, and to determine which exercise setting elicits better performance. This study also aimed to investigate personality factors (self-perceived introverts/extroverts) and performance in a certain workout setting. METHODS: Twelve physically active participants (age 20.42±1.31 years) participated in an individual and group workout. Participants were equipped with heart rate monitors and accelerometers. Every participant used the Borg RPE scale, and had the same choice of dumbbell weights during the two workouts. During the individual workout, the participants followed a high intensity interval training (HIIT) workout video. The group workout was in-person and followed the same workout and certified fitness instructor as in the workout video. Six of the participants completed the individual workout before they performed in a group workout and six of the participants worked out in the group workout before they completed the individual workout. After performing both trials the participants completed a survey about their personality and workout enjoyment. RESULTS: The findings revealed that the heart rate in the group workout was significantly higher at each time point than when working out alone (p=0.0002). The group workout also showed a significant increase in number of repetitions per exercise (p=0.012). However, the group workout did not show a significance difference in: calorie expenditure, RPE, and weights (p>0.05). The study had a greater proportion of self-perceived introverts (N=9) than self-perceived extroverts (N=3). Within the sample, there was an increased preference for the group style workout (N=6) compared to (N=3) who preferred the individual workout. Among the extrovert group, two participants preferred the group style workout and only one participant preferred the individual. CONCLUSION: The outcome of this study suggests that working out in a group setting versus working out individually significantly increases the heart rate and repetitions of exercises. Because of this individuals working in a group setting could experience a greater overall workout.

A COMPARISON OF DIET BETWEEN HOME AND AWAY GAMES IN FEMALE COLLEGIATE ATHLETES
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Collegiate athletes have an increased caloric expenditure due to their rigorous training and competition schedules resulting in increased energy needs. However, they do not always monitor the quality of their nutritional intake, especially during road games. PURPOSE: The purpose of this study was to assess the nutritional knowledge and intake of female collegiate athletes and compare their diets between home and away games. METHODS: Thirty-three division III college-level female athletes completed a nutrition knowledge questionnaire and the eating attitude test (EAT-26) to assess their nutrition knowledge and to determine risk for disordered eating behaviors. To determine nutritional intake, the athletes recorded their food intake on the two days before a home-game and on the two days before an away-game. A paired t test was used to compare the diets of the female athletes between the home and away games. Significance was set at p<0.05. RESULTS: The average caloric intake before the home game (1,994.3 ± 478.0 kcal) was lower than the average caloric intake before the away game (2,054.7 ± 510.0 kcal), but this difference was not significantly different (p=0.38). The athletes consumed more protein (76.7 ± 23.3 g) and carbohydrates (252.0 ± 87.8 g) before the away game versus the amount of protein (72.9 ± 25.7 g) and carbohydrates (240.0 ± 82.4 g) consumed before playing at home, but this was not significantly different (p>0.05). The amount of fat consumed at home (80.4 ± 56.9 g) was higher, but not significantly different (p=0.69) than the amount of fat consumed on the road (76.8 ± 23.9 g). The female athletes consumed more sugar, sodium, and cholesterol on the road compared to the home game, but they were not significantly different (p>0.05). The mean nutritional knowledge test score was 49.9 ± 13.5%. Most athletes had low EAT-26 scores suggesting that there is low risk for disordered eating behaviors. CONCLUSION: In this sample population, the results indicate that the quantity and quality of the diet of female collegiate athletes did not vary between home and away games. Based on the results, further research should be conducted to determine whether playing time affects nutritional intake. Moreover, further research should examine the relationship between nutritional knowledge and intake before home and away games.
THE RELATIONSHIP BETWEEN NUTRITIONAL KNOWLEDGE AND MEAL SKIPPING BEHAVIOR IN NCAA DIVISION III COLLEGIATE ATHLETES

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In order to optimize training and athletic performance, following proper dietary habits and spacing meals throughout the day is important for athletes to reach full athletic potential. The meal skipping behaviors in relation to nutritional knowledge are unknown for NCAA Division III (DIII) athletes. DIII schools tend to have fewer resources in terms of athletic team support staff. This population may need additional nutrition assistance for proper dietary habits. PURPOSE: The purpose of this study was to investigate the relationship between the nutritional knowledge and meal skipping behavior of NCAA DIII athletes at Whitworth University.

METHODS: Thirty-one Whitworth athletes completed a nutritional knowledge (NK) questionnaire in one session to assess adequate nutritional knowledge and frequency of meal consumption. A Spearman correlation test (sig. level p ≤ 0.05) was used to compare the relationship between the nutritional knowledge and meal skipping behavior of the participants. RESULTS: Of the participants, 54.8% ate three meals a day, while the other 46.2% reported frequently skipping at least one meal a day. Breakfast was the most commonly skipped meal, with 35.5% of the subjects reporting a lack of breakfast consumption. There was no significant correlation between nutritional knowledge and regular consumption of three meals a day ($r = 0.143, n = 31, p = 0.443$), nor between nutritional knowledge and irregular meal consumption through meal skipping ($r = -0.180, n = 31, p = 0.332$). CONCLUSION: In the present study, the level of nutritional knowledge of the participants was not related to meal skipping behavior. Despite these findings, the present study may serve as a foundation for further research in the area of nutritional behaviors for NCAA DIII athletes to optimize training and athletic performance.

THE EFFECT OF MAXIMAL SHOES ON WALKING BIOMECHANICS IN OLDER FEMALE ADULTS

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Maximal shoes, defined by increased cushioning in the midsole, have become increasingly popular among the older adult population. Knee osteoarthritis and associated knee pain are prevalent in the aging population. A considerable amount of research has examined the influence of footwear on biomechanical risk factors associated with knee osteoarthritis (OA). However, very little is known about the influence of maximal footwear on these biomechanical factors. PURPOSE: To compare joint kinematics, kinetics and ground reaction forces between maximal and traditional footwear during walking in older adults. METHODS: Participants consisted of 15 active female older adults (50-70 years old). Three-dimensional lower extremity biomechanics were captured during walking using an eight-camera motion capture system and two force platforms in two shoe conditions: maximal footwear (rearfoot: 37 mm, forefoot: 33 mm) and traditional footwear (rearfoot: 33 mm, forefoot: 23 mm). Variables of interest included frontal plane ankle and knee kinematics and kinetics, peak vertical ground reaction forces, and the instantaneous loading rate of the vertical ground reaction force. These variables were compared between shoes using a repeated measures ANOVA and an alpha-level of .05. RESULTS: To date, data for 5 of 15 participants has been analyzed. Participants exhibited greater eversion at initial contact in the maximal shoe ($-$5.2 ± 4.6°) compared to the traditional shoe (4.7 ± 3.6°, $p = .046$). In addition, the peak external knee varus moment was higher in the maximal shoe (0.60 ± 0.25 Nm) compared to the traditional shoe (0.49 ± 0.23 Nm, $p = .022$). There were no differences between the peak vertical ground reaction forces and the instantaneous loading rate between the two shoe conditions ($p < .05$). CONCLUSION: There is a strong consensus in the literature that increased knee varus moments are associated with an increased risk of knee OA. Therefore, our finding of increased knee varus moments in the maximal shoe condition suggests that the maximal shoe may place older females at increased risk of knee OA. Further data analysis is needed to confirm this result.

Research supported by the Layman Research Fellowship Grant at Oregon State University - Cascades
Exercise-induced muscle damage (EIMD) results in reduced strength, inflammatory responses, delayed-onset muscle soreness (DOMS), and muscle/joint stiffness. Joint stiffness has traditionally been measured by changes in static joint positions or a perceived resistance to movement. PURPOSE: To develop a novel protocol to quantify the effects of EIMD of the elbow flexors on joint stiffness by measuring torque during passive isokinetic elbow movements throughout the full range of motion. METHODS: Subjects (n=7) performed 50 maximal eccentric elbow extensions with their nondominant arm to induce EIMD, with the dominant arm as a control. Several measurements, including mid-arm circumference, relaxed elbow angle, perceived soreness rated from 0-100 on a visual analog scale (VAS), elbow torque during passive movement (5 and 15° • sec⁻¹), and isokinetic maximum strength (15° • sec⁻¹) were performed on each arm before the EIMD protocol and 1, 2, 3, and 7 days during recovery. A 2-factor (arm x day) repeated measures ANOVA was used to compare the main effects and interaction of each dependent variable, with α<0.5 as significant. RESULTS: Significant arm x day interactions (p<0.05) existed for perceived soreness, isokinetic maximum strength, and relaxed elbow angle. Soreness in the nondominant arm increased by 31.5 on the VAS after the EIMD protocol. Peak soreness occurred on recovery day 1, and ratings returned to baseline by recovery day 7. Soreness in the dominant arm remained <6 on the VAS throughout the study. Maximal strength in the nondominant arm decreased by 8.75% following EIMD, with peak strength loss on recovery day 1. Strength in the dominant arm increased slightly over the course of the study. Relaxed elbow angle in the nondominant arm became more flexed by 3.43° following EIMD. Peak flexion occurred on recovery day 1, and values returned to baseline by recovery day 7. No main effects or interactions were observed for arm circumference or elbow joint torque during passive isokinetic movements. CONCLUSION: The changes in perceived soreness, isokinetic maximum strength, and relaxed elbow angle following eccentric exercise indicate that EIMD occurred in the nondominant arm. Despite the presence of EIMD in the nondominant arm, changes in passive elbow joint stiffness during isokinetic movement were not observed.

Supported by the Washington NASA Space Grant Consortium and the University of Puget Sound Enrichment Committee

Board 18

ALTERATIONS IN AEROBIC FITNESS PARAMETERS OF COMPETITIVE RUNNERS DURING A YEAR

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Competitive runners train to increase their aerobic fitness and economy. PURPOSE: The purpose of this study is to compare aerobic fitness parameters in competitive runners from southwest Montana over the time span of one calendar year. METHODS: Fourteen competitive runners volunteered for this study (N=14, 8M, 18.75 ± 0.5 yr., 20.66 ± 0.99 kg/m² BMI and 6F, 19.75 ± 0.5 yr., 20.45 ± 1.86 kg/m² BMI). Subjects completed a graded exercise test on a treadmill connected to an open-circuit computerized gas analysis system at 4 assessment periods throughout a year (W17, S18, F18, W18) for the determination of VO₂peak, total time to exhaustion (TTE), maximal respiratory exchange ratio (max RER), and Time at RER>1.0. The graded exercise test consisted of a 3-minute warm-up at 3.5 miles per hour (mph). Males completed a ramp protocol initiated at 7 mph and increased in speed 1 mph every 90 seconds until 12 mph. At 12 mph, a 0.5% grade increase occurred every 90 seconds until volitional exhaustion. Female subjects completed a protocol initiated at 6 mph and increasing 1 mph every 90 seconds until 10mph; followed by 0.5% grade increase every 90 seconds until volitional exhaustion. Verbal encouragement was provided in all tests. A Kruskal-Wallis ANOVA with post-hoc tests were calculated (alpha p = <0.05) to compare BMI, VO₂peak, TTE, max RER, and Time at RER>1.0 between each assessment period for all subjects. A repeated measures ANOVA with planned comparisons was used to evaluate outcomes within genders. RESULTS: There were no differences in BMI, VO₂peak, TTE or Time at RER>1.0 within males or females at any assessment time point. Combined male and female data (N=14), revealed an increase in VO₂peak in W17 vs. W18 (52.61 ± 7.66; 65.5 ± 9.85 ml/kg/min⁻¹, p=0.04). Max RER decreased in W17 vs. F18 (1.13 ± 0.03; 1.05 ± 0.01, p>0.00) and S17 vs. W18 (1.11 ± 0.04; 1.05 ± 0.01, p=0.03), in addition Time at RER>1.0 was decreased in W17 vs. W18 (2:46 ± 1:03; 1:33 ± 0:12 min, p=0.02). CONCLUSION: An increase in VO₂peak was only observed in the initial (W17) assessment period, while max RER and Time at RER>1.0 continued to decline throughout the year. This occurred without a concurrent change in VO₂peak. A decrease in Time at RER>1.0 could suggest an increase in fat utilization with training, although further testing is needed to evaluate these conclusions.
IMPROVING BALANCE, FLEXIBILITY, AND AGILITY USING BALLET TRAINING FOR FOOTBALL PLAYERS: A PILOT STUDY
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Balance, flexibility, and agility (BFA) are beneficial to athletes in many disciplines. Despite the associated improvements in performance and injury risk, the benefits of BFA have long been undervalued in sports like football where gains are often emphasized over grace. While anecdotal evidence implies that implementation of ballet as training that targets BFA can benefit football players by reducing injury risk and improving overall performance, there has not yet been controlled prospective research. PURPOSE: To analyze the impact of thrice weekly ballet classes on the balance, flexibility, and agility of collegiate football players. METHODS: 10 NCAA Division III football players were recruited from Willamette University to participate for three weeks during the off-season. Players were randomly assigned into the ballet training group or the control group. The ballet group attended a 30-minute ballet class three days per week, for two non-consecutive weeks. Balance was assessed using the Biodex Balance System (BBS), flexibility was assessed using a goniometer, and agility was assessed via the Illinois Agility Test (IAT). BFA data were collected at baseline and once per week for three weeks. Differences in means across all testing sessions between groups was assessed using repeated measures ANOVAs. Bonferroni post hoc tests controlled for family-wise error rate during multiple comparisons across time periods. RESULTS: Flexibility: improved ROM of lumbar flexion (p = 0.073) and ROM of shoulder extension (p = 0.073) in the ballet group approached statistical significance. Balance: The ballet group’s improvement in overall balance scores from the BBS (Ballet: 1.6 ± 2.55, Control: 1.5 ± 1.63) was not significantly different from control. Agility: The IAT time was significantly faster in the ballet group (Ballet: $\bar{X}_1 = 19.674 \pm 1.73$ sec, $\bar{X}_4 = 17.034 \pm 1.73$ sec, Control: $\bar{X}_1 = 16.23 \pm 0.46$ sec, $\bar{X}_4 = 16.002 \pm 0.46$ sec; p = 0.001). CONCLUSION: This pilot study indicates that implementation of a ballet class may increase the balance, flexibility, and agility of collegiate football players, warranting continued research on this training intervention.

COMBINATIONAL EFFECTS OF PRE-COOlING AND PRE-HEATING ON SUPRAMAXIMAL EXERCISE
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PURPOSE: To analyze the effects of simultaneous pre-cooling the core body and pre-heating the legs on anaerobic exercise performance. METHODS: Twenty-two college-aged subjects (12 male, 10 female) participated in the study. The first day, subjects performed a 10-second practice Wingate test to minimize learning bias. In the second and third trials, subjects completed a 30-second Wingate test. The control trial had no intervention. The experimental trial included 20 minutes of active pre-cooling of the core and pre-heating of the legs prior. Pre-cooling was achieved using an ice vest and ice neck wrap. Pre-heating was achieved by wrapping a heating pad around each thigh and calf (4 total). Each trial began with a 5-minute warm-up. Heart rate (HR, bpm), blood pressure (BP, mmHg), power output (W), anaerobic capacity (AC, W/kg), skin and temporal temperatures (°C), and blood lactate levels (mmol/L) were recorded. Subjects completed a perceived exertion and activity level questionnaire following each trial. Data was analyzed using repeated measures ANOVA to determine differences between the conditions. RESULTS: Peak power increased by 64.61 W (p < 0.001) and average power increased by 25.96 W (p < 0.001) in the experimental trial. Average RPM increased by 3.95 (p < 0.001), and peak RPM increased by 4.82 (p = 0.013) in the experimental trial. Additionally, peak AC increased by 0.85 W/kg (p < 0.001) and average AC increased by 0.40 W/kg (p = 0.001) in the experimental trial. HR was 5.18 bpm higher (p < 0.001) and systolic BP was 6.82 mmHg higher (p < 0.001) in the experimental trial. There were no significant differences in blood lactate, perceived exertion, or mean arterial pressure. CONCLUSION: Simultaneous pre-cooling the core and pre-heating the legs improved Wingate performance. This was likely caused more so by the increased blood flow to the active muscles from the pre-heating aspect of the experimental condition. The lack of correlation between temporal temperature and power outputs for both conditions indicates the core temperature did not correlate to changes in power output. Adoption of a pre-heating strategy prior to short-duration, high-intensity athletic events could significantly increase performance across many anaerobic sports and competitions.
Ammonia inhalants (AIs) have been commonly used as an over-the-counter first-aid product to alleviate fainting. Recently, an increasing number of athletes began using AIs with the goal of enhancing alertness and physical performance. However, no published studies have evaluated the acute physiological effects of AI administration on pulmonary function. PURPOSE: To determine the effects of a single AI ampule on one-second forced expiratory volume (FEV1.0), forced vital capacity (FVC) and maximum voluntary ventilation (MVV).

METHODS: Twenty-two college aged students (11 males and 11 females) with no history of respiratory conditions participated in this single-blind study, which was approved by the Gonzaga University Institutional Review Board for the use of human subjects. FEV1.0 and FVC pre- and post- inhalation of a single AI capsule or placebo inhalant (PI) capsule were performed two-weeks apart in a randomly-assigned balanced order. MVV was measured only post-inhalation after the post-inhalation FEV1.0 and FVC. All tests were performed using a commercially available metabolic cart. Paired t-tests were used to determine if differences between pre- and post-inhalation of each inhalant and if differences between conditions for MVV existed. RESULTS: No significant differences in FVC existed between pre- and post-PI (mean difference ± SE = 42.0±62.8 mL, p=0.50) or AI (mean difference ± SE =13.0±22.2 mL, p=0.81). Similarly, no differences existed between pre- and post-FEV1.0 for PI (mean difference ± SE =52.7±50.3 mL, p=0.31) or AI (mean difference ± SE =68.2±84.2 mL, p=0.42). MVV also was not different between PI and AI (mean difference ± SE = 2.16±4.18 L, p=0.61). CONCLUSION: The inhalation of a single AI ampule results in neither beneficial nor detrimental effects on pulmonary function.

TWO YEARS OF HEALTH AND FITNESS ASSESSMENTS FOR S.W. MONTANA FIREFIGHTERS

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Health and fitness are vital components to firefighter work performance and safety. PURPOSE: To compare the health and fitness assessments of Southwest Montana firefighters from 2017 to 2018. METHODS: Structural volunteer firefighters (N=16, 36.8 ± 1.7 yrs., 35.8 ± 9.3 kg/m² BMI) were assessed for: systolic blood pressure (SBS) 133.7 ± 9.9 mmHg; diastolic blood pressure (DBS) 80.1 ± 6.2 mmHg; predicted VO₂max (33.6 ± 10.6 ml/kg/min⁻¹) via a YMCA test using a cycle ergometer, maximal upper body strength via a push-up test (19.9 ± 8.7), core/abdominal strength via a sit up test (31 ± 14.6), shoulder flexibility (R: -0.33 ± 5.8, L: -0.9 ± 6.2 cm), trunk rotation (32.4 ± 7.4 cm), hamstring flexibility via a sit-and-reach test (24.7 ± 9.5 cm), and body fat percentage (BF) using a handheld bioelectrical impedance device (18.8 ± 11.9%). In 2018, fifteen firefighters (37.0 ± 8.6 yrs., 28.2 ± 5.1 kg/m² BMI), returned for re-evaluation of SBS: 127.5 ± 12.4 mmHg, DBS: 81.9 ± 5.7 mmHg, predicted VO₂max: 38.1 ± 10.9 ml/kg/min⁻¹, maximal upper body strength: 23.1 ± 8.7, core/abdominal strength: 39.6 ± 20.8, shoulder flexibility: (R: -1.9 ± 5.7, L: -2.8 ± 5.5 cm), trunk rotation (76.1 ± 15.8 cm), hamstring flexibility: 22.2 ± 7.6 cm, and BF: 24.1 ± 6.8%. All testing procedures followed ACSM guidelines for exercise testing prescription. A Mann Whitney test was used to compare assessment outcomes between 2017 and 2018. In addition, a correlation matrix was calculated with r ≥ 0.7 = strong positive relationship and r ≤ -0.7 = strong negative relationship. RESULTS: There were no differences in any health or fitness outcomes except for a decrease SBS (p=0.07) from 2017 to 2018. The 2017 correlation matrix revealed positive relationships between BMI and BF (r=0.90) and negative relationships between pushups and BMI (r=0.7). The 2018 results show a positive correlation between SBS and DBP (r=0.75), along with SBS and BMI (r=0.72). BF and BMI were positively correlated (r=0.71), along with right and left shoulder flexibility (r=0.88). CONCLUSION: Over the course of one year, firefighters had similar health and fitness results. A reduction in SBS was the only measure that improved from 2017 to 2018.
Board 23
A COMPARISON OF METABOLIC AND CARDIORESPIRATORY RESPONSES FOR HIGH INTENSITY INTERVAL CYCLING AND KETTLEBELL PROTOCOLS
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Various High Intensity Interval Training (HIIT) protocols have been previously documented to stress the metabolic and cardiorespiratory systems. PURPOSE: The purpose of the study was to compare oxygen consumption (\(\dot{V}O_2\)), heart rate (HR), and blood lactate (BLA) between a previously-researched HIIT cycling protocol and a HIIT kettlebell swing protocol. METHODS: 12 moderately active individuals between the ages of 18 to 25-y completed both protocols, separated by at least 48-h, in random order. The kettlebell protocol (KB) consisted of 10 × 60-s intervals of maximal kettlebell swings with an assigned weight interspersed with 60-s passive recovery between intervals. The cycling protocol (C) consisted of 10 × 60-s cycling intervals performed at a workload equivalent to 100% \(\dot{V}O_2\text{max}\) interspersed with 60-s of passive recovery. \(\dot{V}O_2\) and HR were continuously recorded during intervals and averaged for analysis. BLA was measured at the end of each interval and averaged for analysis. A dependent groups t-test was used to determine the existence of significant differences between protocols for each dependent variable. RESULTS: Statistical differences were observed between the C and KB protocols for \(\dot{V}O_2\) (C: 1.75 ± 0.57 L/min; KB: 1.37 ± 0.68 L/min; \(p = 0.001\)) and BLA (C: 7.60 ± 1.57 mmol/L; KB: 4.60 ± 2.05 mmol/L; \(p = 0.001\)). No significant difference was observed between protocols for HR (C: 165.6 ± 8.4; KB: 156.5 ± 15.8; \(p > 0.05\)). CONCLUSIONS: Under these research conditions, the HIIT cycling protocol elicited higher \(\dot{V}O_2\) and BLA responses than the HIIT kettlebell protocol. Even though HR was not statistically different between conditions, there was a trend for higher HR responses in the HIIT cycling protocol as well. One explanation for these observations was that the prescribed intensity of the HIIT cycling protocol was simply more aerobically-demanding than the prescribed-intensity of the HIIT KB protocol. Further research should include comparisons of metabolic and cardiorespiratory different responses during different KB protocols or alterations in KB load.

Board 24
ENERGY EXPENDITURE BETWEEN BICEP CURLING SET CONFIGURATIONS
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Caloric expenditure might vary depending on arrangement of volume, intensity of exercise, type of movement, and many other factors. PURPOSE: The purpose of this study is to explore the relationship of set scheme and energy costs of weighted arm curls. METHODS: Six college-aged students (1 female, 5 males, age = 20±2 yrs, height = 71.8±6.8in, weight = 165.9±45.3 lbs.) performed two different set configurations (10x3 and 3x10) while breathing through a metabolic cart using the same load (70%1RM), total volume (30 repetitions), work time (22±2min.) and measured excess post-exercise oxygen consumption (EPOC) (15 min) for both set/reps configurations. A paired t-test was used to compare caloric expenditure between training volume strategies. RESULTS: Significant differences were found in calories burned during work (\(p < 0.01, 3x10= 23.7±9.5kcal, 10x3=30.1±10kcal\)). During EPOC, caloric difference was not significant (\(p=0.17, 3x10= 32±9.5kcal, 10x3=29.5±9.3kcal\)), nor in total calories (\(p=0.08, 3x10= 55.7±18.9kcal, 10x3=59.5±19kcal\)). There was a trend of higher calorie expenditure during EPOC following 3x10 which may have negated the greater calories burned during the 10x3 training bout and caused the total calories between strategies to be non-significant. CONCLUSION: For individuals concerned with burning the most calories within a lifting session, low rep, high load training is no less effective than high rep, low load training when volume is equated.

Board 25
THE EFFECTS OF HELIOMUX ON HEALTHY YOUNG ADULTS DURING MAXIMAL EXERCISE
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Substitution of helium for the nitrogen in room air is known as a heliox mixture and significantly lowers the density of air and the work of breathing in comparison to normal room air. PURPOSE: The purpose of this study was to determine if inhalation of an 80/20 heliox gas during the 30 s of a Wingate test affects pulmonary ventilation \(\dot{V}E\), peak power (PP), average power (AP) and the fatigue index (FI). METHODS: Six male and six female subjects (21.0 ± 0.71 yr) participated in this single-blind study. Subjects performed two Wingate tests in a single-blind randomized and balanced design under two conditions, once breathing room air and once breathing an 80/20 percentage of helium and oxygen, respectively. PP, AP, FI, \(\dot{V}E\), tidal volume (TV) and breathing frequency (RR) were measured continuously before, during and after the Wingate tests. The subjects breathed from a weather balloon full of the appropriate gas during only the 30-s test. A mass of 7.5 % of the individual’s body weight was used to provide the pedal resistance during the test. Ventilatory responses were measured using a commercially available metabolic system. RESULTS: Paired t-tests indicated there were no significant differences between the two conditions for PP (mean difference ± SE = 8.6±15.5 W, \(p = 0.59\)), AP (mean difference ± SE = 9.6±8.0 W, \(p = 0.26\)), or FI (mean difference ± SE = 4.5±3.0 %, \(p = 0.17\)). Additionally, \(\dot{V}E\), TV, and RR all increased linearly throughout the 30 s Wingate test for both conditions in a remarkably similar pattern of equal magnitude. CONCLUSION: Breathing a low density heliox gas mixture does not affect the ventilatory response anaerobic performance during short-term intense exercise.
The countermovement jump (CMJ) test is a standard measure of lower body power. The jump performance in the test can be related to other aspects of athletic performance. With many tools commercially available, it can be difficult for professionals to distinguish which device provides the most accurate results for the best cost. While these devices have been previously validated individually, no past studies have concurrently examined these specific tools. PURPOSE: The purpose of this study was to determine the accuracy of four different CMJ measuring devices when compared to the gold standard of a force plate. METHODS: 31 physically-active university students were recruited for this study (21 ± 3.3 years; 176 ± 10 cm; 80 ± 17 kg; 9 females, 21 males). The participants were lead through a standardized 10-minute warm-up protocol consisting of dynamic stretching and concluding with instruction of proper jumping technique for the tests. Participants then performed 4 maximal CMJ on the force plate, which served as the gold standard for CMJ measures. Following the gold standard jumps, all participants performed an additional 4 maximal CMJ in an area where 4 other instruments were used to measure CMJ simultaneously: accelerometer-based sensor, a contact mat, a photoelectrical cell system, and a mobile device video app. The researchers measured each CMJ synchronically. A data analysis was conducted using IBM SPSSStatistics and Microsoft Excel. An analysis of variance (ANOVA) and intra-class correlation (ICC) were used to analyze the differences between devices. RESULTS: The ANOVA revealed a significant difference in mean CMJ performance between the force plate and the photoelectrical cell system and the mobile device video app (p < 0.001). All devices displayed a strong correlation to the force plate with the contact mat displaying the highest ICC (r = 0.899). CONCLUSION: All four commercial devices showed strong within-device reliability and strong relationships to the force plate regarding CMJ performance. But, only the contact mat and accelerometer-based sensor measured CMJ performance closest in score to the force plate. In summary, while slightly over-estimating measurements, the commercial devices that seem to agree the closest to the gold standard force plate were the contact mat and accelerometer-based sensor.

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Delayed-Onset Muscle Soreness (DOMS), a form of exercise-induced muscle damage, is characterized by muscle tenderness approximately 48 hours following unaccustomed physical activity. Forms of massage therapy, including foam rolling (FR), have been shown to reduce severity of DOMS, perhaps via myofascial release. However, the majority of research on FR has focused on intervention occurring at peak of DOMS, 48 hours post-exercise. Few studies have explored the efficacy of FR as a preventive measure for DOMS, with FR intervention occurring immediately post-exercise. PURPOSE: To examine the effect of immediate post-exercise FR on the alleviation of DOMS. METHODS: Thirteen participants (3 male, 10 female; 20.6 ± 0.8 yrs age; 141.5 ± 5.3 cm stature; 65.8 ± 7.7 kg mass) completed baseline pain-pressure threshold (PPT, kg·cm²), utilizing a dolorimeter to measure sensitivity at multiple, established locations on the hamstring, quadriceps, and calf musculature. For each leg, the multiple assessments were collapsed to one composite, representative score. To induce DOMS in both legs, participants completed a series of leg exercises. Immediately after completion of exercise regimen, one leg was randomly chosen to receive foam rolling treatment (two 45 s bouts for each muscle group). The contralateral leg served as control, to verify inducement of DOMS. 48 ± 6 hours after the DOMS-inducing exercise session, participants legs (both control and treatment) were again tested for PPT. To meet the DOMS criterion, the control leg had to demonstrate a 10% increase in sensitivity from original baseline. RESULTS: Repeated measures 2x2 ANOVA revealed a pre-post main effect (baseline vs. DOMS, F₁,12 = 29, p < 0.001). Post-hoc tests showed no difference between control or treatment legs for baseline PPT measurements (8.92 ± 1.67 kg·cm², 8.73 ± 1.76 kg·cm², respectively, p > 0.05), demonstrating initial leg symmetry. The experimental design was predicated upon successfully inducing DOMS, verified by a decrease in control leg PPT from baseline (pre = 8.92 ± 1.67 kg·cm², post = 6.40 ± 1.70 kg·cm², p < 0.01). Most notably, 48 hours after exercise, the FR leg PPT was lower than the control leg (6.98 ± 1.84, 6.40 ± 1.7, p < 0.05). CONCLUSION: FR immediately post-exercise was effective for alleviating DOMS.

Supported by Pacific University Research Grant
Board 28

**EFFECTS OF CONCURRENT ACTIVATION POTENTIATION ON NEUROMUSCULAR RECRUITMENT AND FORCE PRODUCTION OF THE UPPER-ARMS**

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The utilization of remote voluntary contractions (RVC) in the upper extremities to elicit concurrent activation potentiation (CAP) in the lower extremities has been well studied. However, little research has been focused on the effect of CAP on upper extremity force production. **PURPOSE:** The purpose of this study was to examine the impact of voluntary jaw-clenching on force production and neuromuscular recruitment during an isometric biceps brachii contraction. **METHODS:** 26 undergraduate students (male = 10, female = 16, age = 20.65 ± 1.22 years, height = 170.46 ±7.94 cm, weight = 76.6 ±17.78 kg), with no history of upper-arm injury were recruited. During a single session participants performed 3 maximum voluntary isometric contractions while biting on a mouth guard. They also completed 3 maximum voluntary isometric contractions with a relaxed jaw. The condition order was counterbalanced. During each contraction, force production was recorded via a dynamometer (kg of force) and muscle activation was recorded from the biceps brachii via electromyography (EMG). The average EMG amplitude was normalized for each participant across all max voluntary isometric contractions. A dependent groups t-test (alpha level p ≤ 0.05) was used to measure the differences between mouth guard and no mouth guard conditions. **RESULTS:** There was significantly greater force production for the mouth guard condition compared to the no mouth guard condition (mouth guard: 22.33 ± 6.70 kg; no mouth guard: 21.63 ± 6.60 kg; t = 3.001, df = 24, p = 0.006). There was no significant difference between the mouth guard conditions for neuromuscular recruitment (mouth guard: 3630.72 ± 1486.51 mV; no mouth guard: 3493.32 ± 1373.29 mV; t=0.889, df=25, p=0.383). **CONCLUSION:** Inducing CAP with a mouth guard during an isometric biceps brachii contraction significantly increased force production, however, it had no effect on neuromuscular recruitment in the biceps brachii. This mouth guard technique may be useful to improve performance in both athletes and non-athletes during activities that require the biceps brachii to work anaerobically for short periods of time. Future researchers should more thoroughly explore the effects of CAP on the upper extremities, including more precise EMG analysis techniques.

Board 29

**LIMITING THE ACCELERATION OF SOCCER BALL IMPACT: DOES HEADGEAR USE DECREASE ACCELERATION AND IMPULSE**

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**PURPOSE:** This study tested whether the use of protective headgear decreased the acceleration and impulse from heading a soccer ball. It has been suggested that headgear may decrease the risk of concussions in soccer. Studies have shown that using headgear might decrease peak acceleration, while at the same time studies of performance have shown using headgear results in worse measures of neurocognitive performance. **METHODS:** In this study, soccer balls were launched from a JUGS soccer machine at a headform. The headform was fitted with a tri axial accelerometer that measured linear and rotational acceleration. The protective headgear was attached to the headform, and its thickness varied across the trials. For each thickness of headgear tested, the linear and rotational acceleration, time to peak acceleration and duration of all contact was measured. Twenty five trials were performed for each variable. **RESULTS:** The results showed that the headgear decreased the peak linear (35 %) and rotational (25 %) acceleration with the use of headgear (p&lt;0.05). As the thickness of headgear was increased it correlated with a decrease in peak acceleration (r 2 =0.88). The time to peak acceleration was slowed with headgear (p=0.05); but the time of ball contact was increased by 58% with the use of headgear (p&lt;0.05). The total linear and angular acceleration during the time of ball contact was decreased with headgear (p&lt;0.05). The impulse was calculated (J=m*a*t) using the acceleration data from the trials. The study showed that while the peak acceleration was decreased, the impulse was increased with the use of headgear by 34%. Regression study showed that as the thickness of headgear increased it correlated with an increase in linear impulse (r 2 =0.93). **CONCLUSION:** Though the use of headgear decreased the peak acceleration, it increased the time of ball contact and increased the impulse force. It may be that headgear use may increase the total force of heading a soccer ball. These results might help explain prior studies where using headgear showed a decrease in peak acceleration but poorer performance in cognitive measures.
DOCTORAL STUDENT PRESENTATIONS

Board 30

WILDLAND FIREFIGHTERS’ SELF-REPORTED IDEAL DIETARY INTAKE DURING WILDFIRE SUPPRESSION

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The National Mobile Food Services Contract (NMFSC), developed by the United States Forest Service & National Interagency Fire Center, provides a framework for feeding Wildland Firefighters (WLFFs) in the United States (US). WLFFs’ dietary intake during arduous wildfire suppression is largely dictated by the food items present in the NMFSC to meet the demands of high energy output for long work days (12-16 hrs). Previous research indicates increased frequency of eating episodes may increase energy output (Cuddy et al., 2007; Montain et al., 2008). PURPOSE: To identify WLFFs’ preferred dietary intake during wildfire suppression in order to offer recommendations for the NMFSC and identify opportunities for WLFF nutrition education. METHODS: WLFFs (N=77) in the US participated in an online survey (Qualtrics, Provo, UT) to select entrée, fruit/vegetable (F/V) and snack items, from the current NMFSC, preferred to eat during a theoretical work day, the hour in which each item would be consumed (hr 1-12), and the reasons for choosing items from each category. Descriptive data were reported using SAS software. RESULTS: WLFFs’ self-reported preferred dietary intake consisted of a wide variety of items consumed during all hours of the workday, with hours 3, 5 and 6 identified as the most frequent time for eating and hours 1, 11, and 12 least frequent. Only 6 WLFFs indicated a preference to eat at least one item every hour. Snacks and F/V were chosen more frequently than entrées, with preferred items being nuts (n=82), granola bar (n=75), beef/turkey jerky (n=71), apple (n=67), avocado (n=64), non-sugared dried fruit (n=60), carrots (n=56), single serving peanut butter pouch (n=50), peanut butter and jelly sandwich (n=45), hard boiled eggs (n=44), hard salami or summer sausage (n=41), and turkey sandwich (n=38). Most participants indicated that they chose entrée items (n=55) and F/V items (n=57) because “they taste good” and snack items because “they provide me with energy” (n=61). CONCLUSION: When revising the NMFSC in 2020, it is important to not only design a contract that meets the dietary needs of the WLFFs, but that does this through provision of food items that will be consumed. Future comparisons between the actual shift food intake and the reported ideal shift food intake may identify areas for WLFF nutrition education.

Funding Source: USDA, Forest Service National Technology and Development Program, FS Agreement No. 18-CR-11138100-017

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PULMONARY GAS EXCHANGE EFFICIENCY DURING EXERCISE IN WOMEN AND MEN, DOES SEX MATTER?

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Some have suggested that women have worse pulmonary gas exchange efficiency during exercise than men, but this is not always found to be the case. Patent foramen ovale (PFO) is present in ~30% of the population and could be a potential source of right-to-left shunt that can worsen gas exchange efficiency. PURPOSE: To determine whether or not the presence of a PFO plays a role in determining pulmonary gas exchange efficiency in men and women. METHODS: 25 subjects were recruited and screened for the case. Patent foramen ovale (PFO) is present in ~30% of the population and could be a potential source of right-to-left shunt that can worsen gas exchange efficiency. PURPOSE: To determine whether or not the presence of a PFO plays a role in determining pulmonary gas exchange efficiency in men and women. METHODS: 25 subjects were recruited and screened for presence of PFO utilizing saline contrast echocardiography. 11 female subjects, 7 with PFO and 14 male subjects, 5 with PFO exercised at 5 submaximal workloads (70-190 Watts). Arterial blood was taken from a radial artery catheter pre-exercise and during the final 30 seconds of each workload and was immediately analyzed for pH, PaCO2 and PaO2. Alveolar PO2 was calculated using the alveolar gas equation and the alveolar-to-arterial oxygen difference (gold standard measure of pulmonary gas exchange efficiency) was quantified. Comparisons were made using 2 (PFO+ and PFO-), 2-way ANOVAs (sex x time) with Bonferroni correction for pairwise comparisons, with significance set at p<0.05. RESULTS: PFO+ women did not have worse pulmonary gas exchange efficiency than PFO+ men. However, PFO- women had worse pulmonary gas exchange efficiency than PFO- men with specific pairwise difference at 130W, (10.12 ± 4.4 vs 5.7 ± 2.4) (mean ± SEM). CONCLUSION: These preliminary results suggest that pulmonary gas exchange efficiency is worse only in women without a PFO; data collection for this study is ongoing.

Support: American Heart Association (A.T. Lovering); Department of Defense (W81XWH-11-2-0040 TATRC to R.C. Roach and W81XWH-10-2-0114 to A.T. Lovering)
Both obesity and aerobic exercise training influence partitioning of lipids within skeletal muscle (e.g., toward oxidation or storage). Long-chain acyl-CoA synthetases (ACSL) are implicated in such partitioning; however, to what extent skeletal muscle ACSLs are regulated by diet and exercise remains unknown. **PURPOSE:** To determine regulation of skeletal muscle ACSL1 and ACSL6 by diet and exercise. **METHODS:** Male C57BL/6J mice consumed a 60% high-fat diet (HFD) for 12 weeks to induce obesity compared to low-fat diet (LFD). At week 4, mice either began aerobic exercise (50 min/day, 5 days/week; EX-Tr) or remained sedentary (SED) for an additional 8 weeks (n=10/group). At week 12, tissues were collected in the fasted condition 36 hours post-exercise (or SED). ACSL1 and ACSL6 protein content was measured in gastrocnemius muscles via western blot. Following an acclimation period, in-cage substrate oxidation with ad-libitum access to food and water was assessed in 12 hour “light” and “dark” cycles using indirect calorimetry. **RESULTS:** ACSL1 is known to partition fatty acids toward oxidation. Skeletal muscle ACSL1 protein content was not changed with HFD (P=0.25 vs. LFD) and tended to decrease with EX-Tr (P=0.06 main effect EX-Tr vs. SED). Nevertheless, in-cage lipid oxidation was increased with HFD (P<0.01 vs. LFD) and tended to increase with exercise training in LFD mice (P=0.07 for EX-Tr vs. SED). ACSL6 is known to partition fatty acids toward storage. Skeletal muscle ACSL6 protein content was increased with HFD (P<0.01 vs. LFD) in SED mice but not different between diet conditions following EX-Tr (P=0.17; LFD vs. HFD EX-Tr). Such findings are in agreement with greater skeletal muscle lipid storage following HFD and with aerobic exercise training. **CONCLUSION:** Our results indicate skeletal muscle ACSLs undergo regulation by diet and exercise, with decreased ACSL1 following exercise training and increased ACSL6 in response to high fat feeding. Such findings suggest skeletal muscle ACSL1 content is unlikely to limit lipid oxidation whereas skeletal muscle ACSL6 may be a critical regulator of lipid storage.

**Board 33**

**UTILIZING TECHNOLOGICAL DEVICES TO ENHANCE PREVENTION OF TYPE II DIABETES MELLITUS**

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**PURPOSE:** To evaluate the inclusion of technology, a wearable device and smartphone, into the popular lifestyle modification program: the Diabetes Prevention Program - Group Lifestyle Balance Program (DPP - GLB). The DPP - GLB Program has shown great success in reduction of progression toward T2DM. However, it was unknown how integrating technology would affect overall program outcomes, which included the attainment of 150 minutes of physical activity (PA)/week and weight loss trending toward 7%. **METHODS:** Men and women over the age of 40, and at risk for prediabetes, were recruited. The study included an initial four weeks of baseline PA testing, followed by 12 weeks of lifestyle intervention. Individualized weight loss and PA goals were set. Participants self-randomized to the control (N = 11) or the technology group (N = 13). Session participation was high. Technology participants missed 8.3% of sessions, while control participants missed 18.2% of sessions. **RESULTS:** Participants were aged 66.24 (SD = 7.38) years. At baseline, 21% of participants were overweight, and 79% were obese. Using a generalized estimating equation to estimate average weight lost, participants lost 0.46 lbs/week. One hundred percent of technology participants lost weight, while 73% of control participants lost weight. Only 7.7% of technology participants reached the 7% weight loss goal, while 27.2% of control participants reached the 7% weight loss goal. Both groups lost similar amounts of weight in averages, with technology participants losing an average of 7.35 lbs and control participants losing an average of 7.79 lbs. At study conclusion, 37% of participants were overweight, and 63% were obese. Although statistical significance was not found, we believe clinical significance was found. The majority of participants (63%) self-reported inactivity during the initial meeting. Technology participants averaged PA tracking for 72.5 days while the control group averaged 47.7 days of PA tracking of 77 days available. **CONCLUSIONS:** Monitoring PA with technology can reinforce positive lifestyle changes to encourage users and increase activity due to instant feedback from the device. Participants can be successful with weight loss by going through the GLB Program, with or without technology, reinforcing the importance of lifestyle modification.

Supported by the Dean Fletcher Graduate Fellowship in Clinical Nutrition and the Alberta Hill Academic Excellence Award.
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COMPARISON OF TWO BLUEBERRY SUPPLEMENTATION PROTOCOLS ON RUNNING PERFORMANCE AND PHYSIOLOGICAL RESPONSES

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Blueberries are rich in a class of polyphenol called anthocyanins. As the antioxidant properties of anthocyanins seem to offset mechanisms of fatigue, blueberry supplementation may aid performance. PURPOSE: To examine the effects of two doses of blueberry supplementation on running performance, physiological responses, and recovery. METHODS: Fourteen recreational runners (31.3 ± 10.3 years; 174.3 ± 11.1 cm; 72.1 ± 13.1 kg; 51.1 ± 6.2 mL·kg−1·min−1) supplemented with 3 different protocols: 4 days of blueberries (4DAY), 4 days of placebo (PLA), and 2 days of placebo followed by 2 days of blueberries (2DAY). Following supplementation, participants completed an 8 km time trial on a non-motorized treadmill. Heart rate (HR) and ratings of perceived exertion (RPE) were monitored during the time trial. Blood lactate, vertical jump, and reactive strength index (RSI) were assessed before and after the time trial. RESULTS: No significant differences were observed in time to complete the 8 km run (PLA: 3010±459s; 2DAY: 3014±488s; 4DAY: 3011±423s), mean HR during the time trial (PLA: 171±14; 2DAY: 172±14; 4DAY: 170±12), and mean lactate (PLA: 15.4±1; 2DAY: 15.5±1; 4DAY: 15.3±1). A significant interaction effect (p=0.027) was observed for blood lactate responses; post hoc analysis revealed that 5 minutes post-time trial lactate was significantly less in 4DAY (5.4±2.0 mmol·L−1) than PLA (6.6±2.5 mmol·L−1; p=0.038) and 2DAY (7.4±3.4 mmol·L−1; p=0.034). Blood lactate recovery within 30 minutes of time trial completion was similar between conditions. Post time trial decreases in vertical jump height, though significant (p<0.001), were not different between the conditions. The decline in RSI following the time trial was significantly less following 4DAY (-6.1±13.5%) than the other conditions (PLA: -12.6±10.1%; 2DAY: -11.6 ± 11.5%; p=0.038). CONCLUSION: Two days of blueberry supplementation had no impact on time trial performance, physiological stress, or recovery. Four days of blueberry supplementation did not alter performance, but blunted the blood lactate increase to running, perhaps reflecting an alteration in lactate production and/or clearance; and minimized the post-time trial impairment in RSI, perhaps suggesting a protection against acute muscular impairment.

Supported by US Highbush Blueberry Council

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COMPARISON OF THREE BODY FAT PREDICTION EQUATIONS VS. AIR DISPLACEMENT PLETHYSMOGRAPHY IN OVERWEIGHT AND OBESE MALES

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The body adiposity index (BAI) was developed by Bergman as an alternative to the BMI. In that study, authors utilized a population of Mexican–American and African American subjects from the southwest region of the United States with varying BMI. For this study, we examined Caucasian adult males from the state of Utah. PURPOSE: To examine the difference in body fat percentage (PBF) using Air Displacement Plethysmography (ADP) and three prediction equations (BAI, BAI FELS, BF DURN). We also sought to examine the level of agreement among the various methods used to PBF. METHODS: Adult males (N=452, 37.15 ± 9.91yr; 28.99 ± 3.36 kg/m2 BMI; 27.20 ± 7.70 body fat %; 94.99 ± 10.52 cm waist circumference and 100.24 ± 8.95 cm hip circumference) supplemented with 3 different protocols: 4 days of blueberries (4DAY), 4 days of placebo (PLA), and 2 days of placebo followed by 2 days of blueberries (2DAY). Following supplementation, participants completed an 8 km time trial on a non-motorized treadmill. Heart rate (HR) and ratings of perceived exertion (RPE) were monitored during t
Dance emphasizes a lean physique, which likely influences dietary intake (DI) and body composition (BC). Additionally, for collegiate dancers, optimal DI and BC may be difficult to maintain due to the additional stressors of the college environment.

 Purpose: The purpose of this study was to longitudinally assess DI and BC in female collegiate dancers across one academic year.

 Methods: Female collegiate dancers (n=14; ages 19±2 yr), completed three visits at the beginning of each semester (V1: fall17, V2: spring18, V3: fall18). Visits included completion of a 3-day food log (two weekdays and one weekend day); height and weight using a digital scale and stadiometer (APEX Deteco, Webb City, MO); and a dual-energy x-ray absorptiometry scan (Horizon Hologic, Marlborough, MA) to assess fat mass (FM), lean mass (LM), and bone mineral density (BMD). Food logs were analyzed using Food Processor (ESHA, 10.13.1, Salem, OR). Statistical analyses were completed using SPSS Statistics (v. 24). Data were reported as mean±SD and significance was accepted at p<0.05.

 Results: Total calories (V1: 2,478±748 kcal, V3: 1,496.7±741 kcal, p=0.007), carbohydrate intake (V1: 4.4±1.6 g/kg/d, V3: 2.9±1.6 g/kg/d, p=0.031), and fat intake (V1: 91±31 g, V3: 59±22 g, p=0.036) significantly decreased from V1 to V3. Protein intake did not significantly change between visits (V1: 1.4±0.6 g/kg/d, V2: 1.2±0.7 g/kg/d, V3: 1.0±0.3 g/kg/d). No differences were observed between visits for weight (V1: 67.7±12.5 kg; V2: 68.9±13.1 kg; V3: 70.7±16.5 kg), BMI (V1: 24.5±4.1 kg/m², V2: 24.7±4.1 kg/m², V3: 25.7±4.8 kg/m²), FM (V1: 34.0±5.7%, V2: 34.1±5.0%, V3: 33.7±7.1%), LM (V1: 62.4±5.4%, V2: 62.2±4.6%, V3: 64.1±6.7%), and BMD (V1: 1.2±0.7 g/cm², V2: 1.2±0.1 g/cm², V3: 1.1±0.1 g/cm²). Conclusion: Regardless of decreases in DI, female collegiate dancers maintained LM and FM over the academic year. However, FM reported in the current study is higher than previously reported collegiate or professional dancers. Protein and carbohydrate intake indicate the need for nutrition education in this population in order to avoid decrements in performance and muscle mass over the collegiate career. Further investigation is warranted to assess what may be contributing to increasingly poor dietary behavior in a collegiate dance environment.

 Purpose: This descriptive study examined metabolic responses and propelling efficiency (Ep) of freestyle swimming performed by older trained male swimmers. METHODS: Volunteers included a 59, 60, 64, 64 and 76 yr old. This select group of older swimmers had a history of participating in competitive swimming and engaging in swim training for the last 10 to 22 years, averaging ~9000 meters per week. A series of submaximal freestyle swims (4 to 6 efforts) and one maximal swim to exhaustion were performed. Over the range of velocities (0.73 to 0.94 m/s), metabolic responses to swimming for this age level.

 Results: At a velocity range of 0.73 to 0.94 m/s, average peak metabolic power (MP, Joules/second (J/s); Garby et al., 1988, 1994, 1998). Ep, the quotient of mechanical power to overcome drag to total mechanical power, was estimated according to the work of Toussaint et al. 1988, 1994, 1998. RESULTS: Average peak MP, HR and BLA were 1137 J/s (3.2 lO2/min), 152 bpm, and 7.0 millimolar (mM), respectively. As a group, swimming velocities ranging from 0.73 to 0.94 m/s elicited a MP of 475 to 800 J/s (~42 to 70% of peak MP). For the same velocity range, HR, BLA and RPE were 97 to 127 bpm, 2.3 to 5.0 mM, and 8 (~“very light”) to 14 (“somewhat hard – hard”), respectively. Collectively, the correlation coefficient between MP versus submaximal swimming velocities was 0.69 with velocity explaining 44% of the variance in metabolic response (p=0.002). At a velocity of 0.92 m/s (~67% peak MP), estimated Ep was 39% (range: 32-47%). The 76 yr old achieved a peak MP of 885 J/s (~2.5 lO2/min), and peak HR, BLA, RPE of 144 bpm, 4.2 mM, 18, respectively; and, an Ep of 32%. Conclusion: This study estimates that 39% of the total mechanical power generated during submaximal swimming was utilized to overcome drag forces (useful power to move the body forward) and 61% was lost in giving masses of water a kinetic energy change (wasted power). The range of Ep values (32 to 47%) suggests a varying mechanical skill (technique) set among our older swimmers. Lastly, findings on our 76 yr old are believed to be unique since we have not been able to find data describing physiological responses to swimming for this age level.
AN ALKALIZING NUTRITIONAL SUPPLEMENT THAT POSITIVELY INFLUENCES MEASURES OF AEROBIC PERFORMANCE

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The ingestion of an alkalized diet, alkaliing agents (e.g. sodium bicarbonate), or alkaliing nutrition supplements (ANS), are known to positively influence measures of anaerobic performance, but their influence on markers of submaximal or maximal aerobic performance are not well documented. PURPOSE: Therefore, this study sought to test whether ingestion of an ANS could positively influence measures of submaximal and maximal aerobic performance. METHODS: Recreationally-active college-aged men (16) and women (12) performed two discontinuous incrementally-graded treadmill exercise tests to volitional exhaustion using a double-blind, placebo controlled, crossover design. After a 7-day loading phase of either placebo or an ANS tablets, each subject performed a treadmill test that included standardized moderate (MI) and high intensity (HI) submaximal stages with measures of steady-state heart rate (HR), respiratory exchange ratio (RER), blood lactate (BL), and rating of perceived exertion (RPE). The submaximal test at HI was then continued to volitional exhaustion with successive 1-min stages to measure maximal HR (HRMAX) and RER (RERMAX), maximal oxygen consumption (VO2MAX), and time-to-exhaustion (TTE). Blood pH, bicarbonate, and base excess were also determined for the same testing time points. Two-factor RM ANOVA were used to detect differences by condition (ANS versus placebo) and time point of the measurement with post-hoc planned contrasts (α=0.05). RESULTS: Measures of HR, BL, and RPE were all significantly lower (P=0.02-0.001) for the ANS condition. Further, RERMAX (+0.06), BLMAX (+1.1 mmol/dl), VO2MAX (+1.44 ml/kg/min), and TTE (+0.6 mins) were all significantly higher (P=0.02-0.002) for the ANS tablet condition. Lastly, blood pH was higher at rest and post-exercise while bicarbonate was non-significantly higher at all measures for the ANS tablet condition. CONCLUSIONS: The 7-day ingestion of these ANS tablets had small-moderate positive ergogenic effects (i.e., effects sizes) on outcomes for both submaximal and maximal treadmill exercise, as well as significantly higher blood pH values. This study supports the premise that consumption of ANS tablets can influence markers of both aerobic and anaerobic performance.

Support was provided by pH Sciences Holdings, Inc. (Lynwood, WA).

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PREDICTING HULA DANCING ACTIVITY ENERGY EXPENDITURE WITH ACCELEROMETRY-BASED ACTIVITY MONITORS

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Many forms of dance, such as the Hawaiian Hula, have been used with high risk populations to improve measures of health and physical fitness, but quantifying the dose (IntensityxTime) of dance-related exercise is needed to better understand dose-response relationships. Wearable accelerometry-based activity monitors (AMs, counts/min), for instance, can be used to indirectly quantify the metabolic intensity (i.e., the activity energy expenditure, or AEE, in kcals/kg/min) of specific types of dance, but this technique has never been validated directly against indirect calorimetry for dancing. PURPOSE: This study evaluated whether generalized (for 24/7 free-living AEE assessment) or newly derived Hula-specific dance AM algorithms could accurately predict AEE for Hula dancing. METHODS: 15 women (Mean±SD: 24±2 yrs, 25.4±3.4 kg/m2) and 6 men (27±2 yrs, 25.5±3.8 kg/m2), all professional Polynesian dancers, performed 5 mins of modern or traditional Hula dancing while AEE was assessed using indirect calorimetry. AM data was simultaneously collected at the hip (AMH), wrist (AMW), and ankle (AMA) using standard procedures. Steady-state measures of AEE, AMH, AMW, and AMA were then combined with select demographic measures (gender, age, BMI) to generate least-squares best-fit regression equations predicting dance-specific AEE (overall α=0.05). Measured AEE was then compared to predicted AEE from each new equation, as well as predicted AEE from published generalized equations (non-dance specific) using 1-factor RM ANOVA (α=0.05). RESULTS: Simple linear equations using the hip (AEE=0.0551 + 6.10E-05xAWH; R2=0.76, SEE=±0.0221 kcals/kg/min; P<0.001) and ankle AMs (AEE=0.0418 + 1.77E-05xACA; R2=0.64, SEE=±0.0271 kcals/kg/min; P<0.001), but not the wrist, were derived without use of demographic variables. Measured AEE (0.0840±0.0441) did not differ significantly (P>0.05) from predicted AEE with either ACH (0.0840±0.0384) or ACA dance equations (0.0839±0.0352), while both generalized equations for the hip and ankle AMs significantly underpredicted AEE (P<0.05). CONCLUSIONS: These results suggest that these Hula-specific dance AEE prediction equations from either hip or ankle AMs will provide more accurate prediction of AEE, as well as the dose of Hula dancing exercise, over use of generalized equations.
COMMON EXPERIENCES AND BELIEFS AMONG HIGHLY ACTIVE INDIVIDUALS: IMPLICATIONS FOR PSYCHOLOGICAL SATISFACTION AND FRUSTRATION

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Despite robust informational campaigns in the USA to exhort greater physical activity (PA), the prevalence of physical inactivity has remained largely unchanged. PURPOSE: To identify and analyze motivational characteristics, fulfillment of psychological needs, and individual experiences and beliefs among highly-active, middle-aged adults. METHODS: The Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS), and Motives for Physical Activities Measure Revised (MPAM-R) were used along with semi-structured interviews to elucidate the experiences and beliefs of the five participants (3 males, 2 females), ages 36-50 with a mean age of 45.8 (SD=5.97) years. They were all highly active, with a mean level of vigorous activity of 575 (SD=392.7) min/week. A Wilcoxon signed rank test was used to evaluate BPNSFS data for each psychological needs construct (Autonomy, Competence, Relatedness). Friedman’s two-way analysis of variance was used to compare means in the five groups of the MPAM-R. A post-hoc test with Wilcoxon signed rank test was performed for the MPAM-R data to identify a rank order in prioritization of motivational factors (Competence, Social, Interest/Enjoyment, Fitness, Appearance). The alpha-value was set at 0.05. RESULTS: The MPAM-R revealed highest motivational rankings for interest/enjoyment and competence, with both significantly higher than fitness (p=0.43), appearance (p=0.43), and social factors (p=0.39). The BPNSFS showed greater satisfaction than frustration in the competence (p=0.042) and relatedness (p=0.024) constructs, while there was no significant difference between satisfaction and frustration of the autonomy construct (p=0.68). Statements prioritizing competence were the most frequently mentioned during interviews, and all participants reported free play in childhood and adolescence. Fitness and appearance were the least frequently mentioned categories, suggesting low prioritization of extrinsic motivation. CONCLUSION: Interest/enjoyment and competence motivated the high levels of PA for our middle-aged participants who, additionally, reported greater levels of psychological satisfaction than frustration. This information might inform our approach to counseling individuals whose health would benefit from greater levels of PA.

BEYOND THE RUNNERS HIGH: CANNABIS AND PHYSICAL ACTIVITY

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Cannabis use has been gaining wider social acceptance, and with increased legalization cannabis users are talking more openly about how and why they consume cannabis. Moreover, professional and non-professional athletes are openly discussing their cannabis use before, during, and/or after training. There is a distinct lack of cannabis research in humans, particularly as it relates to physical activity. PURPOSE: To understand how and why people use cannabis with physical activity as well as categorizing the types of activities users engage in under the influence. METHODS: Subjects (n = 126; 63 male, 62 female, 1 non-binary; 18-55 years old) qualified to participate in an anonymous online survey if they reported both participation in regular physical activity and cannabis use. The survey consisted of five sections: demographics, general cannabis use, general physical activity habits, physical activity habits when under the influence of cannabis, and unanticipated experiences. RESULTS: Over 44% of participants reported that they use cannabis every or almost every time before they engage in physical activity. Fifty-three percent reported they smoke cannabis and 65% use Sativa-dominant strains before physical activity. The most common modes of physical activity while under the influence of cannabis were hiking (61%), yoga (58%), aerobic machines (50%), walking (43%), and weight lifting (43%). Fifty-six percent of respondents reported being at an advanced skill level in these activities. The primary reasons for using cannabis before physical activity included: helps me focus/concentrate (66%), helps me enjoy exercise (65%), enhances mind-body-spirit connection (64%), keeps me in the zone (61%), and enhances body awareness (52%). The majority (70%) of respondents reported feeling more satisfied with their workouts under the influence of cannabis compared to when they do not use cannabis prior to physical activity. Additionally, 61% have not suffered any unanticipated experiences when exercising under the influence of cannabis. CONCLUSION: This is the first study to investigate how and why people use cannabis with physical activity. This study provides a starting point for future studies investigating the impact that cannabis consumption has on physical activity participation and performance.
THE METABOLIC INTENSITY OF WALKING FOOTBALL DURING MATCH PLAY IN SOUTHEAST ASIAN WOMEN USING GPS

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The continued rise in obesity rates throughout Southeast Asia are known to be disproportionately driven by rates for women. PURPOSE: Taking advantage of the regional popularity of walking football, this study sought to characterize the metabolic intensity of Southeast Asian women competing in walking football matches to determine the sports’ suitability as a physical activity for promoting physical health and lowering disease risk. It was hypothesized that metabolic intensity (i.e., metabolic equivalents, or METs) would meet or exceed established thresholds for improving physical health and disease risk (\geq 3.0 METs). METHODS: Women’s teams from Singapore (Mean\(\pm\)SD: 42\(\pm\)11 yrs age; 29.2\(\pm\)7.0 kg/m\textsuperscript{2} BMI; n=14) and Malaysia (40\(\pm\)10 yrs age; 32.9\(\pm\)5.7 kg/m\textsuperscript{2} BMI; n=8) competed in two matches within a single day using an outdoor regulation mid-sized field (40 m x 23 m) in Singapore during hot and humid ambient conditions (82-87° F; 87-90%). Data were recorded with portable handheld global positioning satellites (GPS) devices that were worn by each player within a neoprene waist pack. The GPS data were later downloaded and converted to walking distance and speed using standard transformations, and then into METs using a regression formula to predict METs from overground walking speed. Additionally, the GPS data were also used to derive total walking distance during each match (DIST, km), as well as the amount of time spent at \geq 3.0 METs during each match (TIME, mins). A one-sample t-test was used to compare mean predicted METs to the 3.0 MET threshold, and two-sample t-tests were used to compare DIST and TIME variables between teams for each match (\(\alpha=0.05\)). RESULTS: Both Malaysian and Singaporean teams maintained an average metabolic intensity that was statistically similar to the 3.0 MET threshold - 3.2\(\pm\)0.9 METs (\(P=0.0510\)) vs 3.3\(\pm\)1.0 METs (\(P=0.288\)), respectively. Players walked an average of 2.2-2.4 kms/match, while the Malaysian teams spent 17-18 mins/match above 3.0 METs vs 10-11 mins/match for the Singaporeans. CONCLUSIONS: The results of this study support the idea that the physiological demands of competitive walking football are sufficient to promote positive changes in metabolic fitness with this population of Southeast Asian women when performed regularly.

Support provided by Edith Cowan University to the lead author.

EFFECTS OF AN ACUTE BOUT OF AEROBIC EXERCISE ON RISK TAKING

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In recent years there has been a great interest in the effects of exercise on cognition, but few have looked at whether physical activity influences risk taking. Exercise increases levels of circulating cortisol and dopamine, both of which have been linked to risk-taking. Exercise has been considered an outlet for impulsive cravings (e.g., through distraction or stimulation of reward pathways), but whether acute exercise actually attenuates or increases risk taking is largely unknown. PURPOSE: To investigate the effects of an acute bout of vigorous exercise on factors related to decision-making, including risk taking, reward sensitivity, punishment sensitivity, and behavioural inhibition. METHODS: Healthy (free of psychological or neurological conditions), moderately active males and females (\(n=20\), 50% females, mean age = 22.4 years, sd = 2.48) performed either a 30-minute bout of cycling at 60% of their maximal power output (determined at baseline) or watched a neutral film. Participants provided saliva samples to measure cortisol pre- and post-intervention for both the neutral and exercise conditions. Following the intervention, participants completed a series of computerized behavioural tasks: the balloon-analogue risk task (BART), the risky gains task, and the STOP-it task. The study employed a repeated measures, crossover design. RESULTS: There was a significant increase in cortisol (\(m \pm SD: 13.39 \pm 21.41\) ug/dL, \(p = .013\)) following the exercise intervention, and a significant decrease in cortisol (-6.11 \pm 7.41 ug/dL; \(p =.002\)) following the neutral intervention. There were no significant main effects for any of the behavioural tasks, all \(p > .05\). There was a significant interaction between order and condition for the BART (both average and adjusted total balloon pumps, \(P<.05\)). The second time performing the BART (regardless of condition) resulted in fewer total pumps (or decreased risk taking). CONCLUSION: Acute exercise did not influence risk taking in the current sample. It may be beneficial to include a practice session of behavioural tasks (namely, the BART) at baseline to decrease the impact of any practice effect.