ACSM Northwest Annual Meeting 2020

Abstract Booklet

February 28—29, 2020

Boise State University, Boise, ID

Presentation Schedule

Undergraduate Student Thematic Poster Session—Friday @ 11:15 am in Jordan C

Doctoral Student Oral Presentations—Friday @ 11:15 am in Simplot AC

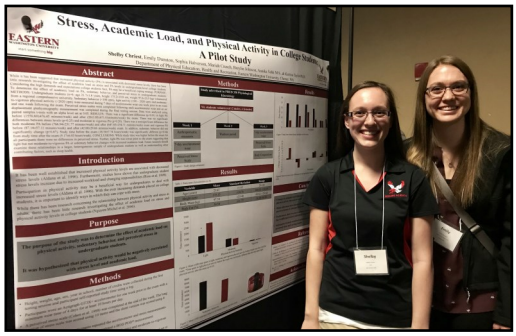
Graduate Student Thematic Poster Session—Friday @ 2:00 pm in Jordan C

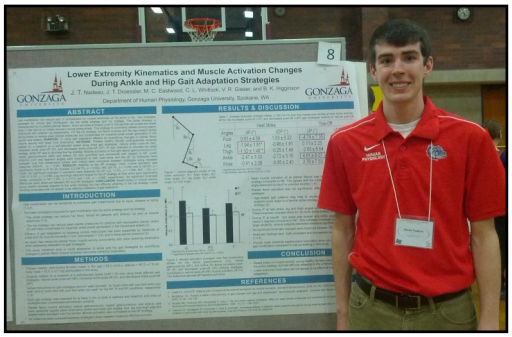
Masters Student Oral Presentations—Friday @ 2:00 pm in Simplot AC

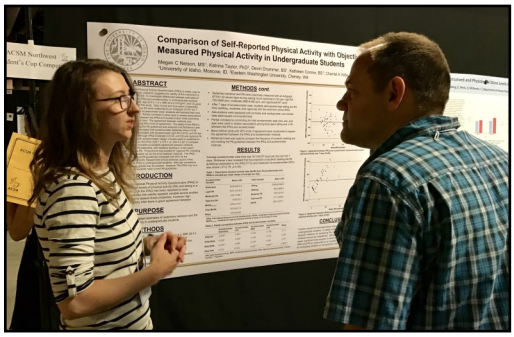
Free Communication Poster Session—Friday @ 5:00 pm in Jordan ABC

Undergraduate Student Thematic Poster Session—Saturday @ 9:00 am in Jordan C

Undergraduate Student Thematic Poster Session—Saturday @ 10:00 am in Jordan C







A special thank you to the following members of our chapter for their assistance in reviewing abstracts and/or judging this year's presentations

Christi Brewer PhD, Alan Coelho EdD, Kirsten Coffman PhD, Chris Connolly PhD, Emily Dunston, BS, Chuck Dumke PhD, Lex Gidley PhD, Stephanie Hall PhD, John Halliwill PhD, Evan Hilberg MS, Charlie Katica PhD, Jacob Kysar MS, James Laskin PhD, Ken Leclerc PhD, Gary McCall PhD, Chris Minson PhD, Megan Nelson MS, Thomas Nightingale PhD, Harry Papadopoulos PhD, Janet Peterson PhD, John Quindry PhD, John Shuna PhD, Matt Silvers PhD, Katie Taylor PhD, Justin Ulbright MS, Cassie Williamson-Reisdorph MS, Annika Vahk MS, Amber Vermeesch PhD

The top presentations for each category will be highlighted at our Awards Ceremony from 4:00—5:00 pm on Saturday in Jordan D.

Please join us to celebrate the student presentations from our region!

Refreshments will be provided.

UNDERGRADUATE THEMATIC SESSION I
FRIDAY, FEBRUARY 28th 11:15 AM – 12:00 PM, JORDAN C

Board 1

COMPARING HEART RATE AND TIRE PRESSURE AS PREDICTORS OF PERFORMANCE IN WHEELCHAIR BASKETBALL SPRINT TESTS

N.T. Adams, B.L. O'Malley, S.R. Crompton, C.P. Katica
Pacific Lutheran University, Tacoma, WA

Wheelchair basketball is an intense, high-paced game played at the recreational-, intercollegiate- and Paralympic-levels. Limited research has been conducted assessing tire pressures and the impact on performance and physiological measures in adapted sports. **PURPOSE:** The goal for this research project was to examine if heart rate or tire pressure would be a better indicator of speed during various performance tests of recreational wheelchair basketball players. **METHODS:** Seven (5 males and 2 females) experienced wheelchair basketball players performed a total of four trials. The first trial was a familiarization trial and the remaining three trials were the testing trials. During the testing sessions, tire pressures were set at 80, 100, or 120 psi and were conducted in a counterbalanced order. A baseline heart rate was collected before testing sessions began. After baseline measures were collected, participants underwent a 10-minute dynamic warm-up. Immediately following the warm-up, the first drill was a modified version of the 5-10-5 drill. After the completion of each performance test, time and HR were collected and each participant had a one-minute rest between performance tests. Participants then performed a modified T-drill, followed by sprinting the length of a basketball court and back (56 meters) four times. **RESULTS:** The omnibus, repeated-measures ANOVA did not detect differences between HR and speed for the different tire pressures ($p > 0.05$); however, pair-wise comparisons found differences between extremely-low pressure (80 psi) and normal pressure (120 psi) for speed in the 5-10-5 drill (80 psi = 12.69 ± 2.05 sec. vs. 120 psi = 13.06± 1.62 sec., $p = 0.023$), the T-drill (80 psi = 8.80 ± 1.43 sec. vs. 120 psi = 9.28 ± 1.31 sec., $p = 0.015$) and the down and backs (80 psi = 9.82 ± 1.68 sec. vs. 120 psi = 10.10 ± 1.61 sec., $p = 0.011$). In addition, a weak correlation was found between heart rate and speed; however, a slightly stronger correlation was found between PSI and speed for all performance tests. **CONCLUSION:** PSI and heart rate were not found to be good predictors of speed. Further studies need to be conducted to determine whether or not variable tire pressure has an effect on wheelchair basketball performance over the course of a wheelchair basketball game or tournament.

Board 2

THE EFFECTS OF GRUNTING ON VERTICAL JUMP IN RECREATIONAL BASKETBALL PLAYERS

K. Bryson, C. Peach, W. Wigen, S. Cool, W.M. Silvers
Whitworth University, Spokane, WA

Grunting effects on muscle force output (MFO) has been examined for sports, such as tennis, mixed martial arts (MMA), and powerlifting. Grunting may increase vertical jump (VJ) height, which is a standard measurement of MFO for the lower extremities. Grunting during a VJ may benefit the overall performance of recreational basketball players. **PURPOSE:** The purpose of this research study was to investigate the effects of grunting on VJ height in recreational basketball players. **METHODS:** Twenty-eight healthy male and female collegiate recreational basketball players, aged 18-25 yr ($n_m = 22$, $n_f = 6$; height: 177.46 ± 3.31 cm, weight: 74.77 ± 12.17 kg, age: 20.85 ± 0.65 yr), participated in the research study. Participants performed two countermovement jump (CMJ) trials, with and without grunting, to measure VJ height. The highest jump was recorded for analysis. Participants warmed up with a dynamic warm-up protocol prior to each trial and rested for 10 min between trials. A dependent groups t-test (significance level $p \leq 0.05$) was utilized to determine the existence of significant differences between experimental conditions for all dependent variables. **RESULTS:** No statistical differences were observed between grunting and non-grunting conditions (55.93 ± 14.36 cm v. 55.65 ± 14.34 cm; $p = 0.48$) for VJ height. Therefore, the research hypothesis that grunting would positively impact VJ was rejected. **CONCLUSION:** Under these research conditions, grunting did not improve VJ height performance. The primary explanations for the observed results were the inability to distinguish between grunting and non-grunting breathing techniques and the small sample size utilized in the study. No learning effect was evident because the a follow up dependent groups t-test revealed no statistically significant difference between the first and second trial ($p = 0.48$). Participants should have been grouped by athletic performance because recreational status may have been too broad of a population, as skill level and experience appeared to vary. Future researchers should investigate the effects of grunting with a larger sample size, alternative breathing technique, and standardization of ability between participants.

Board 3

EFFECTS OF FRESH PINEAPPLE JUICE ON DELAYED ONSET MUSCLE SORENESS RECOVERY IN LOWER EXTREMITY MUSCLES

L. Haley, H. Pfundt, J. Tonkinson, S. Weiler, W.M. Silvers
Whitworth University, Spokane, WA

Pineapple contains important nutrients, such as bromelain and vitamin C (vit C), which have been used to reduce inflammation. Despite this, empirical evidence for pineapple juice (PJ) as a naturopathic mitigator of delayed onset muscle soreness (DOMS) is relatively unknown. **PURPOSE:** The purpose of this study was to evaluate the effects of fresh PJ on perceived pain and exercise performance after induced muscle damage. **METHODS:** Twenty healthy, moderately-active college students (18-24-y) were divided into control © and PJ groups. Participants completed baseline pain pressure threshold (PPT) and countermovement vertical jump (VJ) tests followed by a drop jump (DJ) exercise protocol (10 x 10 DJ, 1-min rest between sets). Fresh PJ supplementation was provided to the PJ group, which included three 100-g doses of PJ consumed within a 48-h period. The C group did not receive supplementation. PPT and VJ tests were completed 48-h following the first round of testing. Factorial ANOVAs ($p \leq 0.05$) were utilized to determine the existence of significant differences between conditions for each dependent variable. **RESULTS:** As shown in Table 1, no significant differences were observed between PJ and C groups for PPT on rectus femoris ($p = 0.487$) and biceps femoris ($p = 0.644$) or for VJ performance (p =o.648). **CONCLUSION:** Under these research conditions, PJ did not mitigate perceived pain or exercise performance decrement after induced muscle damage. The primary explanation for the observed results may have been due to small effect sizes and low statistical powers due to small sample sizes. Future research should include a larger sample size, record muscle soreness at multiple points over time post-exercise and utilize PPT tests on multiple muscle groups.

Table 1. *Descriptive Statistics for PPT and VJT*

Time	Group	PPT-RF (lbf)	PPT-BF (lbf)	VJ (in)
PRE	**CC**	23.25 ± 8.24	23.22 ± 7.98	22.54 ± 6.65
	PJ	19.29 ± 6.31	20.98 ± 9.60	20.56 ± 5.04
POST	**CC**	19.83 ± 10.42	24.93 ± 16.01	22.25 ± 6.25
	PJ	17.07 ± 6.46	20.14 ± 9.70	20.56 ± 5.10

PPT-RF: Pain pressure threshold in rectus femoris and PPT-BF: Pain pressure threshold in biceps femoris.

Board 4

TEMPORAL DECEPTION AND TREADMILL RUNNING: PHYSIOLOGICAL AND PSYCHOLOGICAL VARIABLES AFFECTING CONSISTENCY OF A ONE-MILE RUN

A. Hickey, M. Fisher, B. Halligan, B. Bang, D. Thorp
Gonzaga University, Spokane, WA

Selection of pace is determined before beginning an activity by the process of teleoanticipation. **PURPOSE:** The aim was to determine how temporal deception affected self-pacing and the time taken to run one mile, while considering psychological and physiological aspects. **METHODS:** Subjects (n=17, 18-22 yr.) completed a familiarization trial and three experimental trials (counterbalanced order) in which subjects ran one self-paced mile on a treadmill (0% grade) while the timer prominently displayed to subjects was manipulated (sped up 10% (SU), slowed down 10% (SD), or unaltered/control (C)). Mile time (actual, not manipulated/displayed time), stride rate and length, heart rate (HR), rate of perceived exertion (RPE), and affect were recorded for each trial. Treadmill displays were covered and subjects were informed of distance completed each quarter mile. Subjects were able to adjust treadmill speed at any time, except for 10 seconds at each quarter mile while stride characteristics were measured. A two-way repeated measures ANOVA was performed for all dependent variables evaluating the effects of the experimental timer and distance. Significance at p<.05. **RESULTS:** All data is presented as mean±SD. The mile times were unaffected by the timer displayed to subjects (C: 8:06±1:34, SU: 7:54±1:15, and SD: 7:57±1:13; p=.329). Regardless of timer intervention, RPE increased significantly at each quarter mile (p<.001) with a final value of 15.22±0.03 and affect decreased significantly at each quarter mile (p<.001) with a final value of 0.45 ± 0.09. The altered timer did not affect intensity indicated by average HR in each trial (C: 178.9±18.7 bpm, SU: 171.1±45.3 bpm, SD: 185.6±7.7bpm, p=.150), although HR did increases significantly each quarter mile (p<.001). Neither the altered timer, nor distance had an effect on stride length (p=.343; p=.079, respectively) or rate (p=.458; p=.230). Subjects self-rated their performance better for the SD trial than the SU trial (4.12± 60 vs. 3.29±.59 on a scale of 0 to 5, p=.002). **CONCLUSION:** Subjects perceived that their performance was altered, yet this did not translate to a change in running speed. The selection of speed and RPE are so ingrained prior to beginning via teleoanticipation, that timer manipulation does not alter pacing strategies throughout a one-mile run.

Board 5

EFFECTS OF NASAL ONLY AND APNEA BREATHING ON PERFORMANCE IN TRAINED CYCLISTS

J. Murphey, A. Lafrenz
Concordia University, Portland, OR

Breathwork, or the specific act of controlling breathing to elicit a desired outcome, is not only a potential way to improve one's mental well-being but also to alter adaptation responses through gas exchange at the capillary level. **PURPOSE:** The purpose of this study was to examine the impact of incorporating nasal only breathing and breath mechanics on carbon dioxide (CO2) tolerance and functional training power in adult cyclists. **METHODS:** Twenty-four subjects (male n=15, female n=9, age 34 ± 5 years; height 173.36± 8.03 cm; mass 69.97±8.33 kg; Fat mass 16.60±5.07%) were randomly assigned to experimental or control groups (n=14, n=10 respectively). All participants completed baseline testing of maximal oxygen consumption (VO2max), CO2 Tolerance (CO2Tol), and functional threshold power at CO2 Tolerance (FTPCO2). Subjects also completed the State-Trait Anxiety Inventory (STAI) questionnaire during the FTPCO2 test to access state and trait stress and anxiety (SA and TA respectively) levels when breathing was restricted to the nasopharynx. Experimental subjects completed specific apnea and nasal only breathing protocols, daily. Control subjects completed random, non-focused breathing exercises. All subjects were blinded to which group they were in. Follow up testing was conducted 6-weeks post-baseline tests. ANCOVA and difference in baseline characteristics were analyzed. **RESULTS:** The experimental group showed improvement in CO2Tol (20.6±11.3 seconds, p=.0001), FTPCO2 (23.6±30.6 watts, p=.0001), and SA (.4±.3, p=.00001). Control subjects saw a slight improvement in SA (.4±.3, p=.03) and no improvement in CO2Tol or FTPCO2 (.2±3.3 seconds and .3±7.2 watts, p=.8 and p=.4 respectively). **CONCLUSION:** This study supports the implementation of nasal and apnea breathing protocols as a viable training tool for improving sub-maximal power output in cyclists. This improvement could potentially lead to higher overall aerobic outputs as well as lowering overall fatigue in longer racing or training bouts. Secondarily, increasing tolerance to CO2 and improving breathing mechanics may reduce state anxiety. This can be particularly valuable for high stress/risk environments or sports that require significant amounts of concentration.

UNDERGRADUATE THEMATIC SESSION II
SATURDAY, FEBRUARY 29th 9:00 – 9:45 AM, JORDAN C

Board 1

EFFECTS OF AN AGILITY STEPPING PROGRAM ON FALLING EFFICACY IN OLDER ADULTS

T. Crawford, S. Johnston, N. Halfman, R. Ellington, C. Papadopoulos
Pacific Lutheran University, Tacoma, WA

The number of older adults is rapidly growing and so are their healthcare needs. Maintaining mobility and independence has become a key priority in keeping older adults healthy. Each year, millions of older adults fall. Falling once doubles the chances of falling again. Many people who fall, even without an injury, become afraid of falling while doing daily activities. **PURPOSE:** The purpose of this study was to assess changes in perceived fear of falling in a group of older adults after participating in an exercise class meant to improve their balance and agility. **METHODS:** Seven older adults (age: 80.4 ± 9.91 years) from a local community center with varied experience in physical activity participated in a 12-week program emphasizing on different stepping patterns. All participants completed a series of functional assessments to determine mobility, static and reactive compensatory balance. In addition, the Fall Efficacy Survey (FES), a 16-item survey to assess fear of falling, was administered at baseline and at the end of the program. A paired *t* test was used to determine differences in fear of falling between pre and post. A Pearson's correlation coefficient was used to determine the relationship between functionality and fear of falling. Significance was set at $p < 0.05$. **RESULTS:** Total score from the FES was not significantly ($p = 0.76$) different between baseline and after twelve weeks of training. Statistical analysis showed a significant ($p = 0.03$) negative relationship ($r = -0.68$) between confidence going up and down stairs and functional reach and a significant ($p=0.03$) negative correlation ($r= -0.70$) between confidence walking up and down stairs and backwards compensatory stepping. Finally, a significant ($p=0.03$) negative relationship ($r= -0.42$) between the participants' overall Fall Efficacy Survey score and timed up and go test was found. **CONCLUSION:** In this group of older adults, over the course of a 12-week agility stepping program, there was a significant relationship between confidence walking up and down stairs and the ability to reach for an object and the ability to step backwards to compensate for a slip. However, there was a large interindividual variability in confidence indicating that further research is needed to determine the effectiveness of the program on fear of falling.

Supported by West Region EMS Grant

Board 2

IMPACT OF VIDEO-TRAINER ON MOOD AND MOTIVATION

L. Klepacz, B. Ashbaker, L. Taysom, T. Pincock, B. Whiting, T. Argyle, B. States, D. Lankford, FACSM
Brigham Young University - Idaho, Rexburg, ID

Training videos are becoming increasingly popular as a way to enhance physical activity. **PURPOSE:** To identify the effects of an in-video trainer treadmill on mood, motivation, heart rate (HR), oxygen uptake (VO2), Rate of Perceived Exertion (RPE), Respiratory Exchange Ratio (RER), pace, speed, distance, and burned calories, then compare these effects to a treadmill workout without audiovisual input. **METHODS:** 17 subjects (m=9, f=8) completed two treadmill tests, one with audiovisual input, the other without. The test with audiovisual factors allowed subjects to choose from a list of 5 video courses on the NordicTrack X22i treadmill. VO2, HR, RPE, pace, RER, speed, calories and distance were recorded. Motivation and mood were collected using a feeling scale and the Physical Activity Enjoyment Scale (PACES). The feeling scale was administered in the middle and end of each test. The PACES scale was used at the end of each test. Repeated measures t-tests were used to compare differences in VO2, HR, RPE, pace, RER, speed, calories and distance. A two-factor repeated measures ANOVA was used to compare differences in the PACES and feeling scale responses. ($p<0.05$). **RESULTS:** Between the tests there was no statistical difference in average VO2 (video 27.45±10.21ml/kg/min, no video 26.29±10.09 ml/kg/min, $p=0.274$), HR (video 139.46±22.43 bpm, no video 144.74±21.84 bpm, $p=0.604$), RPE (video 13.58±1.84, no video 13.22±2.00, $p=0.659$), pace (video 14.32±5.46 min/mi, no video 14.16±5.04 min/mi, $p=0.885$), RER (video 0.93±0.05, no video 0.93±0.05, $p = 0.625$), speed (video 4.56±1.52 mph, no video 4.43±1.43 mph, $p=0.340$), calories burned (video 221.92±78.92 kcal, no video 227.38±78.92 kcal, $p=0.865$) and distance (video 1.64±0.46 mi, no video 1.60±0.42 mi, $p=0.32$). Results show midpoint motivation (video 8.89±1.24, no video 7.13±2.06, $p=0.004$), endpoint motivation (video 8.63±1.80, no video 5.61±2.04, $p=0.001$), midpoint mood (video 3.53±1.26, no video 2.52±1.50, $p=0.02$), and endpoint mood (video 4.32±0.67, no video 3.04±1.90, $p=0.001$). The PACES reported differences in "Lots of Fun" (video 5.71±1.40, no video 4.29±1.57) and "Very Pleasant" (video 5.65±1.54, no video 4.24±1.64). **CONCLUSION:** The use of an in-video trainer treadmill produces an increase in motivation and mood compared to a similar exercise without a video.

Board 3

CORRELATION BETWEEN BLOOD LACTATE ACCUMULATION AND PERCEIVED EXERTION IN CANCER PATIENTS DURING PROGRESSIVE EXERCISE TESTING

N. McCarty[2], N. Harman[1], A. Ramani[1], R. Hayward[1]
[1]University of Northern Colorado, Greeley, CO; [2]University of Puget Sound, Tacoma, WA

Cancer cells display a dysfunctional metabolic profile when compared to healthy cells, characterized by increased rates of glycolysis and subsequent lactate production and accumulation. Blood lactate accumulation in healthy populations during an acute, progressive exercise assessment has been thoroughly investigated, but is poorly defined in the cancer population. Furthermore, to date, no studies have identified the relationship between a cancer patient's lactate accumulation and their rating of perceived exertion during and following an acute, progressive exercise assessment. **PURPOSE:** To investigate the relationship between the rating of perceived exertion (RPE) and blood lactate accumulation (BLA) in cancer patients during incremental treadmill exercise to volitional exhaustion. **METHODS:** Seventy-six cancer survivors were recruited from the University of Northern Colorado Cancer Rehabilitation Institute (UNCCRI). All participants completed an initial assessment which included performance of the UNCCRI Treadmill Protocol, a graded treadmill protocol to volitional exhaustion. BLA was quantified at rest and following the termination of the graded exercise test. RPE was assessed using the Modified Borg scale at rest and upon termination of exercise. T-tests were used to compare resting and termination values for BLA and RPE. A Pearson's correlation was used to assess the relationship between the change in BLA and the change in RPE from rest to the termination of exercise. **RESULTS:** Significant increases from rest to termination of exercise occurred for BLA (Resting: 1.79 ± 0.96 mmol/L, Termination: 5.99 ± 2.55 mmol/L; $p < 0.001$) and RPE (Resting: 1.89 ± 0.85, Termination: 8.23 ± 1.62; $p < 0.001$). A significant positive correlation was observed for the change in BLA and RPE ($r = 0.39$; $p = 0.001$). **CONCLUSION:** The current study shows a positive correlation of BLA and RPE during an acute bout of exercise to volitional fatigue in cancer patients, regardless of cancer-specific factors, such as treatment and fatigue. Therefore, it appears as though the exercise response in the cancer population is similar to the generally healthy population in both physiological response and subjective perception of exertion during progressive exercise testing.

Board 4

PERCEPTIONS OF LONELINESS, SOCIAL ISOLATION, AND PHYSICAL ACTIVITY BEHAVIOR DURING PREGNANCY

A.C. Panebianco[1], A.A.B. Cruz[1], T. Reiss[1], F.R. Williams[2], C.P. Connolly[1]
[1]Washington State University, Pullman, WA; [2]Washington State University, Richland, WA

Throughout gestation, it is common for some women to experience feelings of loneliness and isolation. This may have some negative impact on pregnant women's critical health behaviors, as social isolation has been shown to be related to physical inactivity in other populations. **PURPOSE:** The aim of this study was to examine the impact of feelings of loneliness and quality of social network on physical activity (PA) behavior during pregnancy. **METHODS:** An online survey was designed and administered by healthcare professionals to pregnant women at prenatal health clinics in the Yakima Valley Washington area. Participants (N=266) answered questions on feelings of loneliness, the perceived quality of their social network, demographics and pregnancy health, and past and current PA behavior. Though we aimed for a diverse sample, participants were included if they could speak some English, were 18-40 years of age, and currently reside in the U.S. **RESULTS:** Preliminary results reveal associations between moderate to vigorous PA (MVPA) and the number of high contact social roles ($r=0.16$, $p=0.006$). While moderate PA was independently related to social network quality, vigorous PA was not. Logistic regression analysis showed that the number of high contact social roles increased the odds of meeting the current MVPA recommendations (OR=1.16, 95% CI: 1.01-1.34). However, this relationship was no longer significant upon controlling for whether participants met the MVPA recommendations prior to pregnancy (aOR=1.13, 95% CI: 0.96-1.34). A similar trend was displayed for number of high contact social roles and any MVPA participation (OR=1.24, 95% CI: 1.03-1.50 and aOR=1.11, 95% CI: 0.91-1.35). Number of high contact social roles was inversely related with feelings of loneliness ($r=-0.36$, $p<0.001$). **CONCLUSION:** While pregnancy PA behavior may be related to the quality of social networking and loneliness, it appears the most prominent predictor of PA in this population is pre-pregnancy PA behavior.

Board 5

COMPARING CARDIOVASCULAR RISK FACTORS BETWEEN FIRST- AND FOURTH-YEAR UNDERGRADUATE STUDENTS AT GONZAGA UNIVERSITY

T. Tye, T. Ruesch, E. Harting, A. Ferrer, P.L. Crosswhite
Gonzaga University, Spokane, WA

Cardiovascular disease (CVD) is a leading cause of death in adults and represents a major health care expense in the United States. While CVD risk is well studied in adults, it remains largely unexplored in the young adult population. **PURPOSE:** To assess cardiovascular risk factors in first- and fourth-year undergraduate students. **METHODS**: From October to November of 2019, 45 first- and fourth-year undergraduate students were screened for various CVD risk factors including elevated body mass index (BMI), body fat percentage, blood pressure, plasma lipids, blood glucose, inactivity, smoking, alcohol consumption, and family history of diabetes and coronary disease. Participants' total number of risk factors was compared between first- and fourth-year students. Mean differences between first- and fourth-year students for each risk factor were determined using independent t-tests. Trends between lifestyle habits and biometric data were analyzed using Pearson's correlation. **RESULTS:** BMI was significantly greater in fourth-year students (23.9 ± 3.5 kg/m^2) than first-year students (21.7 ± 3.0 kg/m^2), $p = 0.03$. Fourth-year students had two-times more risk factors than first-year students (1.66 ± 1.46 risk factors, 0.88 ± 0.74 risk factors; $p = 0.02$, respectively). Fourth-year students (5.3 ± 1.8 drinks/week) drank significantly more alcohol per week than first-year students (2.0 ± 1.8 drinks/week), $p < 0.01$. **CONCLUSION:** The college environment can have a negative impact on the population studied due to exposure to different activities that may increase CVD risk. Young adults should be aware and understand how the choices today may affect their future cardiovascular health. Preliminary results of the current study support follow-up longitudinal studies regarding the changes of college students' cardiovascular health from the beginning to end of undergraduate study.

UNDERGRADUATE THEMATIC SESSION III
SATURDAY, FEBRUARY 29th 10:00-10:45 AM, JORDAN C

Board 1

EFFECT OF HIGH INTENSITY INTERVAL TRAINING ON MAXIMAL FATTY ACID OXIDATION VERSUS STEADY STATE EXERCISE

K. Beisel, E. Donahue, A. Kalafatis, K. Christison, C.L. Dumke, FACSM
University of Montana, Missoula, MT

Previous evidence suggests high intensity intervals and steady state exercise can enhance fat oxidation. These two stimuli have not been examined in the same exercise bout. **PURPOSE:** This study examines the effect of high intensity interval training (HIIT) on fatty acid oxidation compared to steady state at each individuals maximal fatty acid oxidation (MFAO). **METHODS:** Twelve fasted, uncaffeinated individuals (8 males, 4 females, average VO_2max = 44.3±2.3 $ml \cdot kg^{-1} \cdot min^{-1}$, average age =23.8±0.8 years) underwent a randomized crossover design study with 2 trials; trial A included cycling for 60 minutes at MFAO workload (0.55±0.05 $g \cdot min^{-1}$; 58.6±1.1 % VO_2max; 126.7±9.6 W**)** and trial B included 3 minute intervals at 90% and 30% of maximal workload during the first 30 minutes, and the last 30 minutes the subjects cycled at the MFAO workload. Total work was matched between the two trials. Heart rate (HR), respiratory exchange ratio (RER), rating of perceived exertion (RPE), absolute fat (FAO) and carbohydrate oxidation (CHOO) were recorded every 15 minutes, lactate and glucose taken every 30 minutes. Data was analyzed using a 2X2 repeated measures ANOVA and paired samples T-test for overall trial differences. **RESULTS:** There was a main effect of time on lactate (p=0.002), RPE (p=0.027), HR (45 min: 164.6±2.8 bpm vs. 60 min: 168.0±2.9 bpm, 45 min: 159.4±3.6 bpm vs. 60 min:159.8±4.6 bpm, p=0.028), and FAO (45 min: 0.55±0.05 g/min vs. 60 min: 0.66±0.06 g/min, 45 min: 0.62±0.04 g/min vs. 60 min: 0.63±0.04 g/min, p=0.044). There was a trial effect of RPE (45 min: 13.5±0.3 vs 60 min: 13.8±0.4, 45 min: 11.4±0.8 vs 60 min: 12.5±0.6, p =0.014), and sweat rate (0.91±0.07 $L \cdot min^{-1}$ vs 0.69±0.03 $L \cdot min^{-1,}$ p=0.03) All listed values are trial A vs. trial B respectively. A trial by time interaction was found for lactate (p<0.001). **CONCLUSION:** These data suggest as exercise endurance increases, MFAO is elevated. Despite elevated lactate in the HIIT trial FAO did not differ between trials. Despite matched work between trials, significant reductions in RPE, HR and SR, suggests subjects had reduced metabolic stress at MFAO workloads following HIIT.

Board 2

CHARACTERIZATION OF TEMPERATURE AND RELATIVE HUMIDITY RESPONSES IN AN ENVIRONMENTAL CHAMBER

J.P. Leeds, K.E. Coffman
University of Puget Sound, Tacoma, WA

Environmental chambers are an affordable solution for testing physiological responses to various environmental conditions in a laboratory setting for human exercise research. **PURPOSE:** To characterize the temperature (TEMP) and relative humidity (RH) responses of an environmental chamber in preparation for future studies. **METHODS:** Set points were selected by combining a high and low TEMP (HT & LT) and high and low RH (HH & LH) desired for future testing (HT-HH: 40°C-80%; HT-LH: 40°C-20%; LT-HH: 5°C-80%; LT-LH: 20°C-20%). First, the chamber started at room conditions and the digital TEMP and RH readouts of the chamber were recorded as the chamber reached each set point. Next, a pair of portable TEMP and RH sensors were calibrated and placed in opposite corners of the chamber to test whether there were differences in TEMP and RH values across the chamber. Lastly, the chamber door was opened for 15 s to test the response of the TEMP and RH during personnel entry/exit. **RESULTS:** The results presented here include the conditions which elicited the largest and/or smallest fluctuation or change for each aim. The chamber reached all set points in a minimum of 35 min (HT-LH) and maximum of 120 min (LT-LH). While TEMP remained relatively stable (largest fluctuation in LT-LH; 5.1 ± 0.6°C), RH fluctuated sinusoidally around its set point, and this was more substantial at LT-LH (21 ± 4%, range 16-30%) vs. LT-HH (80 ± 1%, range 78-82%). TEMP and RH were homogenous in both corners of the chamber in HT-LH (Δ2.0 ± 0.4°C; Δ3 ± 1%) and LT-LH (Δ1.5 ± 0.03°C; Δ3 ± 1%). In response to door opening, RH fell rapidly by ~2% but quickly recovered (~5 min) in HT-LH, whereas RH did not fall perceivably in LT-LH. When the chamber door was opened in HT-LH, TEMP fell slightly (~1ºC) but quickly recovered (~5 min); TEMP did not change in LT-LH. **CONCLUSION:** The environmental chamber is able to reach a range of set points in ≤120 min, maintains an acceptable level of homogeneity in TEMP and RH across the chamber, and is minimally impacted by door opening. LT-LH requires a longer setup time and shows the largest fluctuations, likely because water is more difficult to evaporate at low TEMP. Future studies should aim to test similar conditions while one or more subjects are exercising in the chamber to determine the impact on TEMP, RH, and O_2 and CO_2 concentration.

Board 3

EFFECT OF PASSIVE VS. ACTIVE RECOVERY STRATEGIES ON HIGH-INTENSITY INTERVAL EXERCISE

J.K. Lindsey, K.B. Bower, P.A. Haglund, H.J. Penner, A.L. Stuart, K.A.Witzke, FACSM
Oregon State University - Cascades, Bend, OR

Whole body high-intensity interval training (HIIT) has been shown to be effective for fitness development and management of cardiovascular risk factors. While research has been done on the optimal work-to-rest ratio during high-intensity training, there is little research on the optimal body position for rest periods. **PURPOSE:** To determine differences in heart rate and power output during whole-body HIIT exercise using different inter-set recovery strategies. **METHODS:** This study was approved by the OSU IRB. Participants with at least six months of regular participation in whole-body HIIT (n=10, 2 males, 8 females; age: 35.4±6.8 y, range 28-51 y; height: 171.2±9.3 cm; weight: 70.6±11.6 kg), participated in two identical workouts on separate days, only differing in the rest strategy used between sets. The workout consisted of four sets of ten front squats at 70% of 1-RM, immediately followed by a two-minute maximal effort row. Each row session was followed by a two-minute rest interval using a passive (supine) strategy one day and an active (walking) rest strategy the other day. Dependent measures included post-row heart rate (bpm), rowing power (watts), total row distance (meters), and post-rest heart rate (bpm) averaged across the four sets. Paired t-tests were used to determine differences in dependent measures between the two workouts for each subject, at the $p<0.05$ level. **RESULTS:** There were no significant differences between passive and active recovery strategies for rowing power (189.0±33.4 W vs. 186.3±32.7 W), distance per interval (502±28 m vs. 502±29 m), or post-row HR (169±10 bpm vs. 174±9 bpm; $p>0.05$) respectively. There was, however, difference in post-rest HR (114±14 bpm vs. 136±17 bpm; $p<0.001$) for passive vs. active recovery, respectively. **CONCLUSION:** Passive recovery enhances cardiovascular recovery but does not appear to affect performance. It is possible that the better heart rate recovery provided by passive recovery may provide a psychological benefit or performance advantages during longer workouts or those with shorter rest intervals. A larger sample would provide more statistical power to detect a difference if it exists. Future research should test the effects of passive and active recovery on HIIT workout sessions lasting longer than 30 minutes, or with rest shorter than two minutes.

Board 4

THE ACUTE EFFECTS OF EXERCISE ON BODY COMPOSITION MEASUREMENTS USING THE BOD POD

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Air displacement plethysmography (ADP) is considered one of the most accurate and accessible methods of body composition testing. Exercise prior to testing is known to influence ADP results, and is thought to be related to how the temperature, humidity, and compressibility of air inside the BOD POD changes as a result. **PURPOSE:** To examine the effect of exercising at a moderate intensity prior to ADP assessment on the results, and how temperature and humidity changes in the chamber may be related. **METHODS:** 10 healthy college-aged participants were recruited for this study. Body composition, as well as ADP chamber temperature and humidity, were measured before exercise, immediately post-exercise and two hours post-exercise. Participants exercised at ≥70% maximal heart rate for 15 minutes. The difference between conditions was analyzed via paired t-tests and least-square regression tests. **RESULTS:** No trend of note was found with temperature, as from pre-exercise to post-exercise and post-exercise to two hours post-exercise, means increased by 1.040 ($p=0.013$) and 0.390 ($p=0.540$) degrees C, respectively. Humidity, on the other hand, increased by 12.3% after exercise ($p=0.001$) and subsequently returned to the same level as the pre-exercise mean after two hours. Body composition results (specifically percent body fat) also decreased significantly after exercise by 2.91% ($p=0.000$). After two hours, the body composition results increased by 2.37% ($p=0.000$) from post-exercise levels, not quite returning to pre-exercise conditions but approaching them. No correlation was found between temperature and body composition results in this experiment ($r=-419$, $p=0.725$), but a strong negative correlation approaching significance was found between humidity and body composition results ($r=-0.985$, $p=0.112$). **CONCLUSION:** A single bout of exercise does affect body composition results as determined by ADP. In addition, humidity shows a very strong negative correlation to ADP body composition results, possibly due to an increased presence of isothermal-like air in the BOD POD chamber following exercise.

Board 5

THE INFLUENCE OF PASSIVE HIP EXTENSION ON RUNNING BIOMECHANICS

J. Stoewer[1], E. Foch[2], M.B Pohl[1]
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Restricted passive range of motion (PROM) of hip extension has been anecdotally linked with low back pain. A potential mechanism for this may be that restrictions in passive hip extension prevents the hip from fully extending during running. As a consequence, the pelvis may undergo anterior tilt to allow the thigh to extend, thus, resulting in greater loading of the lumbar spine. However, it is currently unclear whether restricted passive hip extension has any bearing on hip and pelvis biomechanics during running. **PURPOSE:** To determine whether runners who differ in passive hip extension also demonstrate differences in hip extension and anterior pelvic tilt during running. **METHODS:** Participants included 9 healthy runners (3 males, 6 females) between the ages of 18-28. Passive hip extension was measured using the Thomas Test. Kinematic data during running was collected using a 3D motion capture system. Subjects were split into three groups (tight, normal, & flexible) using tertiles based on their Thomas Test score. Both hip extension and anterior pelvic tilt during running were then compared between groups using Cohen's effect sizes (ES). **RESULTS:** The tight group exhibited the least amount of hip extension during running with a large effect size (ES=0.84) when compared to the flexible group (Table 1). The tight group exhibited the greatest amount of anterior pelvic tilt with large effect sizes when compared to both the normal (ES=0.80) and flexible (ES=2.34) groups. **CONCLUSION:** Limited passive hip extension was linked with alterations in running biomechanics including reduced hip extension and greater anterior pelvic tilt. These kinematic alterations could potentially place greater loading the lumbar spine.

Table 1: Dependent variables (DV) among the three groups of healthy runners.

DV	**Tight** mean (SD)	**Normal** mean (SD)	**Flexible** mean (SD)
Hip Ext (-)	**0.2°** (18.7)	**3.1°** (15.8)	**-10.5°** (16.5)
Ant Pelv Tilt (-)	**-27.8°** (6.0)	**-22.1°** (8.1)	**-18.1°** (2.3)

GRADUATE THEMATIC PRESENTATIONS
FRIDAY, FEBRUARY 28th 2:00-2:45 pm, JORDAN C

Board 1

METABOLIC AND CARDIOVASCULAR ALTERATIONS DURING CRITICAL TRAINING IN WILDLAND FIREFIGHTERS

S.C. Gurney, K.S. Christison, C.M. Williamson-Reisdorph, K.G.S. Tiemessen, J.A. Sol, T.S. Quindry, M.W. Bundle, C.G. Palmer, J.C. Quindry, FACSM, C.L. Dumke, FACSM
University of Montana, Missoula, MT

Wildland firefighters (WLFF) are confronted with numerous physical and mental stressors. Pre-fire season includes an intense 2-week critical training (CT) period; a preparatory phase that can result in injury, illness, and rhabdomyolysis. **PURPOSE:** To identify physiologic changes in metabolic biomarkers that occur during 2 weeks of CT in WLFF. **METHODS:** Eighteen male (29.4±1.1 yr, 182.1±1.6 cm) and three female (26.7±2.6 yr, 169.5±4.2 cm) participants were recruited from a Type I interagency hotshot fire crew and monitored over their 2-week CT. Fitness was assessed via BLM Fitness Challenge (push-ups, pull-ups, sit-ups, 1.5 mi run). Subjects were asked to fast and abstain from caffeine for blood draws on days 1, 4, 8, and 11. Plasma was analyzed for changes in the metabolic profile and oxidative stress markers 3-Nitrotyrosine (3NT), 8-Isoprostane (8ISO), and Lipid Hydroperoxides (LOOH). A one-way repeated measures ANOVA was used to analyze 8ISO, 3NT, and LOOH. Paired samples t-tests were used to compare metabolic biomarkers. Data presented as mean±SEM. **RESULTS:** CT elicited decrease in total cholesterol (TC) (173.6±12.1 to 153.4±8.6 mg·dL^{-1}, p=0.01), hemoglobin A1c (5.2±0.1 5.1±0.1 %, p=0.003), hemoglobin (15.5±0.4 to 14.3±0.3 g·dL^{-1}, p=0.003), and estimated plasma volume to (53.8±0.7 to 50.7±1.4 %, p=0.005) from day 1 to 11. No difference was observed in high-density lipoprotein cholesterol. A main effect for time was observed in 8ISO (p<0.001), 3NT (p=0.033), and LOOH (p=0.001). A significant decrease was observed in 8-ISO at day 4 and 8 when compared to day 1 (day 1: 15.5±1.3, d4: 11.8±1.0, d 8: 12.9±1.1 pg·mL^{-1}). 3NT was significantly elevated from day 4 to day 8 (d4: 2.4±0.6, d8: 2.9±0.6 mg·mL^{-1}). LOOH showed a significant increase across all days (d1: 2.2±0.4, d4: 2.8±0.5, d8: 3.4±0.5, d11: 4.0±0.6 mM). Fitness was significantly correlated with DTC (r=0.58, p=0.046) and D8ISO (r=0.60, p=0.050). **CONCLUSION:** These data suggest the exertion required of WLFF during CT results in positive alterations to the metabolic profile. The changes in oxidative stress markers may reflect rapid adaptation to the CT stressors. These data suggest that WLFF are able to adapt quickly to the physical stress of CT, where fitness may be a protector of metabolic perturbations.

Funded by the US Forest Service 16-CR-11138200-005.

Board 2

ACUTE EFFECTS OF 3 HOURS OF UNINTERRUPTED SITTING ON HEMODYNAMICS IN MIDDLE-AGED AND OLDER ADULTS

M.C. Nelson, M.P. Casanova, J.R. Ball, R.D. Midence, C.A. Vella, FACSM
University of Idaho, Moscow, ID

Previous research has consistently demonstrated that a bout of uninterrupted sitting induces endothelial dysfunction in young, healthy men. However, there is little research examining the acute effects of uninterrupted sitting in other groups, especially women. **PURPOSE:** To investigate the effects of a single bout of uninterrupted sitting on hemodynamics in middle-aged and older men and women. **METHODS:** Thirty adults (14 men, 16 women; age, 46.6±8.8 y; body fat, 28.9±8.7%) performed a 3 h bout of uninterrupted sitting in a controlled laboratory environment. Body composition was assessed using multifrequency bioelectrical impedance analysis. Hemodynamic variables including blood pressure (BP), heart rate (HR), and calf circumference were measured at baseline, 1 h, 2 h, and 3 h of sitting. Additionally, superficial femoral artery (SFA) diameter and blood velocity were measured using Doppler ultrasound. SFA blood flow and shear rate were calculated using standard equations. Repeated measures ANOVA were utilized to understand changes in hemodynamic variables over time and between men and women. **RESULTS:** Systolic BP, diastolic BP, and calf circumference increased (p<0.01 for all), whereas HR decreased (p<0.001) over 3 h of sitting. SFA blood flow decreased over time with a quadratic trend (p<0.001; baseline: 76.1±47.9, 1 h: 46.2±28.8, 2 h: 39.0±19.7, 3 h: 34.7±18.5 mL/min). SFA arterial diameter did not change (p=0.12), however, SFA blood velocity decreased (p=0.03) over 3 h. Lastly, shear rate decreased over 3 h (p<0.001; baseline: 30.0±4.5, 1 h: 19.2±3.8, 2 h: 18.4±2.8, 3 h: 15.3±3.0 s^{-1}). No differences were found between men and women for all variables. **CONCLUSION:** A single bout of uninterrupted sitting induced unfavorable changes in BP, calf circumference, and SFA blood flow, velocity, and shear rate in middle-aged and older men and women. Unfavorable changes in hemodynamic variables from repeated exposure to uninterrupted sitting throughout the lifespan may help explain the increased risk for cardiometabolic disease and premature mortality with excessive amounts of sedentary behavior.

Supported by: University of Idaho Webb Education Faculty Endowment and University of Idaho Exercise Physiology Research Laboratory

Board 3

PREVALENCE AND ASSOCIATIONS BETWEEN TESTOSTERONE DEFICIENCY AND BONE MINERAL DENSITY IN MALE COLLEGIATE ATHLETES

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University of Idaho, Moscow, ID

Research has identified that endurance runners are at an increased risk for relative energy deficiency in sports (REDS). Testosterone (T) deficiency and low bone mineral density (BMD) are common symptoms among those experiencing REDS. However, a lack of research exists on the prevalence of T deficiency and low BMD among a wider variety of male athletes. **PURPOSE:** To assess the prevalence and associations of T deficiency and BMD in male collegiate athletes. **METHODS:** Male collegiate cross-country (CC) runners, track and field (TF) sprinters/jumpers, and club rugby (R) athletes, completed one visit to the Human Performance Lab at the end of their sports off-season. Participants arrived fasted (8 hours), abstained from exercise (12 hours), and arrived within 60 minutes of waking. Testing included collection of a saliva sample (Salimetrics SalivaBio Oral Swab), height and weight using a digital scale and stadiometer (APEX Deteco, Webb City, MO), a 24-hour dietary food recall (ASA-24), and 3 dual-energy x-ray absorptiometry scans (whole-body, lumbar spine (LS), left femoral neck (LFN); Horizon Hologic, Marlborough, MA). Statistical analyses were completed using SPSS Statistics v. 24 and data were reported as mean±SD. Significance was accepted at $p \leq 0.05$. **RESULTS**: Saliva samples are currently being analyzed for T levels at Salimetrics. CC had a higher caloric intake than R but not TF (CC: 3,813±1,239 kcal; R: 2,402±589 kcal; TF: 3,117±647 kcal, p=0.005, p=0.278 respectively). CC had lower LS BMD when compared to R but not TF (CC: 0.99±0.07 g/cm^2; R: 1.14±0.07 g/cm^2; TF: 1.12±0.16 g/cm^2, p=0.023, p=0.059 respectively). Additionally, CC had lower LFN BMD than R but not TF (CC: 0.99±0.08 g/cm^2; R: 1.12±0.14 g/cm^2; TF: 1.11±0.06 g/cm^2, p=0.046, p=0.069 respectively). One of eight CC athletes (12.5%) had low BMD (z-score < -1.0) in LFN, and two of eight CC athletes (25%) had low BMD in LS. Meanwhile, none of the R or TF athletes had low BMD in LS or LFN. **CONCLUSION:** Our findings support previous research findings demonstrating low BMD in endurance runners. Even though CC had a higher caloric intake, CC had a higher prevalence of low BMD in LS and LFN compared to R and TF indicating that caloric intake may not be the only contributing factor toward bone health in athletes. BMD associations with T levels will be determined upon analysis completion.

Board 4

EFFECTS OF ENVIRONMENTAL CONDITIONS ON SELF-SELECTED WORK AND PHYSIOLOGICAL STRAIN DURING WILDLAND FIREFIGHTING

J.A. Sol[1,2], M.R. West[1], J.W. Domitrovich[1], B.C. Ruby, FACSM[2]
[1]USDA Forest Service – National Technology and Development Program, Missoula, MT, [2]University of Montana, Missoula, MT

The combination of thermal extremes and metabolic demands associated with wildland firefighter (WLFF) job tasks may elicit acute impairment in work capacity. As heat injuries persist in WLFF and other tactical occupations, field evaluations can gather insight into characteristics of job tasks that may contribute to thermoregulatory challenges. **PURPOSE:** To evaluate the activity and physical demands of wildland firefighting as they relate to the associated environmental conditions. **METHODS:** Direct observation and real-time wireless physiological monitoring allowed for weather and physiological metrics, including heart rate (HR), percentage of HR max (%HRmax), core temperature (Tc) and physiological strain index (PSI), of male (n=301) and female (n=33) WLFFs to be monitored during wildfire management activities. Activity levels (ACT; counts·min^{-1}) were recorded using an ActiCal activity monitor (Mini Mitter) located in the left pectoral pocket. Heat Index estimations (HI) were calculated using temperature (TEMP) and relative humidity (HUM) inputs recorded using an OMEGA Temperature Data Logger. One-way ANOVAs were used to compare means of HI quartiles data using HR, ACT, and PSI as dependent variables. **RESULTS:** TEMP and HUM values were computed to heat index (n = 3891 hours) and divided into quartiles (Q1: 13.3-25.1°C; Q2: 25.2-26.4°C; Q3: 26.5-28.9°C; Q4: 29.0-49.1°C). Average ACT displayed a negative, linear correlation with HI (Q1: 535 ± 731 counts·min^{-1}; Q2: 423 ± 615 counts·min^{-1}; Q3: 384 ± 571 counts·min^{-1}; Q4: 309 ± 416 counts·min^{-1}; $p < 0.05$). However, this reduction in activity level resulted in only a moderating effect on HR and PSI as average HR (Q1: 113 ± 27 bpm; Q2: 116 ± 26 bpm; Q3: 116 ± 26 bpm; Q4: 111 ± 25 bpm) and PSI values (Q1: 3.5 ± 1.6; Q2: 3.7 ± 1.6; Q3: 3.7 ± 1.5; Q4: 3.5 ± 1.5) were lowest in Q1 and Q4. Average Tc values increased only slightly with increasing HI (Q1: 37.49 ± 0.46°C; Q2: 37.59 ± 0.48°C; Q3: 37.60 ± 0.43°C; Q4: 37.59 ± 0.41°C). **CONCLUSION:** Although physical activity occurred for approximately half of a typical 12 to 16-hour work shift, physical exertion was the primary indicator of challenges to thermoregulation in this population. Reductions in activity levels with increasing heat index values suggest adequate regulation of body temperature in the majority of WLFF field operations.

Supported by the US Forest Service.

Board 5

SEASONAL CHANGES IN CARDIOVASCULAR FUNCTION, RISK FACTORS, AND OXIDATIVE STRESS OF WILDLAND FIREFIGHTERS

C.M. Williamson-Reisdorph, K.S. Christison, S.C. Gurney, K.G.S. Tiemessen, J.A. Sol, T.S. Quindry, C.G. Palmer, M.W. Bundle, C.L. Dumke, FACSM, J.C. Quindry, FACSM
University of Montana, Missoula, MT

Wildland firefighters (WLFF) experience extreme physiological strain throughout a typical season due to intense occupational demands and consistent woodsmoke exposure. There is a rationale to indicate that accumulated physiological strain, and oxidative stress, throughout a WLFF season has the potential to negatively alter cardiovascular function and risk factors. **PURPOSE:** The purpose of the study was to examine the effects of a season on cardiovascular function, risk factors, and markers of oxidative stress in WLFF. **METHODS:** Fourteen members of a Type I interagency hotshot crew participated in the study (males: n=13, females: n=1, age: 30.1 years ± 4.8). Pre- and post-seasonal resting measurements (May, October) were obtained for heart rate variability (lnRMSSD, lnHF, lnHF, LF:HF), pulse wave velocity (PWV), blood lipid panels (TC, TG, LDL, HDL), metabolic biomarkers (blood glucose, HbA1c), blood pressure (SBP, DBP) and blood oxidative stress (3-nitrotyrosine, 8-isoprostane, lipid hydroperoxides). Paired samples t-tests were used to identify differences among pre- and post- seasonal values. **RESULTS:** There were no seasonal effects observed on resting heart rate variability, PWV, 3-nitrotyrosine, 8-isoprostane, TC, TG, LDL, blood glucose, SBP, or DBP ($p>0.05$). A significant reduction occurred in HDL (Pre: 53 mg/dL ± 14, Post: 45 mg/dL ± 18, $p=0.043$) and both HbA1c (Pre: 5.2% ± 0.2 , Post: 5.3% ± 0.2, $p=0.034$) and lipid hydroperoxides (Pre: 2.5 ± 0.5, Post: 4.9 ± 0.6, $p = 0.003$) increased from pre- to post-season. **CONCLUSION:** These data suggest a WLFF season did not impact resting markers of heart rate variability, pulse wave velocity, 3-nitrotyrosine, and 8-isoprostane. Alterations in metabolic biomarkers of cardiovascular risk factors (HDL and HbA1c) and lipid hydroperoxides demonstrate unfavorable seasonal changes, suggesting that the WLFF season may increase cardiovascular risk.

Funded by the USFS 16-CR-11138200-005

MASTERS STUDENT ORAL PRESENTATIONS
FRIDAY, FEBRUARY 28th 2:00-2:45 pm, SIMPLOT AC

Speaker 1

MUSCLE SORENESS AND DAMAGE DURING WILDLAND FIREFIGHTER CRITICAL TRAINING

K. Christison, S. Gurney, C. Williamson-Reisdorph, T. Quindry, J. Sol, K. Tiemessen, C. Palmer, M. Bundle, J. Quindry, FACSM, C. Dumke, FACSM
University of Montana, Missoula, MT

Wildland firefighters (WLFF) undergo a critical training (CT) period immediately prior to the firefighting season. The intensive nature of preparatory CT exercise regimen could lead to muscle damage, as previously reported cases of rhabdomyolysis in WLFF have been documented. **PURPOSE:** To establish the effects of a two-week critical training period on acute markers of muscle damage in WLFF. **METHODS**: Eighteen male (29.4±1.1 years, 182.1±1.6 cm) and three female (26.7±2.6 years, 169.5±4.2 cm) Type I Interagency Hotshot (IHC) WLFF were studied during a 13-day critical training period. Daily body weight (BW), upper body (US), and lower body (LS) muscle soreness scales were collected. Venous blood was collected from the antecubital region on Days 1, 4, 8, and 11 to measure creatine kinase (CK) and lactate dehydrogenase (LDH). Skin fold measurements were taken on Day 1 and Day 11 to calculate body fat (BF). Fitness was assessed by the BLM fitness challenge (pushups, pullups, situps, 1.5-mile run). One-way repeated measures ANOVA were used to analyze CK, LDH, US, and LS. Paired samples t-tests were used to identify differences in BW and BF. Data presented as mean±SEM. **RESULTS**: No differences in body weight were observed between Day 1 and 11 ($p=0.065$). BF significantly decreased from Day 1 and 1 (15.3±1.4% vs. 14.1±1.3%, $p=0.002$). US and LS showed a main effect of time, elevated from baseline for subsequent days, with a peak on Day 3 (US: 3.8±0.5 cm, $p<0.001$; LS: 4.3±0.3 cm, $p<0.001$). CK showed a significant effect of time, elevated from baseline, with a peak on Day 4 (73.4±14.4 $U \cdot L^{-1}$ vs. 132.8±15.4 $U \cdot L^{-1}$, $p=0.001$). LDH showed a significant effect of time, where Day 11 significantly increased from Day 1 (159.4±5.5 $IU \cdot L^{-1}$ vs.164.4±6.9 $IU \cdot L^{-1}$, $p=0.04$). Fitness was negatively correlated with the change in muscle soreness from baseline to peak ($r=-0.72$, $p=0.013$). **CONCLUSION:** These data suggest that WLFF undergo significant physiological stressors that result in muscle soreness and damage during CT. Fitness appears to attenuate the soreness induced by CT. Careful preparation and monitoring of the training stimulus is key to avoid clinical ramifications.

Funded by the USFS 16-CR-11138200-005

Speaker 2

MEASURES OF COMPETENCY OVER SIX-WEEKS OF TRAINING: DOES IT PAY TO COMMIT TO HIIT?

E.R. Dunston, A.J. Coelho, K. Taylor
Eastern Washington University, Cheney, WA

The appropriateness of high-intensity interval training (HIIT) for inactive individuals has been questioned due to its challenging nature and potential low adherence. Yet, little is known about changes in measures of competency across a period of training which may be related to long-term adherence. **PURPOSE:** To determine the effect of 6 weeks of HIIT and moderate-intensity continuous training (MICT) on measures of psychological and physiological competence. **METHODS:** Physically inactive young adults (n=11; 21.5±1.9 years) were randomized to the HIIT or MICT training group. Before and after the intervention, all participants completed an incremental exercise test on a cycle ergometer. Participants completed a total of 18 training sessions over 6 weeks, with the first 3 weeks of training supervised and the latter 3 unsupervised. Perceived competence, autonomy, and self-efficacy were measured after the first, ninth, and eighteenth training sessions. Differences were analyzed using 2 (group) x 3 (time) repeated measures ANOVAs for psychological variables and 2 (group) x 2 (time) repeated measures ANOVAs for physiological variables. **RESULTS:** Adherence to the intervention was good (HIIT: 99%; MICT: 100%). There were no significant differences in perceived competence ($p=0.13$), autonomy ($p=0.22$), or self-efficacy ($p=0.99$) due to time. However, MICT (96.5±4.3) had significantly higher self-efficacy scores than HIIT (84.0±3.2; $p=0.04$). There were no group differences in competence ($p=0.13$) or autonomy ($p=0.36$). Peak oxygen uptake ($p<0.01$) and peak power output (Pre: 225.1±20.7 watts; Post: 239.4±27.4 watts; $p<0.0001$) improved significantly across the training intervention with no differences between groups ($p>0.05$). **CONCLUSION:** Physiological measures of competency improved across the intervention irrespective of training group; although, there were no differences in psychological competency due to time. Our findings suggest that both HIIT and MICT may improve physiological competency over 6 weeks in previously inactive, young adults. However, psychological competency may change at a different rate and could be more sensitive to training intensity. Future research may be important to determine the effects of prolonged training on measures of psychological competency in inactive individuals.

Supported by an ACSM Northwest Student Research Award

Speaker 3

FLUID DELIVERY SCHEDULE AND COMPOSITION: FLUID BALANCE, PHYSIOLOGIC STRAIN, AND SUBSTRATE USE IN THE HEAT

A.M. Rosales, W.S. Hailes, A.N. Marks, P.S. Dodds, B.C. Ruby, FACSM.
University of Montana, Missoula, MT

Hydration position stands propose exogenous volume intake considerations but remain ambiguous regarding frequency parameters. **PURPOSE:** To determine the effects of micro-dosing or bolus-dosing plain water or a carbohydrate-electrolyte solution (MW, BW, MCE, BCE, respectively) on fluid retention, heat stress, and carbohydrate (CHO) oxidation during exercise in the heat. **METHODS:** In a repeated measures cross-over design, males (n=12, 77.6±11.3 kg, VO_2 peak 55.4±6.6 $ml \cdot kg^{-1} \cdot min^{-1}$) completed four 2-hour trials (treadmill, 1.3 $m \cdot s^{-1}$, 5% grade) in a heat chamber (33°C, 30% RH) outfitted with a 15 kg pack and standardized USFS uniform. Fluid delivery during the experimental trials was based on 100% of calculated loss from a pre-experiment familiarization trial under identical conditions. Micro-dosed fluids were provided at 22 $doses \cdot h^{-1}$ (46±11 $ml \cdot dose^{-1}$), while bolus-dosed fluids were provided as a single $dose \cdot h^{-1}$ (1005±245 $ml \cdot dose^{-1}$). CE trials delivered 62±15 g $CHO \cdot hr^{-1}$ and 878±214 mg $Na^{+} \cdot hr^{-1}$. Nude body weight (BW) and urine volume were recorded pre, during, and post exercise. Heart rate and core temperature were recorded to determine physiologic strain index (PSI), while steady state expired air samples were collected to determine VO_2 and CHO oxidation rates. Sweat rate was calculated from BW, urine output, fluid intake, and estimated respiratory water loss. A two-way repeated measures ANOVA was used to determine differences. Statistical significance was established at $p<0.05$. **RESULTS:** Total BW loss (n=11, -0.56±0.25 kg, $p>0.05$), cumulative urine output (n=10, 729±427 ml, $p>0.05$), and sweat rate (0.79±0.20 $L \cdot h^{-1}$, $p>0.05$) were similar across trials. PSI at hour 1 was significantly lower than hour 2 (3.6±0.7, 4.5 ±0.9, respectively, $p<0.05$), however there were no differences across trials. CHO oxidation was significantly higher in the CE trials when compared to the W trials (1.5±0.3, 0.8±0.2, $g \cdot min^{-1}$, respectively, $p<0.05$), but was not different between dosing styles of identical composition. **CONCLUSION:** These data demonstrate that physiological strain, sweat rate, fluid retention, and CHO oxidation during continuous work in the heat are unaffected by varied fluid delivery schedules of equal volume.

Supported by the United States Forest Service (USFS), National Technology and Development Program

Speaker 4

PRE-SEASON CHARACTERISTICS OF DIVISION I CROSS-COUNTRY RUNNERS AND ASSOCIATION WITH PERFORMANCE: A PILOT STUDY

K. Sanchez, C. Brewer
Eastern Washington University, Cheney, WA

The pre-season aerobic capacity (VO_{2max}) of cross-country (XC) runners influences race performance (RP), yet research is limited on the association of VO_{2peak} with race placement (R-PL). Energy intake (EI; kcal), percent body fat (%BF), and perceived social support (PSS) also influence RP; thus, pre-season evaluations may have practical implications for resolving deficits before competition. **PURPOSE:** To examine associations between pre-season VO_{2peak} and RP in XC runners. Sufficiency of EI, %BF, and PSS were also assessed. **METHODS:** Division I male (M; *n*=10; 19.7 ± .7 yrs) and female (F; *n*=8; 18.5 ± .9 yrs) XC runners completed a maximal graded treadmill test to establish VO_{2peak}. The Automated Self-Administered 24-hour Dietary Assessment Tool (ASA24®) estimated daily EI. Air displacement plethysmography (BOD POD®) estimated %BF. The 16-item Perceived Available Support in Sport Questionnaire (PASS-Q) assessed PSS. Two weeks post-testing, athletes competed in their first race (M: 5.75-km; F: 4-km). RP measures included race time (RT; min) and R-PL (M: 85 total competitors; F: 79 total competitors). Descriptive statistics were calculated for all variables, and simple linear regression tested for associations between VO_{2peak} and RP measures. Sufficiency of EI was determined by estimating daily energy expenditure from body composition and daily activity level. **RESULTS**: Relative VO_{2peak} (M: 68.6 ± 3.6; F: 55.1 ± 4.4 ml/kg/min) significantly predicted R-PL among total competitors (M: 48.3 ± 23.2; F: 37.6 ± 15.2) in males (β = -.646, p = .044) and females (β = -.738, p = .038). Relative VO_{2peak} was not a significant predictor of RT (M: 20.2 ± .9; F: 16.2 ± 1.2 min) in males (p > .05) but was in females (β = -.758, p = .029). Insufficient EI was observed in 73% of athletes. Deficits averaged 532 ± 983 (M) and 522 ± 669 kcal/day (F). Males achieved a risky %BF (5.9 ± 4.1%), while females were in healthy range (20 ± 5.8%). Athletes reported adequate PSS (M: 12.4 ± 2.1; F: 13 ± 1.3). **CONCLUSION**: This study suggests that VO_{2peak} is a predictor of R-PL in XC runners; yet, additional variables have further practical implications. The caloric deficit observed across athletes and risky %BF in males suggest these constructs should be addressed in the pre-season. Future research should assess these factors and their contribution to RP over a XC season.

DOCTORAL STUDENT ORAL PRESENTATIONS
FRIDAY, FEBRUARY 28TH 11:15 AM – 12:00 PM, SIMPLOT AC

Speaker 1

SEX DIFFERENCES IN THE HEMODYNAMIC RESPONSE TO ACUTE PASSIVE HEAT EXPOSURE

E.A. Larson[1], B.R. Ely[1], M.A. Francisco[1], V.E. Brunt[1,2], S.M. Harris[1], J.R. Halliwill, FACSM[1], C.T. Minson, FACSM[1]
[1]University of Oregon, Eugene, OR; [2]University of Colorado Boulder, Boulder, CO

Increased conduit vessel shear stress acutely improves vascular function in a dose-dependent manner and potentiates many of the beneficial vascular adaptations that accompany chronic heat therapy. However, physical and physiologic differences exist between sexes which influence thermoregulation and may alter the adaptive shear stimulus accompanying a single bout of passive heat stress. **PURPOSE:** To compare the hemodynamic response to acute passive heat exposure (APHE) between sexes. **METHODS:** 10 women (W) and 11 men (M) completed a one-hour APHE session immersed to the level of the sternum in 40°C water. Rectal temperature (Tre), mean arterial pressure (MAP), and brachial artery hemodynamics (ultrasound) were measured at baseline (seated rest before APHE) and every 15 min throughout APHE. Subject characteristics were compared using unpaired t-tests. A 2 X 5 mixed model ANOVA was used to compare Tre, MAP, and brachial hemodynamics across time and between sexes. **RESULTS:** Both body mass (W: 62.9 ± 8.1 kg, M: 74.2 ± 5.1 kg, $P < 0.01$) and body surface area (W:1.71 ± 0.14 m2, M: 1.93 ± 0.10 m2, $P < 0.001$) were lower in W compared to M. W had a higher Tre than M ($P < 0.05$) at baseline (W: 37.5 ± 0.1°C, M: 37.2 ± 0.1°C) and after 60 min APHE (W: 38.7 ± 0.03°C, M: 38.5 ± 0.1°C). W had a lower MAP than M ($P < 0.05$) at baseline (W: 85 ± 2 mmHg, M: 88 ± 2 mmHg) and throughout APHE (W: 74 ± 2 mmHg, M: 82 ± 3 mmHg at 60 min APHE). W and M had a similar baseline brachial shear rate (W: 170 ± 30 1/s, M: 105 ± 19 1/s). Brachial shear rate was elevated to a greater extent in W than M during APHE ($P < 0.01$), reaching 651 ± 49 1/s and 396 ± 24 1/s at 60 min APHE, respectively. The sex difference in brachial shear response to APHE was the result of a greater increase in brachial velocity seen in W (+47 ± 6 cm/s) compared to M (+35 ± 4cm/s) with APHE ($P < 0.1$). This elevated brachial velocity allowed for a similar increase in brachial blood flow between sexes with APHE (W: +339 ± 53 mL/min, M: +369 ± 37 mL/min) despite the smaller brachial diameter in W compared to M ($P < 0.0001$) at baseline (W: 0.31 ± 0.01 cm, M: 0.41 ± 0.01 cm) and throughout APHE (W: 0.37 ± 0.01 cm, M: 0.46 ± 0.01 cm at 60 min APHE). **CONCLUSION:** These data indicate the presence of a sex difference in the hemodynamic response to a single bout of passive heat stress and may have implications for sex-specific vascular adaption accompanying chronic heat therapy.

Supported by APS Porter Pre-Doctoral Fellowship

Speaker 2

RELATIONSHIP BETWEEN FUNCTIONAL HOP PERFORMANCE AND QUADRICEPS RATE OF TORQUE DEVELOPMENT IN ACL RECONSTRUCTED FEMALES

C.M.S. Mulligan[1], Y.L. Huang[2], S.T. Johnson[1], M.F. Norcross[1]
[1]Oregon State University, Corvallis, Oregon; [2]University of Wisconsin-Eau Claire, Eau Claire, WI

Greater quadriceps rate of torque development (RTD) is associated with sagittal-plane landing strategies that are consistent with lesser ACL injury risk. While it is recommended to include quadriceps RTD in return to play testing, the necessary equipment is inaccessible to many clinicians. Therefore, quantifying absolute performance (AP) in a single-leg triple hop (SLTH) that requires the quadriceps to both control landing and to propel the body forward could provide an accessible measure for quadriceps RTD. **PURPOSE:** To determine the relationship between SLTH AP and quadriceps RTD from 0-100ms and 0-200ms. **METHODS:** Nineteen physically active females who have undergone ACLR (Age: 19.2 ± 1.8 years, Height: 164.1 ± 7.0 cm, Mass: 63.8 ± 7.6 kg) were included. RTD was calculated from isometric torque-time curves averaged over three trials of the ACLR limb by fitting a line of best fit through 100ms and 200ms after onset and normalized to body mass. AP for the SLTH was quantified by taking the average distance traveled across three trials and normalized to body height. Relationships between AP and RTD were assessed via Pearson correlation coefficients ($\alpha \leq 0.05$). **RESULTS:** Means and standard deviations for AP and RTD are included in Table 1. No significant relationships were identified between AP and RTD (Table 1). **CONCLUSION:** While a requisite level of quadriceps strength is needed to perform a SLTH, these results suggest that AP is not indicative of improvements in quadriceps RTD. Because RTD is influenced by the intent to move fast, the lack of relationship could be explained by the nature of the task. A SLTH is measured by distance traveled with no instruction on the intent to move fast. Additionally, compensatory propulsion strategies through the hip or ankle can also influence AP. Therefore, future research should assess multi-joint propulsion strategies and whether functional hop tasks that are measured by time-to-completion and that instruct the individual to move quickly (i.e. 6-m hop for time) are associated with RTD.

Supported by the NATA Research and Education Foundation Doctoral Grant

Table 1. Correlations for Single-Leg Triple Hop Performance and Quadriceps Rate of Torque Development

		Single-Leg Triple Hop AP 2.14±0.37 body heights	
Criterion Variable	Mean±SD	*r*	*p-value*
0-100ms RTD (N·m/s/kg)	7.94±3.62	*r* = 0.309	0.198
0-200ms RTD (N·m/s/kg)	7.14±2.38	*r* = 0.187	0.442

Speaker 3

RISING FROM A SUPINE POSITION AFFECTS PHYSICAL FUNCTION IN OLDER ADULTS

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Rising from supine to an upright position has the potential to evoke dizziness, and thereby presents a risk of falling. Surprisingly, little evidence is available to characterize the functional consequences of rising from a supine position. The Timed Up-and-Go (TUG) test is commonly used to describe the risk of falling in older adults. Recently, we have established that the percentage of time spent in the active propulsion (APT) phase of the gait cycle is inversely associated with history of falls. **PURPOSE:** To determine the reliability of TUG time and APT following supine and seated rest, and to assess the main effect of position on TUG time and APT. **METHODS:** 40 older adults (age=73.5±1.0 yrs, height = 165.8±7.9 cm, weight = 74.0±16.2 kg) completed the TUG after at least 10mins of seated and supine rest on two separate days, one week apart. The order of the conditions was randomized. TUG time to completion was recorded and gait data were collected using a force-plate embedded walkway. APT was derived as the proportion of the gait cycle when center of gravity exceeded the base of support in single limb stance to contralateral heel contact. Intraclass correlations (comparing day 1 to day 2 values) were used to determine the determine the reliability of our measures. The main effect of resting condition (seated v. supine) was tested by applying repeated measures ANOVA to day 1 observations. **RESULTS:** ICC of TUG time after seated rest was 0.91, $p<0.001$, and after supine rest was 0.95, $p<0.001$. ICC of APT after seated rest was 0.74, $p<0.001$ and 0.74, $p<0.001$ after supine rest. There were significant main effects of condition on time to complete the TUG (10.3±0.4 seconds versus 11.9±.7 seconds after seated and supine rest respectively, $p<0.001$), and APT (69.3±4.1% and 56.3±4.9% after seated and supine rest, respectively, $p<0.05$). **CONCLUSION:** TUG time and APT during the TUG are reliable following either supine or seated resting conditions. These data support the hypothesis that physical function is poorer and risk of falls is heightened immediately after rising from supine rest compared to seated rest. The risk of falls following supine rest is further evident by an average TUG time approaching 12 seconds. These results may assist clinicians in more appropriate screening, and in developing treatment strategies to reduce falls risks and falls.

Speaker 4

DIVISION 1 FOOTBALL PLAYERS AND METABOLIC SYNDROME RISK FACTORS: A THREE YEAR OBSERVATIONAL STUDY

A. Vahk[1], W.E.S. Repovich, FACSM[1], G.J. Babcock[1], J. Peterson, FACSM[2]
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Professional football players, especially linemen are at increased risk for early Metabolic Syndrome (MetS) leading to cardiovascular disease and death. There are no longitudinal studies examining if MetS risk factors are present during college and if the risk factors change over time. **PURPOSE:** The purpose of this longitudinal study was to follow MetS risk factors in Division 1-FCS players over three years. MetS is defined by the NCEPT ATP III standards. **METHODS:** Players were tested in the fall prior to the start of each season. Of the 39 players tested the first fall, eight players completed all assessments every year of the study. Testing included waist circumference (WC), systolic blood pressure (SBP), diastolic blood pressure (DBP), fasting blood glucose (BG), high density lipoprotein (HDL), and triglycerides (TG). Descriptive statistics and comparisons were analyzed. A repeated measures ANOVA was used to compare the means of each dependent variable across the 3 years. A Bonferroni correction was used to adjust for multiple comparisons. **RESULTS:** One participant met the criteria for MetS during all three years with the same risk factors each year, low HDL, elevated TG and WC. Another participant met the MetS criteria during the second year (low HDL, elevated TG and WC), but not during the first and third year. Both players were offensive linemen. There was no significant difference in SBP, DBP, BG, or HDL across the three years. There was a significant difference in TG over time (F [1.122, 7.852] = 6.355, p = .034). Pairwise comparisons indicated a significant difference in TG between year one-two, one-three, and two-three (p = .001, p = .001, p = .05; respectively). **CONCLUSION:** These findings suggest that nonskilled football positions have a higher incidence of MetS risk factors. Additionally, TG varied across the three years, indicating that nutrition may be a primary influencing factor as players maintain fitness training during the off season. A limitation of this study was the small sample size based on players completing testing all three years. Pre-season evaluation for early detection of MetS with follow up for early intervention is recommended. Further research should explore the off-season nutrition of collegiate football players.

FREE COMMUNICATION POSTER PRESENTATIONS
FRIDAY, FEBRUARY 28th 5:00-7:30 PM, JORDAN AB, JORDAN C

UNDERGRADUATE PRESENTATIONS

Board 1

EFFECTS OF A 16-WEEK PILATES MAT TRAINING INTERVENTION ON DANCE EXERCISES & BODY COMPOSITION

H. Bideganeta, S. Brooks, M.J. Meenan, A.F. Brown
University of Idaho, Moscow, ID

Athletes in aesthetic sports, such as dance, are often placed under high pressure to maintain a lean physique, therefore it is important to maintain an optimal workout regimen on top of usual training. Previously, Pilates has been used to enhance dance performance and subsequently body composition. The current study sought to further investigate effects of Pilates mat training on dance exercises and body composition of collegiate dancers. **PURPOSE:** To assess the effects of a 16-week Pilates mat training intervention on dance exercises, lean soft tissue (LST) and fat mass (FM). **METHODS:** Female dancers (n=18, ages 19±2 yrs) were assigned to a dance conditioning group (DC; n=9) or a control group (CON; n=7). Participants in DC completed an 80-minute Pilates mat training class 2 days per week. CON and DC groups maintained regular dance schedules throughout the intervention. Pre and post-testing consisted of teaser, side plank (R and L) to exhaustion, and a dual-absorptiometry scan (Hologic Horizon™; Marlborough, MA). Body composition index (BCI=(LST_{post}-LST_{pre}) + (FM_{pre}-FM_{post}) was used to evaluate overall body composition changes. Statistical analyses were completed using SPSS Statistics (v. 24). Data were reported as mean±SD and significance was accepted at $p<0.05$. **RESULTS:** No significant interaction by time and group was observed for teaser and left side plank (p=0.27; p=0.26 respectively), however CON performed significantly better on right side plank at pre (10.14±6.01) compared to post-testing (17.00±7.57; p=0.004). There were no significant changes from pre to post-testing in FM (CON: 34.3±8.12 and 32.98±8.01 %, p=0.766; DC: 34.02±5.41 and 34.00±5.39 %, p=0.837, respectively) or LST (CON: 61.99±7.56 and 63.34±7.54, p=0.743 %; DC: 62.18±5.15 and 62.48±4.12 %, p=0.741) for either CON or DC. BCI was significantly different (p=0.019) between the CON 1.69±0.78 and DC 0.27±1.19 groups. **CONCLUSION:** The Pilates intervention produced little to no significant changes in dance specific exercise performance measurements. BCI reflects that the CON group had overall more positive body composition outcomes when compared to the DC group. Therefore, adjustments to dance specific Pilates interventions may be necessary to specifically optimize collegiate dancers training and body composition.

Board 2

THE EFFECTIVENESS OF THE COMBINATION OF COMPRESSION AND ELEVATION ON RECOVERY AFTER A WINGATE TEST

L. Brinton, L. Covell, C. Stepniewski, J. McKenzie
Gonzaga University, Spokane, WA

Recovery post exercise is a topic that has piqued interest across athletics. Recovery is used by athletes as a way to improve performance by increasing blood circulation. Compression after exercise in recovery increases blood flow while elevation of limbs increases venous return and preload. **PURPOSE:** The purpose of the study was to test the effectiveness of the combination of compression and elevation on recovery in comparison to a control group using passive recovery. **METHODS:** 11 subjects, ages 19-21, were selected using a convenience sampling method and deemed physically fit after completing a questionnaire. Participants came in for three visits, at least 48 hours apart. After performing a Wingate test, they recovered for 30 minutes with minimal body movement while HR, BP, blood lactate, VO2, and VCO2 were measured. The three trials included a control trial of lying supine for the recovery period, compression trial of wearing compression socks while supine, and compression/elevation trial of elevating legs at approximately 90 degrees while wearing compression socks. Data analysis was performed using SPSS and the α-level was set to 0.05. **RESULTS:** No significant difference was found between trials in Early and Late Recovery for blood lactate (CONT: 4.36 ± 1.31, COMP: 3.01 ± 2.19, COMP/ELEV: 1.93 ±1.44). No significant differences were found between post recovery and resting for the following variables: HR (CONT: 14.55 ± 11.84, COMP: 12.00 ± 7.35, COMP/ELEV: 10.27 ± 8.49), systolic BP (CONT: 35.09 ± 23.21, COMP: 10.09 ± 9.76, COMP/ELEV: 7.55 ± 6.30), diastolic BP (CONT: 21.27 ± 15.01, COMP: 12.91 ± 4.64, COMP/ELEV: 13.00 ± 8.02), blood lactate (CONT: 1.99 ± .77, COMP: 2.26 ± 1.15, COMP/ELEV: 2.01 ± 1.54). No significant differences found for post exercise RPE and post recovery RPE of the body (CONT: 2.45 ± 1.44, COMP: 2.36 ± 1.36, COMP/ELEV: 2.18 ± 1.83) or the legs (CONT: 2.18 ± 1.53, COMP: 2.18 ± 1.54, COMP/ELEV: 1.91 ± 1.76). **CONCLUSION:** The current study could not determine whether the addition of passive leg raise on compression helped to increase venous return, increase lactate removal and therefore increase the quality of recovery in subsequent exercise performance. Given our findings, it would be more advantageous to increase the time in compression and PLR so as to maximize the benefits of circulation.

Board 3

ACUTE EFFECTS OF EXERCISE: IMMEDIATE DEPRESSION AND SUBSEQUENT ELEVATION OF INTRAOCULAR PRESSURE

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Intraocular pressure (IOP), the fluid pressure within the eye, is the main treatable risk factor for glaucoma. Although numerous research studies have shown IOP is decreased immediately following exercise, very few studies have addressed IOP alterations during recovery and return to baseline. **PURPOSE:** To investigate the acute effects of exercise intensity on IOP, including return to baseline. **METHODS:** Nineteen (9 males, 10 females; age = 20.26 ± 0.87 years; stature = 172.27 ± 13.51cm; mass = 72.23 ± 16.64 kg) with no history of ocular hypertension or glaucoma completed the study. Baseline measurements of heart rate (HR), blood pressure (BP), and IOP were assessed. Participants completed Queen's College Step Test to estimate VO2 max and prescribe treadmill speeds for 2.0 km at each intensity to keep work performed constant. Measurements continued immediately after exercise, and in 10 min intervals until IOP returned to within 10% of stable baseline value. Repeated measures ANOVA and post hoc tests compared IOP for baseline, moderate, and high intensity exercise. **RESULTS:** Immediately following high intensity exercise, IOP was reduced (12.27 ± 4.7 mmHg) compared to either baseline (16.25 ± 4.19 mmHg, $p<0.001$) or moderate intensity (15.87 ± 3.91 mmHg, $p<0.01$). Moderate intensity IOP was no different than baseline. Interestingly, after the initial depression of IOP, we also observed a subsequent elevation of IOP during the recovery period from both high (18.93 ± 4.41 mmHg, $p<0.05$) and moderate intensity exercise (18.23 ± 4.43 mmHg, $p<0.05$). **CONCLUSION:** High intensity exercise elicited an immediate and transient decrease in IOP, in agreement with existing research. However, a subsequent elevation of IOP, or overshoot, also occurred during the recovery period of both exercise conditions. To the best of our knowledge, we are the first to document the transient elevation of IOP that occurs during recovery from exercise.

Board 4

OPTIMAL KNEE ANGLE FOR MAXIMUM VERTICAL JUMP HEIGHT

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Vertical jump height is used as a measure of overall health and power and is vital to performing many jumping sports. It is important to understand how lower-extremity kinematics influence vertical jump height performance. **PURPOSE:** The aim of this research is to explore the relationship between peak knee flexion angle and maximum vertical jump height. **METHODS:** Seventeen able-bodied subjects (5 Female, 12 Male; mass = 85.8 ± 18.7kg, height = 1.8 ± 0.1m) performed six maximum vertical jumps. Before jumping, markers were placed on the lateral aspect of the mid-thigh (midway between lateral epicondyle of femur and greater trochanter), the lateral epicondyle of the femur, and lateral aspect of the lower leg (midway between lateral epicondyle of femur and lateral malleolus). Peak knee flexion angle was determined by finding the relative angle between the lower and upper leg during counter-movement. After marker placement, subjects jogged in place for 40 seconds as a warmup. Next, vertical jump height was determined. Each subject jumped maximal hitting the tiles on the Vertec. A two-minute rest period was given between each jump. The highest three jump heights were used for analysis. A video camera recorded (120 fps) lower-extremity movement. Maximum knee flexion angle was determined using video uploaded in a freeware motional analysis software (Kinovea 0.8.15). Linear and curvilinear regressions were used to determine the relationship between knee flexion angle and vertical jump height. **RESULTS:** Average vertical jump height was 17.9 ± 4.3 in. Average peak knee flexion angle was 97.2 ± 10.5°. Based on the curvilinear regression, knee flexion angle significantly correlated with maximum jump height ($r = 0.6$; $p = 0.49$). In this model, knee angle accounted for 35% of the variance in jump height with a prediction equation of $Y = -0.017x^2+3.264x-136.54$. Linear regression analysis was not significant. **CONCLUSION:** There is a significant relationship between maximal jump height and peak knee flexion angle. A knee flexion angle between 87 and 107 degrees was shown to maximize vertical jump height. Training athletes to achieve a knee flexion angle within this range is suggested. Further a prediction equation using knee flexion angle may be used to estimate jump height when no other methods are available.

Board 5

THE EFFECT OF A DIETARY STRESS SUPPLEMENT ON PHYSIOLOGICAL & PSYCHOLOGICAL MEASURES IN COLLEGIATE STUDENTS

C. Contreras, S.J. Brooks, C. Richardson, A.F. Brown
University of Idaho, Moscow, ID

College students report an immense amount of stress, which can lead to an increased production of the stress hormone cortisol. Chronic elevated levels of cortisol may be implicated in adverse physiological responses such as increased heart rate (HR) and blood pressure (BP). **PURPOSE:** To assess the effectiveness of a daily stress and mood dietary supplement in supporting optimal mood balance and reducing daily stress among collegiate-aged men and women. **METHODS:** Participants (age 18-22) were randomly assigned to either a placebo (n = 29) or supplement (n = 27) group following a 1-week placebo lead in period. During the 8-week intervention, resting HR, BP and salivary cortisol were collected in weeks 2, 5 and 8. In addition to physiological measurements, depression, anxiety, stress, and affect were assessed. Multilevel modeling using the MIXED procedure was used to analyze whether changes in physiological and psychological outcomes occurred throughout the 8-week study, and if so, whether these changes were a result of supplementation. **RESULTS:** There was a significant between-person and within-person variability following the 8-week study in cortisol awakening response (CAR), heart rate, blood pressure, depression, anxiety, stress, positive affect, and negative affect (all $p < 0.001$). There was a significant negative linear change in CAR ($p < 0.05$), depression ($p < 0.01$), stress ($p < 0.001$), positive affect ($p < 0.001$), and negative affect ($p < 0.05$) throughout the study. Further, there was a reduction in CAR in the supplement group (week 2: 0.159±0.228 ml/dL, week 5: 0.114±0.196 ml/dL, week 8: 0.0702±0.151 ml/dL; $p < 0.05$) and placebo group (week 2: 0.138±0.277 ml/dL, week 5: 0.110±0.174 ml/dL, week 8: 0.0726±0.0966 ml/dL; $p < 0.05$). **CONCLUSION:** These results suggest that supplementation may help maintain a healthy physiological response during stressful life events. There was no significant effect of supplementation on HR and BP; however, cortisol responded positively. Although the supplementation group demonstrated higher CAR levels at baseline, by week 8, CAR levels were lower compared to the placebo group. Given that the participants were in a normal range for salivary cortisol, future research should consider including participants with elevated cortisol to test the effects of this daily supplementation.

Supported by ONNIT Labs.

Board 6

THE EFFECT OF VISUAL FLOW ON CYCLING IN A VIRTUAL ENVIRONMENT

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[1]Gonzaga University, Spokane, WA; [2]XENOFI, LLC, Sheridan, WY

There are limited data on the effects of virtual reality (VR) on speed perception and motor control. Previous studies examining changes in walking and running speed in relation to visual flow speed (VFS) in 2D environments have found 15-30% underestimations in VFS compared to locomotion speed. None have studied the effects of cycling speed (CS) in a 3D, VR environment. **PURPOSE:** The aim was to determine if 1) subjects can match CS to VFS, and 2) if surreptitious alterations in the VFS affects CS during cycling in a VR environment. **METHODS:** Subjects (n=18) participated in three trials on an electronically-braked cycle ergometer, while wearing a VR headset displaying an outdoor path. VFS was specifically created to move independent of the subjects CS. During all trials, subjects were told to match their CS to VFS for the first 2 minutes and then continue cycling. During the familiarization trial, VFS was at 20 km/h continuously for 8 minutes, where the final minute served as the control (CFAM). During the two counterbalanced experimental trials (7 minutes), VFS started at 20 km/h for 3 minutes, serving as the in-trial controls, then either increased (fast trial) or decreased (slow trial) by 15% during the third minute. This experimental speed was held for the final 3 minutes. CS and heart rate (HR) were recorded every 10 seconds. A RM ANOVA analyzed the repeatability of CS between the control trials based on the order in which they were completed, CFAM, in-trial control 1 (C1) and 2 (C2). To assess any differences in CS before and after VFS was altered, a paired samples t-test compared the ratios of experimental/control speeds in the fast and slow trials. Significance set at $p<0.05$. **RESULTS:** CS during the CFAM (21.0±4.1 km/h, +5.3% compared to VFS) was significantly greater than in C1 (17.9±4.5 km/h, -10.7%) ($p<0.05$), while C1 and C2 (18.7±3.9 km/h, -6.5%) were not significantly different ($p=0.161$). There was no significant difference between fast (1.04±0.07) and slow (1.13±0.46) trial speed ratios ($p=0.46$). Average HR across all trials was 109±5 bpm, indicating low intensity exercise. **CONCLUSION**: While CS was not perfectly matched to VFS, our findings suggest that VR cycling reduces the underestimation of VFS to CS when compared to 2D running environments. Further, CS was not altered in a predictable way when VFS was altered surreptitiously.

Board 7

EFFECTS OF PEPPERMINT AND LAVENDER OIL ON MOOD AND PERCEIVED EXERTION DURING EXERCISE

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Use of essential oils, such as peppermint and lavender, via aromatherapy appears to be growing, especially in naturopathic and alternative medicine. **PURPOSE:** The purpose of this study is to compare the effects of peppermint oil and lavender oil on mood and rate of perceived exertion during aerobic exercise. **METHODS:** Ten healthy, moderately active male (n = 3) and female (n = 7) college students 18-25 y, attended three testing sessions where they completed a 15 min run on a treadmill at their own preferred pace and intensity. For all three sessions, the participants completed a Profile of Mood States (POMS) questionnaire before and after exercise, while rate of perceived exertion (RPE) was measured every 3 min during exercise. No essential oils were administered during one testing session (C). During another testing session, a piece of gauze with four drops of peppermint oil (P) was attached to participants' shirt collars during exercise. During another session, a piece of gauze with four drops of lavender oil (L) was attached to participants' shirt collars during exercise. The conditions of the sessions were randomly assigned between participants and exercise intensity was standardized across sessions based upon the intensity participants chose in their first session. Factorial ANOVAs ($p \leq 0.05$) were utilized to determine the existence of significant differences between conditions. **RESULTS:** No statistical differences were observed between odor conditions on POMS during exercise for all dependent variables (p = 0.241; pre-POMS - C: 92.8 ± 21.3, L: 92.0 ± 15.4, P: 87.4 ± 8.8; post-POMS - C: 99.7 ± 18.5, L: 88.5 ± 5.5, P: 87.3 ± 13.9). No statistical differences were observed between odor conditions on RPE during exercise for all dependent variables (p = 0.828; C: 10.4 ± 1.7, P: 10.1 ± 1.4, L: 10.0 ± 1.6). **CONCLUSION:** Under these research conditions, administration of essential oils did not affect POMS and RPE. The primary explanation for the observed results may have been the small sample size. A secondary explanation may be that the method of essential oil delivery was not strong enough to elicit a physiological change. Further research is needed to determine the efficacy of essential oils for mood and perceived during exercise.

Board 8

DETERIORATION OF LIPID METABOLISM DESPITE FITNESS IMPROVEMENTS IN WILDLAND FIREFIGHTERS

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Wildland fire suppression presents a working environment that often exceeds an energy expenditure of 20 MJ/day. However maladaptive seasonal responses in adiposity and blood lipid profiles have been noted. **PURPOSE:** To determine changes in clinical health metrics and serum lipids resulting from 5 months of seasonal wildland fire suppression. **METHODS:** We recruited wildland firefighters (WLFF), (n=100, 92 males, 8 females) from seven crews (5 Hotshot crews, 1 Initial Attack crew) based in MT and CA. After an overnight fast, nude body mass, blood pressure (BP), grip strength, and step test heart rate (HR) (~VO_2=20.7 mL/kg/min) were recorded. Blood samples were collected and analyzed for serum total cholesterol (CHOL), high density lipoprotein (HDL), low density lipoprotein (LDL), very low-density lipoprotein (VLDL), and triglycerides (TG). A 2-tailed dependent t-test was used to compare pre and post-season values. Statistical significance was established at p<0.05. **RESULTS:** Body mass was increased (pre 77.4±9.7, post 78.4±9.5 kg, p<0.01). Systolic BP decreased (pre 133±13, post 128±14 mmHG, p<0.0001), while diastolic BP was stable (pre 76±10, post 73±9 mmHG, p>0.05). Grip strength remained unchanged (pre 56±11, post 56±11 kg, p>0.05). HR response decreased during the step test (pre 102±13, post 96±9 BPM, p<0.001). Serum CHOL, TG, LDL and VLDL increased pre to post-season. In contrast, HDL was significantly reduced (pre 66±16, post 64±13 mg/dl, p<0.05) and resulted in an increase in the TG/HDL ratio (pre 1.2±0.8, post 1.5±1.2 (p<0.0001). **CONCLUSIONS:** Despite favorable changes in systolic BP and aerobic fitness, there were maladaptive changes in serum lipids that occurred in conjunction with an increase in body mass.

Supported by the United States Forest Service, National Technology and Development Program

	Pre-Season	Post-Season	
CHOL	173±31	179±28	*
TG	71±33	90±51	**
LDL	93±28	97±25	*
VLDL	14±7	18±10	**

* p<0.05; **p<0.01

Board 9

COLLEGIATE ATHLETES NUTRIENT CONSUMPTION AND UTILIZATION OF THE ATHLETICS FUELING CENTER

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Collegiate athletes face challenges meeting the high demands of practice, training, academic work, travel, and competition. Since the NCAA deregulation in 2015, universities may provide food and beverage items to collegiate athletes. Specifically, Fueling Centers (FC), often located near the weight room, offer snack items to support pre and post exercise nutrition to optimize athletic performance. However, collegiate athletes' use of FCs and nutrient quality of food and beverage items provided remains unknown. **PURPOSE:** The purpose of this study was to determine collegiate athletes' utilization of a FC, favorite items consumed (2 items/day), nutrient quality of items offered, as well as ideal items to be offered in the future. **METHODS:** Male (n= 53) and female (n= 24) collegiate athletes completed a survey including demographic information and FC utilization questions. Favorite items consumed were analyzed using Food Processor (ESHA, 10.13.1, Salem, OR) to determine nutrient quality. Athletes reported what time they frequented the FC as well as their consumption timing (pre or post workout). **RESULTS:** Collegiate athletes (n=77, 20 ± 2.5 years) who completed the survey consisted of freshmen (n=18), sophomore (n=14), junior (n=23), senior (n=18), and 5th year seniors (n=3). Football (n=41), cross country & track (n=10), women's basketball (n=8), men's basketball (n=5), women's tennis (n=3), soccer (n=7), volleyball (n=2), and men's golf (n=1) reported their favorite FC items as sports beverages (n=33;CHO= 21g, PRO=2.2g, FAT=0g), flavored protein drinks (n=16;CHO=28g, PRO=26g, FAT=3.5g), milk (n=5;CHO=20g, PRO=26g, FAT=0g), and cereal (n=4;CHO=53g, PRO=10g, FAT=1g). Additionally, athletes reported future items including sandwiches (n=18), wraps (n=6), smoothies (n=4) protein shakes (n=3), and beef jerky (n=2). The FC was utilized most frequently from 1:30-2:00pm (n=43), 8:00-9:00am (n=31), and 7:15-8:00am (n=22) for both pre and post workout nutrition (n=47). **CONCLUSION:** The utilization and preferences of the FC was predominately composed of sports drinks for both pre and post nutrition as opposed to whole food options which may provide greater macronutrient and micronutrient quality. Therefore, nutrition education is warranted to provide optimal fueling strategies for training and performance.

Board 10

RELATIONSHIPS BETWEEN MATERNAL HEALTH, PRE-PREGNANCY BEHAVIOR, AND PHYSICAL ACTIVITY DURING PREGNANCY

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Physical activity during pregnancy is beneficial to both the mother and unborn child. Many complications throughout pregnancy can make it difficult for women to achieve the physical activity (PA) guidelines of 150 minutes of moderate-intensity activity per week. **PURPOSE**: This survey-based study examined the relationships between pre-pregnancy PA and also prenatal maternal health with PA behavior during pregnancy. **METHODS**: An online survey was completed by 266 pregnant participants at prenatal health clinics in the Yakima Valley Washington area. Participants were queried on PA behavior and the mother's physical and mental health during pregnancy. Bivariate correlations and logistic regression analyses were calculated to examine possible relationships between each adverse maternal health condition and PA behavior. **RESULTS:** The analytic sample was primarily Caucasian (58.3%) or Hispanic (33.8%) and characterized by variable education and income levels. Few participants were high risk (23.0%), had 1 or more adverse pregnancy health condition (19.0%), and reported moderate to severe levels of nausea (13.1%). Over half reported having 1 or more miscarriage (51.3%). Significant correlations were not found between these and current moderate and vigorous PA behavior during pregnancy. However, moderate correlations were found between pre-pregnancy and current PA behavior (meeting PA recommendations: r=0.49, vigorous PA participation: r=0.35). Specifically, pregnant women who participated in vigorous-intensity PA prior to pregnancy, had increased odds of current vigorous PA participation (OR=5.18, 95% CI: 2.94-9.14). Fewer women reported meeting the current moderate to vigorous physical activity (MVPA) recommendations during pregnancy (39.0%) compared with prior to pregnancy (49.2%). Likewise, only 26.8% of participants participated in vigorous intensity PA compared to 43.7% prior to pregnancy. **CONCLUSION:** Pre-pregnancy PA behavior is a significant predictor of current pregnancy PA. The relationship between several adverse maternal health conditions and pregnancy PA neared statistical significance.

Board 11

MUSCULAR STRENGTH IN A MODEL OF ALZHEIMER'S DISEASE AND THE EFFECT OF TREADMILL TRAINING

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Alzheimer's disease (AD) is the most prevalent neurodegenerative disease affecting 5.5 million in the United States. Exercise is a proven method to increase functionality, cognition, muscular strength, and muscular mass in AD patients. However, the relationship between muscular strength and AD disease progression is one that needs further understanding. **PURPOSE**: The objective of this study is to evaluate the effect of exercise on the muscular strength in a rat model of AD. **METHODS**: Four different groups were utilized in this pilot project. AD animals were genotyped for APP and PSEN1 genes and were compared to their wild type (WT) litter mates. Next, animals were randomly assigned to either sedentary (S) or treadmill training (T). At 12 months of age, a four-month treadmill training protocol began. At 16 months of age, muscular strength was assessed by grip strength. **RESULTS**: Values relative to body mass were analyzed and a significant improvement in strength was seen with treadmill training in the WT groups (WT-S 2.4 vs WT-T 3.2, $p<.05$). No significant effect of exercise was found among the AD groups (AD-S 2.5 vs. AD-T 2.7, $p>.05$). **CONCLUSION**: While exercise improved muscular strength in control animals, AD animals did not see the same improvements.

Board 12

EFFECT OF DIFFERENT ANKLE SUPPORT METHODS ON RUNNING GROUND REACTION FORCES BETWEEN GENDERS

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Many athletes rely on ankle support techniques during an athletic performance. It is unclear how ankle support influences running ground reaction force (GRF) characteristics, and if the response to ankle support changes between gender. **PURPOSE:** To analyze gender differences in vertical, braking, and propulsive GRFs during running with multiple ankle support methods. **METHODS:** Twenty college-aged subjects (10 female, 10 male) ran across a force plate (1000Hz) with three different ankle support conditions (control (no support), taped, and braced), in a counterbalanced order. The taped condition used a standard stirrup and heel lock technique. The braced condition used a standard ankle support brace. Subjects wore their own athletic shoes in each condition. Each subject ran across the force plate three times for each condition. Average peak vertical, braking, and propulsive GRFs were obtained. Running speed was constant (set distance traveled ± 0.5 sec) for each condition. Mixed model ANOVAs were used to determine the difference in GRFs between ankle support conditions and between gender. **RESULTS:** Normalized average GRFs can be found in Table 1. As main effects, both condition and gender were non-significant ($p > 0.05$). Meaning, GRFs were not different between ankle support conditions or between gender. Further, the condition x gender interaction was also non-significant ($p>0.05$). **CONCLUSION:** Different ankle supports do not influence GRF characteristics when running speed is constant. These results do not differ between gender. It is important for further research to investigate other types of ankle support and other respective benefits (different than GRF changes).

Table 1: Average peak GRFs (mean ± standard deviation) between gender and condition.

	Male			Female		
	Control	Taped	Braced	Control	Taped	Braced
Vertical GRF (BW)	2.93 ± 0.40	2.92 ± 0.31	2.80 ± 0.26	2.80 ± 0.36	2.81 ± 0.28	2.83 ± 0.38
Braking GRF (BW)	0.41 ± 0.05	0.42 ± 0.06	0.43 ± 0.04	0.46 ± 0.06	0.45 ± 0.05	0.42 ± 0.08
Propulsion GRF (BW)	0.36 ± 0.07	0.36 ± 0.08	0.34 ± 0.08	0.40 ± 0.10	0.40 ± 0.10	0.42 ± 0.12

Board 13

EFFECT OF EXERCISE ON MEMORY IN A MODEL OF ALZHEIMER'S DISEASE, TgF344-AD

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Alzheimer's disease (AD) is a neurodegenerative brain disease characterized by the accumulation of tau protein inside the neurons of the brain and amyloid-β outside of the neurons of the brain, and it is often accompanied with progressive memory loss. In previous studies of animal models of AD, exercise was shown to delay memory decline. The TgF344-AD rat model of AD has successfully demonstrated memory impairment in past studies, but the effects of exercise on this animal model have not yet been discovered. **PURPOSE**: To understand the effect of exercise on memory in this novel rat model of AD. **METHODS**: In this study, we genotyped the animals for the AD genes APP and PSEN1. AD animals and their wild type (WT) littermates were then randomly assigned to treadmill trained (T) or sedentary (S). The treadmill training groups then underwent training 5 days a week for four months on a progressive protocol. Their memory performance was assessed using the Morris Water Maze Test at 16 months of age. **RESULTS**: While there were no statistically significant results, the best and average latency times for AD-S (2.81 and 15.64 s) were higher than WT-S (1.88 and 12.62 s) and AD-T (2.58 and 10.15 s) demonstrating a trend toward significance. **CONCLUSION**: The rats with AD genes seemed to have worse memory performance exhibiting memory decline, and treadmill training did seem to delay the memory decline because AD-T had lower latency times than the AD-S. This study lends to the expectation that further analysis of 17 or 18-month data may reveal statistically significant results.

Board 14

THE EFFECTS OF FUNCTIONAL RESISTANCE TRAINING ON PREGNANCY-RELATED PHYSICAL DISCOMFORTS AND QUALITY OF LIFE

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The majority of pregnant woman experience several physical discomforts throughout gestation, which may include fatigue, pregnancy-induced nausea, and back and/or leg pain. Previous qualitative findings suggest physical activity during pregnancy may alleviate some of these discomforts. **PURPOSE**: We sought to examine the impact of a late-pregnancy functional resistance training program on perceptions of sleep quality, pregnancy-induced nausea and back pain, and quality of life (QOL)**. METHODS**: Participants (n=18) were randomized into either an exercise intervention or control group. Both groups began participating between 22-24 gestational age. Intervention participants completed an eight-week program which consisted of viewing and simulating video exercise sessions. Study investigators determined baseline exercise intensity for each participant and adjusted the training intensity throughout the eight weeks as needed. Participants completed an online questionnaire prior to participation and immediately after intervention/control completion (P1) and also two weeks after completion (P2). Participants answered questions on common physical discomforts during pregnancy, past and present pregnancy health history, and basic demographics. **RESULTS**: The analytic sample was primarily Caucasian (83.3%) and well-educated, with intervention participants being slightly older (n=9, mean age=30.3) than control participants (n=9, mean age 28.0). Effects for sleep quality, pregnancy-induced nausea and back pain did not differ between intervention and control participants. While intervention participants saw no significant change in QOL scores from pre to P2 (pre=88.3, P1=90.3, P2=89.4), control participants experienced a clear decrease in QOL throughout (pre=95.1, P1=91.6, P2=90.1). As such, the change in quality of life scores throughout participation significantly differed between intervention and control participants (p=0.02). **CONCLUSION:** Functional resistance training appears to have a protective effect on quality of life during mid-late pregnancy despite have no effect on common physical discomforts.

Board 15

EFFECTS OF FLAVANOL-RICH CACAO ON MUSCLE SORENESS AND RECOVERY

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Little empirical evidence exists to support the efficacy of cacao supplementation as a recovery agent amongst competitive athletes. Despite this, cacao powder (CA) is rich in flavanols that can exhibit antioxidant properties in the human body. Flavanol-rich CA may offer an alternative path to recovery for athletes. **PURPOSE:** The purpose of this study was to examine the effects of flavanol-rich CA supplementation on recovery from exercise-induced muscle soreness as indicated by vertical jump performance (VJ), a lower extremity functional scale (LEFS), and pain pressure threshold (PPT). **METHODS:** Twelve, college-aged, Division III NCAA male and female athletes (n_m = 8, n_f = 4) participated in a pre-testing session that consisted of a LEFS questionnaire, PPT measurements for the hamstrings and quadriceps, VJ performance, and a drop jump (DJ) protocol. Following the DJ protocol, participants received either CA or placebo (PL) supplementation. CA supplementation consisted of 375-mg of cocoa flavanols in pill form. Post-testing was completed 48-hrs later. Analyses of variance ($p \leq 0.05$) were utilized to determine the existence of significant differences between conditions. **RESULTS:** No differences were observed ($p > 0.05$) between CA and PL groups for all dependent variables (see Table 1). **CONCLUSION:** Under these research conditions, cacao supplementation did not appear to improve recovery or perceived soreness. The dose of cocoa flavanols may have been too little to elicit an ergogenic effect on recovery and the sample population was too small. Further research is needed to investigate the optimal dosage of cocoa flavanols.

Table 1. *Descriptive Statistics for Cacao and Placebo groups.*

	Cacao	**Placebo**
Pre-LEFS	2.0 ± 3.5	3.5 ± 5.8
Post-LEFS	8.2 ± 13.3	2.0 ± 3.5
Pre-Quadriceps PPT (lbf)	27.98 ± 7.88	26.00 ± 9.89
Post-Quadriceps PPT (lbf)	18.89 ± 5.81	24.86 ± 10.57
Pre-Hamstrings PPT (lbf)	30.86 ± 7.86	27.50 ± 4.32
Post-Hamstrings PPT (lbf)	24.74 ± 4.91	26.21 ± 12.08
Pre-VJ (inches)	19.7 ± 5.5	22.7 ± 4.3
Post-VJ (inches)	19.5 ± 4.4	21.7 ± 3.6

Board 16

CHANGES TO OVERALL FITNESS IN RESPONSE TO VARYING RATIOS OF CARDIOVASCULAR AND RESISTANCE TRAINING

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Obesity prevalence is high among young adults (18 – 29yrs) and is further elevated among those reporting some college education. **PURPOSE:** To determine the effect of varying ratios of resistance and cardiovascular training on aerobic capacity, muscular strength, and anthropometric measurements in college students. **METHODS:** For six weeks, participants were allocated to one of two training groups: cardiovascular (CT) (n = 6) or mixed (MT) (n = 7). CT subjects were instructed to perform cardiovascular exercise for 30 minutes, 3x per week, for six weeks. MT subjects were instructed to perform 15 minutes of resistance training with 15 minutes of cardiovascular training at an equivalent frequency. Prior physical activity, exertion, and favored exercise modality was measured at the outset of the study and a variety of health-related behaviors were assessed weekly for six weeks. Exercise intensity was standardized by heart rate. Aerobic capacity was assessed at week 0, 2, 4, and 6 by metabolic cart. Muscular strength was measured as bicep, tricep, and leg extension maximum-length holds, performed biweekly. Bodyweight and bodyfat was measured biweekly. **RESULTS:** CT subjects exhibited a significant decrease in aerobic capacity over the 6-week period compared to individuals in the MT group (-7.59±8.34% vs. 3.70±5.26%, respectively, p=0.014). Bicep strength in both groups saw no significant change over the 6-week period (5.1±28.1% and 32.1±93.1%, respectively, p>0.05), as did tricep strength (-10.4±27.3% and 48.4±80.2%, respectively, p>0.05). Leg strength saw a significant increase in the CT group (120±40%, p=0.002) but not in the MT group (110±179%, p>0.05). Bodyweight change was insignificant in both groups (3.42±8.68lbs and -2.4±3.42lbs, respectively, p>0.05), but bodyfat decreased significantly in the MT group (-14.6±11.5%, p=0.01) while remaining unchanged in CT participants (2.1±9.0%, p>0.05). Noncompliance to protocols was due to a lack of time in 70% of cases. **CONCLUSION:** Our findings indicate that 30min of cardiovascular exercise performed 3x per week may be insufficient to maintain fitness in students. Additional resistance training may be a useful strategy to attenuate physical decline and improve body composition. Insufficient time should be addressed as a significant barrier to exercise in students.

Board 17

EFFECT OF GLUTE TARGETING WARM-UP ON MUSCLE ACTIVATION AND KNEE KINEMATICS DURING WEIGHTED BILATERAL SQUAT

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Weighted squats are a common training and rehabilitation exercise. Stability during the exercise is critical to prevent injury and two major muscles groups working throughout the dynamic movement of the squat include the hip abductors and quadriceps. Weakness in these muscles reduces stability of the entire lower extremity kinetic chain and may result in excess knee loading. **PURPOSE:** This study aimed to increase glute activation during a squat, therefore increasing knee stability to aid injury prevention relating to weightlifting. **METHODS:** Thirty (18-23 yr) students that participated in weightlifting activities at least three days a week were recruited. Surface electromyography (EMG) of the gluteus maximus, gluteus medius, and vastus lateralis (normalized to Maximum Voluntary Isometric Contractions (MVIC)) and 2-dimensional motion capture data were collected. A six-minute jogging warm-up was followed by five barbell squats (with 15% of their body weight). After a five-minute rest, ten repetitions of four glute-activation exercises were performed on each leg, followed by five more barbell squats. Mean muscle activity (as % MVIC) of the middle three squats were compared between trials and changes in changes in the peak medial, peak lateral, range, and standard deviation were compared between trials. Paired t-tests were used with a=.05. **RESULTS:** There was a decrease in gluteus maximus activation **(**trial 1: 26.18 ± 14.12 %, trial 2: 23.59 ± 12.14 %). There was a significant decreases in gluteus medius recruitment (trial 1: 30.69 ± 15.88 %, trial 2: 29.59 ± 16.17 %, p=0.05) and vastus lateralis muscle activation (trial 1: 128.41 ± 81.75 %, trial 2: 101.38.50.62 %, p=0.036) following the glute targeting warmup. No significant differences were seen in knee kinematics for medial or lateral movement, or standard deviation of knee movement. **CONCLUSION:** Our kinematic results show that the squat form was unchanged, while muscle recruitment decreased following a glute targeting warmup. This suggests that the warmup caused the measured muscles to output similar forces with decreased activation, or possibly shifted activation to other muscles. The findings imply that glute targeting activities are a beneficial squat warmup for knee stability, force production and performance improvements.

Board 18

CARDIOMETABOLIC ASSESSMENT OF FIREFIGHTERS FROM THE GRANDE RONDE RAPPELLERS WILDLAND FIREFIGHTING CREW

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Wildland firefighting is a job that requires strength and stamina. The Grande Ronde Rappellers (GRR) are highly-trained aerially delivered firefighters that provide ‘initial attack’ on forest fires. Rappellers are often ‘on’ fires for 72 hours, where they work physically active shifts ranging from 4-16 hours, and then are required to ‘pack out’ across 5-15+ miles of mountainous terrain carrying loads in excess of 50 kg. Few studies have examined the cardiometabolic fitness and efficiency of wildland firefighters, and no studies to our knowledge have examined members of a USFS rappel crew. **PURPOSE:** To examine the heart rate, oxygen consumption, and rate of caloric use of GRR firefighters during a 4 stage metabolic test. **METHODS:** Each subject underwent a metabolic test with four consecutive 6-minutes stages (24 minutes total) that included sitting, walking on a treadmill at 4mph, walking on a treadmill at 4mph with a 6-8% incline, and walking on an inclined treadmill at 4mph while wearing a 20.45kg vest. Heart Rate (bpm) and VO2 (ml/kg/min) were measured throughout the test. Respiratory Exchange Ratio (RER) and kilocalories burned (kcal/min) were calculated for each stage. Data from stages was analyzed using ANOVA. **RESULTS:** Male (n=13) and female (n=2) subjects tested were aged 30.47±3.56 years, weighed 85.12±10.90 kg, and had a mean body fat % of 17.35±4.80. Mean HR (bpm) was different for the sitting, walking, incline, and weighted incline stages were 67.00±9.9, 99.71±12.71, 118.29±13.27, and 146.07±9.62, respectively ($p<0.05$). Mean VO2 (ml/kg/min) for each of the 4 stages was 3.47±1.01, 18.51±2.37, 24.98±2.18, and 33.55±4.49 ($p<0.05$). Mean oxidative caloric use rates (kcal/hr) were 86.35±31.15, 454.50±81.79, 622.12±93.64, and 850.77±156.83 ($p<0.05$). RER for each state was 0.87±0.10, 0.81±0.05, 0.88±0.03, and 0.92±0.02. **CONCLUSION:** This study provided insights into oxidative energy use and substrate utilization in highly skilled wildland firefighters.

Board 19

THE EFFECTIVENESS OF AN AGILITY DRILL PROGRAM ON BALANCE IN OLDER ADULTS

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In the U.S., one in four older adults fall each year, making this the leading cause of injury in individuals 65 and older. To counter the chance of an injury occurring, exercise programs have been created to help older adults regain and maintain strength and balance. **PURPOSE:** The aim of this study was to evaluate the effectiveness of a 12-week agility program using foot drills for a group of older adults. **METHODS:** Twenty participants (age: 80.3 ± 8.8 yrs; body weight: 77.8 ± 14.3 kg; height:1.6 ± 0.1 m; BMI: 24.76 ± 4.2 kg/m^2) were divided into an experimental (E) and reference (R) group. Once a week, the E group participated in an exercise program which primarily consisted of a collection of agility drills to improve mobility and balance. The drills were practiced in a random, progressive sequence and focused on enhancing motor and cognitive abilities. The R group was involved in an evidence-based program. Each participant completed a series of functional tests including the Functional Reach Test, Timed Up and Go, and Compensatory Reactive Balance. To determine differences within and between groups, a repeated-measures ANOVA was used. When significant interaction was found, a *post hoc* test was used to determine further statistical differences. Significance was established at $p<0.05$. **RESULTS:** There were no significant differences in the interaction of condition by time for the Functional Reach Test ($p=0.27$) and Timed Up and Go ($p=0.94$). However, there was a significant difference in the interaction for the Compensatory Reactive Balance ($p=0.04$). *Post hoc* analysis revealed that Compensatory Reactive Balance did not improve for the R group ($p=0.65$), but significantly improved for the E group ($p=0.01$) over 12 weeks. **CONCLUSION:** The results suggest that after twelve weeks of agility drills, balance may be increased in a group of older adults. However, further research is needed to investigate the program's effectiveness.

Supported by West Region EMS Grant

Board 20

MAXIMAL FAT OXIDATION DURING STEADY STATE EXERCISE

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Research has demonstrated multiple factors contributing to maximal fatty acid oxidation (MFAO). However, less is known about factors that regulate changes in fatty acid oxidation during exercise. **PURPOSE:** The purpose of this study is better understand how cycling at MFAO for 60 minutes will alter fat oxidation. **METHODS:** Twelve fasted, uncaffeinated individuals (8 males, 4 females, average VO_2max = 44.3± 2.3 mL·kg^{-1}·min^{-1}, average age =23.7±0.8) underwent two laboratory visits. They first underwent a VO_2 max test in which heart rate (HR), rating of perceived exhaustion (RPE), absolute fat (FAO) and carbohydrate oxidation (CHOO) were recorded. Hydrostatic weighing was used to determine body fat percentage. The second visit included a 60-minute exercise on a cycle ergometer at the subjects predetermined maximal fatty acid oxidation (MFAO) workload (0.55±0.05 g·min^{-1}; 58.6±1.1 % VO_2max; 126.7±9.6 W**)**. HR, RPE, and the respiratory exchange ratio were recorded every fifteen minutes, with water provided at 3 ml·kg^{-1} at 15, 30, and 45 minutes. Lactate and glucose were measured at 30 and 60 minutes. Data were analyzed using repeated measures ANOVA, and paired samples T-test for pre- and post changes. **RESULTS:** There was a main effect of time on HR (154.7±3.5 at 15min, vs 168.0±2.9 bpm at 60min; $p=0.005$), RPE (11.2±0.3 at 15 min vs 13.8±0.4 at 60 min; $p=0.001$) and FAO (0.46±0.05 at 15 min vs. 0.65±0.06 at 60 min; $p<0.001$). FAO at the end of 60 mins of exercise was significantly greater than MFAO ($p=0.04$) from the VO_2max test. The change in FAO during exercise did not correlate with subject characteristics. However, MFAO was superior in the tallest ($r=0.67$, $p=0.02$), heaviest ($r=0.78$, $p=0.003$), and those with the greatest maximum workload ($r=0.82$, $p=0.001$). Correlation was found between the tallest and weight loss during the trial ($r=0.66$, $p=0.019$). **CONCLUSION:** These data suggest that during the 60 minute bike ride that FAO exceeds the MFAO during a VO_2max test. In addition, the largest subjects with the greatest maximum workload had the highest MFAO and FAO during the one hour trials.

Board 21

PROPRIOCEPTIVE ACUITY IN THE ABSENCE OF SENSORY FEEDBACK USING AN ISCHEMIC NERVE BLOCK

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PURPOSE: Our laboratory was the first to document proprioceptive disruption in patients with Type II Diabetes Mellitus (T2DM) with and without peripheral neuropathy (PN). The cause of proprioceptive disruption is unknown. Evidence suggests two likely mechanisms involving the sensory receptors and nerves as well as cerebral disruption altering the processing of sensory information are likely in this population (Ryu 2019, Ettinger 2018). Separating the afferent signaling from the processing would give insight as to which mechanism is more likely disrupted in patients with T2DM. In the present study, an ischemic nerve block was used to disrupt the generation of afferent signals while the processing of sensory information was unmanipulated. We hypothesized that during the block, non-diabetics would demonstrate proprioceptive errors that were consistent with those measured in patients with T2DM. **METHODS:** A tourniquet block (40 mmHg above systolic blood pressure), was imposed on the brachium of 5 non-T2DM participants (21.5 years). A magnetic tracking device (Polhemus Fastrak, Colchester, VT) was used for measuring arm motion. For joint position sense (JPS) subjects were outfitted with a head-mounted display, which allowed the subjects to see a virtual representation of the target position while preventing visual feedback from their hand. Target angles 50°, 70°, and 90° of shoulder elevation were selected. All targets were repeated 4 times and were randomized. The center of the screen contained a box representing a ±1° boundary of the target. The arm was virtually represented as a red dot. The subject was then asked to hold the red dot in the target and then memorize the "location of their arm in space." Afterwards the participant was asked to return to where the perceived target location was. All methodology for JPS testing was repeated between the ischemic and control conditions which were randomized prior to participation. **RESULTS:** Preliminary results indicate higher proprioceptive errors in the ischemic conditions at most target angles.

Board 22

GROUND REACTION FORCES AND TEMPORAL CHARACTERISTICS DEFINE CUTTING PERFORMANCE

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Moderate angle cutting maneuvers (between 45º and 90º) are a common and essential performance skill for success in multidirectional sports (Havens et al, 2017). Research often addresses the injury risks of cutting (e.g. Shin, et al., 2011; Beaulieu, et al, 2009) but very few studies have attempted to quantify the performance of the cut itself (e.g. Andrews, 1922; Queen, et al, 2007). **PURPOSE:** To identify any anthropometric, kinematic, and/or kinetic markers of a high-performance cut. **METHODS:** Ten college-aged male athletes (*A*) (mass 73.97 ± 8.77kg, height 1.81 ± 0.07m) and ten non-athletes (*NA*) (mass 87.37 ± 13.93kg, height 1.85 ± 0.04m) completed five moderate angle cutting trials with a speed constraint of 4.03 m/s - 4.44 m/s through a 3m in to and 3 m out of a 60˚ change in direction set-up. Ground reaction forces (GRF) were collected with a force plate at the apex of the cut, and 2 cameras (210fps) were used for kinematic analysis (Kinovea®). Fifty variables, including anthropometrics, measures of power, and kinematic, kinetic and temporal variables related to the cuts were measured and compared between the two groups using independent T-tests (α=.05). **RESULTS:** Of the 50 variables tested, only 6 variables, including percent time in the braking and propulsion phase, GRF Y loading rate (kN/s), right leg squat jump takeoff velocity (m/s), Q-angle (deg), and body mass (kg) were significantly different between the two groups. *A* spent significantly less time in the propulsion phase (52.0% ± 0.02%, p=.007) compared to *NA* (55.4% ± 0.03%). The propulsion phase was determined as the percentage of the contact phase the knee was extending (e.g. Green, et al, 2012). Additionally, *A* produced significantly greater instantaneous values of X GRF, Y GRF, and Z GRF during the propulsion phase (p<.05). **CONCLUSION:** Greater GRFs coupled with a shorter propulsion phase by *A* accounted for the lack of differences in the propulsion impulse between the two groups. Therefore, both groups accomplished the task with a similar exit velocity, but *A* made the move into the new direction in a shorter amount of time. We believe this skill is an important component of performance in multidirectional sports. Changing direction in a shorter time improves an athlete's ability to evade an opponent, by decreasing the time an opponent has to react to a new direction.

Board 23

EFFECTS OF BODY MASS AND CHAIR HEIGHT ON MUSCLE ACTIVATION AND BALANCE DURING SIT TO STAND

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Performance of the sit to stand movement (STSm), a critical aspect of daily life, has been primarily studied in elderly populations. In addition, obesity has been shown to affect stability, but its relation to STSm has not been studied. **PURPOSE:** This study examined the impact of simulated weight gain on muscle activation and balance at varying chair heights in a young, healthy population. **METHODS:** Subjects (n=30, aged 20.9±1.25 yr), were asked to perform six STSm, at three different chair heights, under a bodyweight (BW) and added-weight (AW) condition. The chair heights were set at 80%, 100% and 120% of their knee height (lateral condyle of tibia to the floor) while the added weight (via a weight vest) was equal to 15% of their body weight. Muscle activation was evaluated for the rectus femoris (RF) and biceps femoris (BF) and normalized to their respective maximum voluntary contractions (MVCs). All trials were randomized and counter-balanced. CoP distance and velocity were compared between trials. **RESULTS:** RF Activation was the highest at the 80% seat height in both the AW (78.37 ± 30.37%) and BW conditions (63.42 + 26.73%). Additionally, RF recruitment was significantly higher in AW vs. BW at all seat heights ($p<.05$). BF activation was significantly higher at the 80% AW seat height (19.80 + 11.56%) when compared to the 120% AW height (18.05 + 9.90%, $p=.004$). There were no changes in CoP distance or velocity for either seat height or weight condition. **CONCLUSION:** Increasing chair height under added and body weight conditions leads to decreased activation of the RF and BF suggesting a reduced difficulty in performing this movement. The RF, under the AW condition, was most effected by seat height changes. The findings indicate that increasing seat height does not alter balance. Our study suggests that weight gain impedes the ability to perform the STSm and that increasing chair height is a successful method in easing the difficulty of performing this movement.

Board 24

SHORT TERM EFFECTS OF TRANSCUTANEOUS ELECTRICAL STIMULATION OF THE QUADRICEPS ON RECOVERY FROM EXHAUSTIVE EXERCISE

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PURPOSE: The use of portable electrical muscle stimulation (EMS) units is becoming a popular tool for both professional and amateur athletes. This study evaluated the effectiveness of EMS as a means of short-term recovery following exhaustive quadriceps exercise. **METHODS**: 14 moderately active subjects had an average: age of 20.9 ± 0.6 years, height of 172.3 ± 9.0 cm, mass of 70.7 ± 13.4 kg, and fat free mass (FFM) of 58.6 ± 13.5 kg. In the first visit subjects completed a self-determined exhaustive set of quadriceps extensions consisting of three bouts each followed by 30s of rest. The added weight was predetermined based on FFM. In visits two and three subjects were instructed to do the same number of leg extensions for set one. This was followed by EMS or passive recovery (PR), the order of which was counterbalanced. After the intervention, subjects performed another set of quadriceps extensions until self-determined exhaustion. The amount of reps completed pre and post intervention was recorded. Additionally, blood lactate, heart rate (HR) and thigh circumference were recorded before and after the first set and after the second set. **RESULTS**: No significant differences were found between HR, blood lactate, and thigh circumference between EMS and PR tests. In the first set of leg extensions following the intervention the EMS group averaged 42 ± 18 reps vs. the PR group that averaged 26 ± 9 reps ($p=.017$). There was no significant difference in average reps between interventions in the second and third bout ($p=.135$, $p=.683$ respectively). After EMS, subjects averaged 170 ± 39 total reps vs. 60 ± 17 total reps after PR ($p=.039$). **CONCLUSION**: EMS improves exercise capacity following exhaustive exercise when compared to PR. Increased blood flow as a result of the evoked muscle contractions is thought to flush out metabolites and help replenish muscle glycogen, aiding with recovery of the motor unit. For short-term recovery, EMS is effective in producing more repetitions after exhaustion.

Board 25

THE EFFECTS OF "PHYSICAL BEMER VASCULAR THERAPY" ON WORK PERFORMED DURING REPEATED WINGATE TESTS

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Physical Vascular Therapy using Bio-Electro-Magnetic-Energy-Regulation (BEMER) is being increasingly recognized as a promising modality in therapeutic settings around the world. Although proponents of BEMER suggest that physically active populations (e.g. athletes) may also benefit from treatments, scant research exists to actually test this hypothesis. **PURPOSE:** To explore the effects of BEMER technology on recovery and performance parameters in anaerobic exercise. If found to be effective at enhanced recovery in active populations, this intervention could prove viable for reducing injury risk and positively affect return-to-exercise outcomes. Additionally, the improved recovery may secondarily lead to legitimate performance-enhancement in sport. **METHODS:** Study participants will complete three testing sessions separated by 3-7 days. Each session will involve four repeated Wingate tests (i.e. 30-second sprints) on a Monark cycle ergometer separated by four minutes of recovery. The three randomized recovery methods will include the following: 1- passive recovery (i.e. laying supine), 2- BEMER treatment (i.e. laying supine on the BEMER pad), and, 3-active recovery (i.e. cycling at a light intensity on the Monark ergometer). Data collection will include peak power output, mean power, total work, and fatigue index. Additional measures will include heart rate, blood pressure, percent Hemoglobin saturation, blood glucose levels, blood lactate levels, and subjective pain ratings. **RESULTS:** Data collection will commence starting in early January, 2020. A one-way repeated measures ANOVA will be conducted to determine if the three recovery protocols produced statistically significant differences in the dependent variables within subjects. **CONCLUSION:** The current project has potential to advance knowledge in the areas of exercise recovery and performance enhancement.

Supported by ASCM Northwest Student Research Award, Idaho Higher Education Research Council (HERC) Student Research Award, Idaho HERC Research Collaborative Award.

Board 26

EFFECTS OF BETA-ALANINE ON ANAEROBIC PERFORMANCE

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Increasing total power and decreasing overall fatigue in anaerobic performance are sought-after physical abilities among various athletic and fitness disciplines. Beyond physical training, many athletes supplement with the popular pre-workout beta-alanine to further optimize performance. Beta-alanine binds with histidine to form carnosine and is stored within skeletal muscle. Research has found that multi-week Beta-alanine supplementation improves total power and decreases overall fatigue in anaerobic exercise $\geq$ 60 seconds. However, data is limited among supplementation phases of under two weeks. **PURPOSE:** To analyze the effects of one week of beta-alanine loading on anaerobic power during a Wingate cycle ergometer test (WAnT). **METHODS:** 11 physically active college-age students were recruited from Willamette University. After conducting a baseline WAnT, participants were randomly assigned to either the control (placebo sugar pill) or experimental condition (10 mg/kg body weight/per day beta-alanine). Participants were instructed to take their respective supplements twice daily, for seven days. Following the supplementation period, a second WAnT was performed. Paired t-tests were conducted to assess the change in fatigue index and mean power variables within each group. **RESULTS:** Significant differences were observed when comparing pre to post supplementation for individuals in the Beta-alanine group in both mean power output and fatigue index score. Individuals increased their mean power by an average of 94.43 ± 49.73 watts ($p=0.012$) and decreased their fatigue score by an average of 34.74 ± 22.32% ($p=0.006$). In comparison, the placebo group's mean power output was an average of 30.79 ± 30.16 Watts ($p=0.054$). Fatigue index for the placebo group saw only slight improvements totaling a 2.2 ± 14.06% lower fatigue score than their first attempt ($p=0.714$). **CONCLUSION:** This pilot study indicates that implementation of a one-week supplementation of 10 mg/kg body weight of beta-alanine results in both an increased total power output and a lower fatigue index score; therefore, this may be an effective tool for improved anaerobic performance.

Board 27

DELIVERY AND ASSESSMENT OF A BI-WEEKLY WELLNESS LETTER TO UMATILLA MORROW COUNTY HEAD START

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Elevated stress amongst teachers can reduce their ability to provide a positive learning environment. Stress, and the negative effects of stress can be compounded by unhealthy behaviors including lack of exercise, inadequate diet, over nutrition, overweight, and obesity. In contrast, improving healthy behaviors in teachers may decrease stress, improve the learning environment, and provide healthy modeling for students. **PURPOSE:** To deliver a bi-weekly health information letter via email to teachers and staff of Umatilla Morrow County Head Start (UMCHS) and assess the impact of the letter through pre/post survey. **METHODS:** A health behaviors and habits questionnaire based on the transtheoretical model of behavior change was distributed to UMCHS before and after the delivery of the letters. Thirteen issues of the 'Kick Start for Head Start!' (KSFHS) letter were delivered to staff and teachers bi-weekly during the 2018/19 AY. Each issue had a 'theme', which included evidence based background and potential action items regarding the theme. **RESULTS:** There were 74 responses to the pre-survey which was a 31% response rate. The post-survey was completed by 53 staff which was a 22% response rate. In the post-survey 89% responded they would continue to read the KFHS letter. 51% of respondents said they would use the information provided and 43% reported trying one or more of the suggested action items. Other notable responses included a 17% increase in meeting or acting on meeting sleep recommendations. Respondents reporting to limit soda intake between 0 and 8oz per day increased 14% pre to post. Starting or continuing yoga practice increased by 15%. Those who reported starting or continuing to dedicate time exclusively to taking care of themselves rose from 23% to 39%. **CONCLUSION:** A bi-weekly newsletter promoting health and wellness with suggested action items was well received by the staff of UMCHS and may have contributed positively to staff health behaviors.

Board 28

E***XAMINING THE EFFECTS OF THORACIC LUNG VOLUME MANIPULATION ON BODY COMPOSITION BY AIR DISPLACEMENT PLETHYSMOGRAPHY***

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Air displacement plethysmography (ADP) is commonly used to determine body composition (%BF), as an assessment of health and fitness among athletes and non-athletes alike. Using Boyle's law, by manipulating the volume of the ADP chamber and measuring the resulting changes in pressure, the volume and density of the subject can be determined. ADP relies upon the assumed compressibility of air surrounding the test subject (adiabatic air), as well as thoracic gas volume (isothermal air). During normal breathing thoracic gas volume is predicted by height, sex, and age. **PURPOSE:** To analyze changes in %BF results when violating the assumption of thoracic gas volume. **METHODS:** 20 healthy college students were recruited from Willamette University. %BF was determined via ADP under five randomly ordered conditions: normal breathing/normal seating position, expanded chest/normal seating position, depressed chest/normal seating position, expanded chest/arched back, and depressed chest/arched back. Differences within subjects across all conditions were assessed by repeated-measures ANOVA with pairwise post hoc analyses and Bonferroni correction. **RESULTS:** %BF measures increased when comparing normal breathing/normal seating condition ($\bar{X}$=22.450±10.717) to both the depressed chest/ normal seating position ($\bar{X}$=24.475±10.012, $p<0.001$) and depressed chest/arched back position ($\bar{X}$=24.785±10.291, $p< 0.0001$). Expanded chest/normal seating ($\bar{X}$=21.430±10.317) and expanded chest/arched back ($\bar{X}$=22.195±10.692) were lower than normal breathing/normal seating position at non-significant levels. The expanded chest/normal seating position resulted in significantly lower %BF than the depressed chest/normal seating ($p<0.002$) and the depressed chest/arched back ($p<0.001$). Similar differences were noted when comparing the expanded chest/arched back to the depressed chest/normal seating ($p<0.007$) and the depressed chest/arched back position ($p<0.012$). **CONCLUSION:** Results of this study indicate that changes in breathing during ADP may alter body fat % readings, likely due to changes in the volume of isothermal air present. Accurate results when using ADP require clear instructions that emphasize normal breathing throughout testing.

Board 29

EXPRESSION OF CHROMATIN-REMODELING ENZYMES IN A HIGH-FAT DIET MOUSE MODEL

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Chromatin remodeling complexes (CRCs) are nuclear enzymes that regulate gene accessibility and are critical for the proper development of blood vessels during gestation. Little is known about the activity CRCs in the adult cardiovascular system but preliminary studies suggest they may be important in maintaining adult cardiomyocyte and endothelial profiles. **PURPOSE:** To determine expressional changes of three CRCs, *Brm*, *Brg1,* and *Chd4,* in a high fat diet adult mouse model. **METHODS:** Seven male mice were evenly distributed into low fat diet (LFD) (10% fat) and HFD (60% fat) conditions and euthanized at 26-27 weeks. Tissue samples were incubated in digestion buffer to liberate RNA, which was then converted to cDNA using reverse transcriptase. RT-qPCR with mouse-specific primers was used to determine relative CRC expression compared to the housekeeping genes *GAPDH* and *Actin.* **RESULTS:** In kidneys from HFD animals, *Brg1* was significantly upregulated when compared to the housekeeping genes *Actin* ($t(5) = 1.53$, $p = 0.03$) and *GAPDH* ($t(5) = 3.05$, $p = 0.04$) individually. While *Brm* also appeared to be upregulated in kidneys from HFD animals, these results were not significant. *CHD4* was significantly downregulated when compared to the housekeeping gene *GAPDH* ($t(5) = 0.31$, $p = 0.03$). Results from heart tissue were inconclusive. **CONCLUSION:** Very little is known regarding the various CRCs and their ability to regulate gene expression in the adult cardiovascular system. This study is the first to study the expression of three CRCs in a HFD mouse model and preliminary evidence indicates that their activity is altered by a diet high in fat. Future studies should assess the activity of CRCs in a cell specific manner, including cardiomyocytes or endothelial cells from LFD and HFD specimens.

Board 30

ANKLE AND FOOT ANGLES AT FOOT STRIKE BECOME MORE PLANTAR FLEXED AS RUNNING SPEED INCREASES

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Previous research found decreased contact time, increased hip and knee flexion at heel strike, and initial contact with the forefoot are characteristic of maximal speed running compared to slower running speeds (e.g Novacheck, 1998). **PURPOSE**: To determine if kinematic variables change linearly up to maximal speed running, and if sprinting can be defined kinematically. **METHODS**: 18 males between the ages of 18-22 years completed two visits: the first including 3, 25m maximal-effort overground trials, and the second, two submaximal runs for 20 seconds on a treadmill at 4.47 and 5.36 m/s. During both visits, markers were placed on sagittal plane bony landmarks: acromion, greater trochanter, lateral epicondyle, lateral malleolus, heel, and fifth metatarsal head, which were recorded with high speed video (overground: 420fps, treadmill: 210fps). Segment and joint angles were determined using Kinovea®. **RESULTS**: The average speed of the maximal run was 7.2 ± 0.38 m/s. Hip and knee angle at foot strike became significantly more flexed with increasing speed ($p<.001$). The change with respect to speed was linear for both hip ($R^2= .978$) and knee angles ($R^2 = .976$). The ankle was significantly more plantar flexed at foot strike during maximal running than at 5.36 m/s ($p<.001$) and 4.47 m/s ($p<.001$), both were dorsiflexed at strike. The shank angle remained relatively similar through the increase in speed; the sprinting trials were 3 degrees lower than both the 5.36 m/s trials ($p=1.000$) and the 4.47 m/s trials ($p=1.000$). However, the foot angle became more plantar flexed curvilinearly ($R^2 = 1.00$) with speed, such that the sprint trial was significantly more plantar flexed than the 5.36 m/s trial ($p<.001$) and the 4.47 m/s trial ($p<.001$). **CONCLUSION**: Maximal speed running can be characterized by increased ankle plantar flexion at foot strike as compared to lower speeds, with foot angle being the main contributor. Though slower runners were still heel-striking at their maximum speed, they exhibited decreased dorsiflexion. Maximal speed running for an individual may not be characterized by footfall pattern (e.g. Miyamoto, et al., 2018); however, we conclude that individuals will exhibit significantly more plantar flexion or less dorsiflexion at their own maximal running speed compared to submaximal speeds.

Board 31

THE EFFECTS OF POSTURE ON BODY FAT COMPOSITION RESULTS

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Air displacement plethysmography (ADP) is a widely used method in body composition analysis which relies on the principles of air compressibility. In the ADP chamber, variations in seated posture can affect trapped air pockets and exposed skin surface area; therefore, the changing the compressibility of the adjacent air which may affect calculated body composition results. **PURPOSE:** To analyze the effect of various seated postures on body fat composition results using air displacement plethysmography. **METHODS:** 24 college-aged students were recruited from Willamette University. Body composition was assessed using an ADP chamber. Four positions were tested, seated normally, seated with an arched back, seated while leaning forward, and a maximal surface exposure condition in which subjects positioned their body to maximize airflow around them. A repeated-measures ANOVA with Bonferroni correction and pairwise post hoc analysis assessed the effect of posture on body composition. **RESULTS:** Posture had a significant impact on body composition ($p<0.0001$). Compared to the normal posture, the leaning forward posture had a 0.97% lower average body fat result ($p=0.002$), arched had a 1.42% higher reading than bent posture ($p<0.001$) and arched was 0.16% higher than maximize ($p=0.015$). There was no difference between normal and either the arch or maximize postures ($p=0.96$, $p=0.4$ respectively). Finally, there was no difference between leaning forward and maximize posture($p=1.00$). **CONCLUSION:** ADP is sensitive to changes in seated posture, resulting in variations in body composition results, likely due to changes in air compressibility. These significant differences indicate a need to further research which postural position is the most accurate and create a standardized protocol for posture in air displacement plethysmography chambers.

Board 32

EFFECTS OF PEPPERMINT OIL INHALATION ON VERTICAL JUMP PERFORMANCE IN NCAA DIVISION III SWIMMERS

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Aromatherapy with peppermint oil has some documented physiological benefits, such as anti-inflammatory and vasodilator properties, which may affect athletic performance. The arousal effects of peppermint oil may benefit athletes, such as swimmers, who must perform explosive jumps. However, evidence to support the effectiveness of peppermint oil on vertical jump performance has been equivocal. **PURPOSE:** The purpose of this study was to investigate the effect of peppermint oil aromatherapy on vertical jump performance in NCAA Division III swimmers. **METHODS:** Nine ($n_m = 5$, $n_f = 4$) competitive swimmer undergraduate students participated in this study. The participants were between the ages of 18-21-y. Participants performed two test sessions, each of which consisted of three countermovement vertical jumps with 30-s rest between each jump. The test sessions were completed with and without the use of peppermint oil, assigned in random order. In the experimental peppermint oil test sessions participants were given a protective ear-loop face mask with 3-drops of 100% peppermint oil applied below the nose. In the control test sessions, no peppermint oil was applied to the mask. The face mask was placed on the participants for 10-min before the completion of vertical jumps. A dependent group *t*-test ($p \leq 0.05$) was utilized to compare vertical jump height with and without the use of peppermint oil. **RESULTS:** In the experimental peppermint oil test session, participants mean score was 46.9 ± 11.2-cm and in the control non-peppermint oil test session, participants mean score was 47.8 ± 10.2-cm. No statistically significant difference was observed ($p = 0.544$) between performance obtained from the experimental peppermint oil and control non-peppermint oil conditions. **CONCLUSION:** In the present study, vertical jump performance did not significantly improve with the presence of peppermint oil compared to control session. The primary explanation for the observed findings was the method of administration of peppermint oil, relative to similar aromatherapy studies. Due to the high observed beta ($b = 0.96$), there was a high probability a Type II error was committed. Further research is needed to investigate the appropriate method of administration of peppermint oil to enhance vertical jump performance in collegiate swimmers.

Board 33

EFFECT OF EXERCISE ON MOTOR COORDINATION IN A MODEL OF ALZHEIMER'S DISEASE

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Alzheimer's Disease (AD) is a neurological disease that results in a progressive cognitive decline. There is currently no cure for this disease, and it has risen to be the third leading cause of death in older adults. In addition to the well-studied declines in memory and cognition, AD causes declines in motor coordination impeding the individual's ability to perform activities of daily living. The mechanisms of motor coordination declines are not well understood. **PURPOSE**: This study utilized a novel transgenic rat model that replicates the human brain of AD to evaluate the changes in motor coordination and the effect of exercise. The hypotheses are that motor coordination will decline in these animal models genotyped to have AD compared to wild type (WT) littermates, as well as aerobic exercise will have a positive effect by improving motor coordination in the animal models with AD. **METHODS**: Following genotyping, animals were randomly assigned to undergo treadmill training (EX) or remain sedentary (SED). At twelve months of age, EX animals began a progression forced treadmill training protocol for four months. At 16 months of age, motor coordination was analyzed using a Rotarod. **RESULTS**: While not statistically significant ($p<.05$), there was a trend toward improved motor coordination in animals undergoing treadmill training. Most importantly, the trend was evident in AD animals. As the animals age, it is expected to see an even greater improvement. **CONCLUSION**: This pilot study is a strong first step to understand the impact of AD on motor coordination and future tissue analysis will shed light on the mechanisms of this apparent decline in motor coordination.

Board 34

EFFECTS OF CAFFEINE CONSUMPTION ON REACTION TIME IN UNDERGRADUATE STUDENTS AT WHITWORTH

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Caffeine is a common stimulant with a relatively quick time of onset. Many researchers have studied the physiological responses individuals undergo after caffeine consumption, which may be influenced by tolerance or genetics. Reaction time (RT) tests have been previously utilized in caffeine studies, and provide an effective measurement of cognitive ability. However, many previous researchers reported findings within a clinical context and gave less attention to the effects of caffeine in a "real world" setting. This may be important, as some researchers suggest physiological effects from caffeine may be more situationally-dependent. **PURPOSE:** The purpose of this study was to understand the effects of "real world" caffeine consumption on RT in undergraduate students. **METHODS:** Nineteen college-aged students, ranging from ages 18-25 y, completed two simple RT tests, with and without caffeine. Participants signed up for two experimental sessions, 48 hr apart, which lasted approximately 45 min. Caffeine administration consisted of one 8 fl oz flavored drink (C), which contained 125 mg of caffeine. For the control session, participants consumed one 8 fl oz placebo (P) flavored drink in a similar fashion as to not distinguish from the caffeinated drink. After the participants sat for 30 min, they performed a simple RT test on a laptop. Participants wore noise-cancelling headphones when necessary. The tests consisted of clicking the mouse pad as quickly as possible once a circle on the screen changed from yellow to red. The average RT after five repetitions was recorded. Wilcoxon signed-rank test (significance level $p \leq 0.05$) was used to determine the existence of significant differences between experimental conditions. **RESULTS:** No statistical difference ($p = 0.687$) was observed for RT between caffeine (M = 0.35, range = 0.421) and the placebo (M = 0.344, range = 0.266). **CONCLUSION:** Under these research conditions, caffeine did not improve RT. The primary explanation for the observed results was that the dose of caffeine administered (125 mg) may not have been large enough to elicit a significant effect on RT. Further research is needed to investigate larger doses of caffeine ingestion with a larger sample size.

Board 35

THE EFFECTS OF BODY COMPOSITION, FUEL MIX, AND TRAINING TYPE, ON RESTING METABOLIC RATE

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Over 70% of the U.S. population is overweight or obese. A sustained positive energy balance is a key component in this epidemic. With only 20% of the population meeting the physical activity guidelines for health, it is important to consider factors besides physical activity that contribute to total energy expenditure, especially Resting Metabolic Rate (RMR). **PURPOSE:** To determine if type of conditioning (aerobic vs. anaerobic), gender, or body composition has a greater effect on resting and exercise energy expenditure. **METHODS:** Using a convenience sampling approach, 10 recreationally active participants were recruited from a small Northwest United States college. Participants underwent body composition testing using hydrostatic weighing, 9 site skin-fold, and GE Lunar DEXA 3500. Resting metabolic rate, exercise energy expenditure, and non-protein respiratory exchange ratio (RER) were measured from utilizing the TrueOne 2400 metabolic cart (Parvo Medics). A self-reported survey was administered to determine type of conditioning (aerobic vs. anaerobic). **RESULTS:** Gender had a larger influence on RMR than any other factor (Males: 1.2975, Females: 0.975; p=0.03). Body composition, fuel mix, and training type had no effect on RMR based on a one-way ANOVA (p=0.301). Lean muscle mass had the strongest correlation to RMR (r=0.795). **CONCLUSION:** Our findings indicate that lean body mass is more closely related to RMR regardless of conditioning type or fuel mix during exercise. Males generally have a higher RMR and our results suggest this may be due to males also having greater lean muscle mass than females. These findings reiterate the critical role that physical activity plays in the fight against obesity as it promotes the development of lean muscle mass, thereby elevating RMR and total energy expenditure.

Supported by Lewis-Clark State College Movement and Sport Sciences Division

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REDEFINING STEADY-STATE PARAMETERS USING RESPIRATORY AND CARDIOVASCULAR VARIABLES

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Steady-state (SS) exercise is characterized by a physiological equilibrium between energy demand of the working muscles and aerobic metabolism, indicating that both ventilation and heart rate (HR) will remain within a range. Currently, the HR ≤ 5bpm method is a guideline for determining SS. However, little research has been done on this parameter and potential applications. **PURPOSE**: To redefine the determining parameters for SS exercise. **METHODS**: Each subject (n=31, m=21, f=10) performed four treadmill exercise tests consisting of an incremental VT/$VO_{2\,max}$ test (day 1) and three 10-minute constant workload exercises at 2.5, 3.5, and 6.0 mph (day 2). Variables VO_2, RER, and HR were recorded throughout each test. Statistical control charts were used in reverse time order to identify the earliest time point where the constant workload test variables remain in statistical control. The onset of SS was recorded as one minute after statistical control began (CC-1). Data collected after this time were used to create the Steady-State Speed Adjusted Coefficient of Variation (SAC-V): (SD/Mean) *(Speed in mph). SAC-V values less than the 95th percentile represent acceptable SS for each variable. Paired t-tests were used to compare the differences between: 1) the time at the onset of SS VO_2 and HR at each speed as determined by CC-1; and 2) the time at the onset of SS HR determined by CC-1 vs. HR ≤ 5bpm method. **RESULTS**: SAC-V 95th percentile for VO_2 = 0.39, RER = 0.15, and HR = 0.10. Time at CC-1 VO_2 and HR were statistically different at 3.5 mph (2.63 ± 1.85 min, 5.23 ± 1.83 min, $p < 0.05$) and 6 mph (3.24 ± 1.25 min, 6.95 ± 1.31 min, $p < 0.05$), but not at 2.5 mph (2.83 ± 2.13 min, 3.81 ± 2.07 min, $p = 0.07$). HR ≤ 5bpm method prematurely determined time at SS compared to CC-1 at 3.5 mph (5.23 ± 1.83 min, 3.44 ± 0.53 min, $p < 0.05$) and 6 mph (6.95 ± 1.31 min, 3.67 ± 0.50 min, $p < 0.05$), but not at 2.5 mph (3.81 ± 2.07min, 3.46 ± 0.39 min, $p = 0.38$). **CONCLUSION**: The study showed that objective VO_2, RER, and HR values can be used as independent parameters to identify and establish SS and may occur at different time points. At low work rates, the HR ≤ 5bpm method variation gave similar results as CC-1 HR for identifying time at SS, but resulted in different time at SS as intensity increased. The SAC-V values can be used to determine SS during exercise testing.

MASTERS STUDENT PRESENTATIONS

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EFFECT OF STATIC HIP FLEXOR STRETCHING ON STANDING PELVIC TILT AND LUMBAR LORDOSIS

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Pain and dysfunction of the lumbar spine has been shown to be related to excessive lumbar lordosis, especially during upright positions like standing. In particular, anterior pelvic tilt has been associated with increased lordosis and posterior pelvic tilt related to reduced lordosis. **PURPOSE:** To determine if an acute bout of static stretching of anterior hip muscles can produce a measurable change in sagittal pelvic and lumbar position during actively aligned standing. **METHODS:** Following completion of consent form and a brief survey to quantify participant habitual stretching habits, participants performed a moderate warm-up on a stationary bike. Reflective markers were placed on the skin/clothing on the right side of the participant by palpation of the posterior and anterior superior iliac spines (PSIS & ASIS respectively), greater trochanter of the femur, and three along the spinous processes; T7, T12, L4 vertebrae. Pelvic and lumbar position were assessed while the participant stood in an actively-aligned body position with their arms overhead being asked to 'stand as straight and tall as possible'. Experimental intervention involved participants stretching in a half-kneeling lunge position, commonly used to stretch the anterior hip musculature, performed for 30 sec each leg for three repetitions bilaterally. A single photograph of the standing position, pre and post-acute stretch, recorded pelvic and lumbar position to determine if a change in position occurred. From the photographs, 2D coordinate locations of the reflective markers were determined using the software IC Measure. **RESULTS:** Following stretching, participants significantly decreased lumbar lordosis ($t = 3.72$, $p < 0.05$) between pre and post stretch angles of the Perry lumbar (LUM_P) landmarks (L4, ASIS, and greater trochanter). The Crowel pelvic tilt landmarks (PSIS, ASIS, & horizontal line through ASIS) and McNeal lumbar lordosis landmarks (T7, T12, L4, & PSIS) were not significantly changed. **CONCLUSION:** Participants were able to ignificantly decrease the LUM_P angle, reducing lumbar lordosis from an acute bought of stretching. The information from this study suggests that individuals with excessive or undesirable lordosis while standing could benefit acutely from a bout of static stretching of the anterior hip musculature.

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PROTOCOL FOR TESTING BEETROOT JUICE ON ANAEROBIC POWER AND PERFORMANCE

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The nitrates found in beetroot juice (BR) are known to be a precursor of nitric oxide (NO). NO is a known vasodilator which allows more oxygen to travel in the blood and may improve muscle efficiency. **PURPOSE:** This study aims to set up a testing protocol to evaluate the effects of beetroot juice on anaerobic power and performance in trained CrossFit athletes. **METHODS:** The protocol was a randomized, cross-over, double-blind, placebo-controlled design to measure 500-meter row time, countermovement jump (CMJ), and blood lactate levels before and after the row. Participants consumed either 2.7 oz shot of BR (6.5 mmol nitrate) or a placebo nitrate-free beetroot juice (PL). Two hours later, they rowed 500 meters at maximum capacity. Measurements of blood lactate and the highest of 3 CMJs were recorded before and after the row. After a 7-day washout period, athletes repeated this sequence with either BR or PL for comparison. This study was performed in Fall 2019 at Mercer Island CrossFit with athletes who had at least six months CrossFit experience and were very familiar with the Concept 2 Rower. **RESULTS:** Twenty-five athletes over age 18 (18 females, age range 25 to 60, average age 44) participated. The range of 500-meter row time was 1:28.8 – 2:26.4 (1:50.9 median). Blood lactate ranged from 0.8 to 5.6 (1.6) mmol before the row and 5.0 to 21.2 (10.2) mmol post row. Net CMJ ranged from 7.5 to 23.9 (11.9) inches pre row to 7.6 to 19.8 (11.4) inches post row. The median of the CMJ remained fairly stable pre and post row as not all athletes experienced muscle fatigue after the row. **CONCLUSION:** There were some inconsistencies in the measurement of the CMJ as athletes used chalk on their fingers to mark the spot on the wall next to a ruler. Most athletes tolerated the BR, though some had GI distress and others did not like the taste. All athletes were enthusiastic about participating and all but two participants agreed to measure their blood lactate. Overall, this protocol for measuring anaerobic power and performance was successful, though modifying the CMJ procedure could eliminate some inconsistencies.

Supported by Bastyr student research funding

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MUSCLE PROTEIN METABOLISM EFFECTS OF ACUTE DIETARY INGESTION OF CHEDDAR CHEESE

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Dietary protein is fundamental to maintain muscle mass. Muscle protein synthesis transiently increases following protein ingestion; the magnitude and duration of which is dictated by the amino acid profile, type of protein, and protein digestion. No studies have evaluated the acute skeletal muscle protein response to cheese ingestion especially since it is rich in leucine content (~10%). **PURPOSE:** The purpose of this study was to determine the blood amino acid profile to the acute ingestion of cheddar cheese and how this responds to that of milk of the same protein amount. We hypothesized in healthy young male (n=12, 27 ± 4, 24.6 ± 3.8) and female (n=12, 26 ± 4, 21.9 ± 2.8) adults that a single dose of cheddar cheese, equivalent to 20g of protein, would acutely increase the blood branched-chain amino acids (particularly leucine) compared to baseline. Furthermore, we hypothesized that the blood branched-chain amino acid in response to cheese would demonstrate a similar response when compared to a single dose of an equivalent amount of protein in the form of 2% bovine milk. **METHODS:** We conducted a randomized cross-over clinical study in young men and women such that participants completed both nutrient product experiments within 1-4 weeks of each other. Blood samples were assessed in plasma for essential and non-essential amino acids before and repeatedly after nutrient ingestion (5h) following milk or cheese. **RESULTS/CONCLUSION:** We found that an acute ingestion of both cheddar cheese and milk (20g of protein) increased BCAA and NEAA plasma levels to a similar extent over a 5h period following ingestion in young healthy adults. Though milk demonstrated an acute peak response that was greater than cheese, cheddar cheese demonstrated a slow release of amino acids such that the total amino acid appearance over 5h was similar between the two products. Our next step is to evaluate the protein anabolic response in skeletal muscle following before and following the ingestion of these two protein-dense food products.

Support provided by Build Dairy and Glanbia Nutritionals

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THE IMPACT OF TEMPERATURE ON CRITICAL POWER DETERMINED BY A THREE MINUTE ALL-OUT TEST

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Critical Power (CP) separates the heavy and severe exercise domains, and work above CP (defined as W') results in an inexorable progression to maximal oxygen uptake and a rise in blood lactate concentration to fatigue. The thermoregulatory demands accompanying a rise in body core temperature (Tc) compounded with the cardiovascular challenges presented by maximal exercise in a hot environment may impact CP and W'. To date, no study has explored the effects of Tc and environmental temperature on CP and W'. **PURPOSE:** The purpose of this study is to determine the effect of high environmental and Tc on CP. **METHODS:** CP was estimated as end test power (average of the last 30 sec) from a series of three-min "all out" tests (3MT). Volunteers (n=5, 3F) performed a 3MT on a familiarization visit and two experimental study days (thermoneutral and hot) in a randomized crossover design. Prior to the 3MT in both experimental conditions, subjects were immersed in either thermoneutral (36°C for 30min) or hot (40.5°C) water until Tc was ≥ 38.5°C. All 3MT were performed in an environmental chamber controlling for both temperature and humidity (18°C and 45% RH; 38°C and 40% RH for hot). **RESULTS:** Although variable, CP (mean ± SE) was modestly reduced from thermoneutral (226 ± 25W) to hot (223 ± 30W). Total work (mean ± SE) performed was moderately reduced between thermoneutral (51 ± 6 kJ) and hot (47 ± 5) conditions. Peak Power (mean ± SE) was comparable between thermoneutral (737 ± 174W) and hot (736 ± 125). W' (mean ± SE) was reduced from thermoneutral (10 ± 1 kJ) to hot (7 ± 1). **CONCLUSION:** These preliminary data suggest that high Tc and environmental temperature appear to have a modest impact on CP as estimated by a 3-minute all-out test.

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STEPS TOWARDS EXERCISE IS MEDICINE ON CAMPUS: A POINT OF DECISION SIGNAGE STUDY

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Mixed evidence exists to support physical activity (PA) interventions on campus. Several strategies to promote PA demonstrate some initial promise, including point of decision stair use prompts (PODS) and Exercise is Medicine™ on Campus (EIMoC). More research is needed to evaluate their general effectiveness and message design on campus PA behavior. **PURPOSE:** To determine the effect of gain-framed PODS messaging and an EIMoC campaign on university stair use behavior. **METHODS:** Infrared sensors were installed in four buildings at a midsized Northwest University. Data was collected at baseline, during a PODS intervention, and PODS plus our EIMoC campaign. EIMoC consisted of a series of university-wide emails with gain-framed stair use messaging as well as numerous student-led EIMoC activities. Our control site received no PODS but was exposed to EIMoC. The PODS intervention was placed at all three treatment sites (health and wellness, student living, and workplace settings). The control site consisted of a combination of offices and classrooms. **RESULTS:** A generalized linear mixed model was used to analyze the random effects of building and treatments. Effect range variance estimates increased across all building and with the introduction of treatment conditions. Control site variance increased with exposure to EIMoC. Variance-Partitioning-Coefficients (VPC) suggest building accounted for 9% of the variance (Conditional R^2 = .097). Treatment VPC suggests that only 0.28% is accounted for by PODS and EIMoC. Day of the week explained a small amount of the variance (Marginal R^2 = .004) with less activity on weekends than weekdays. **CONCLUSION:** PODS and EIMoC using gain-framed messages were shown to have an effect on stair use PA behavior across campus settings. In general, buildings have substantial effect on the variance of stair use. EIMoC initiatives should consider using gain framed messages and multiple mediums to promote PA.

Supported by the ACSM NW Student Research Grant

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ALTERATIONS IN COLLEGIATE FEMALE SOCCER ATHLETE EXPLOSIVENESS FOLLOWING OFFSEASON TRAINING

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The new, increased training demands of collegiate sports produce greater injury rate and reduced physical performance for first-year collegiate athletes compared their non-first-year counterparts. Reactive Strength Index (RSI) is reportedly a measure of athletic "explosiveness" that is easily obtained from ground reaction force data and may provide insight into athlete performance and response to training. However, alterations in explosiveness for female, in particular first-year, athletes following offseason training is unknown. **PURPOSE:** To determine if first-year athletes exhibit similar alterations in athletic explosiveness (i.e., RSI) following off-season training as their non-first year counterparts. **METHODS:** Twenty-seven athletes (8 first-year) from an NCAA Division I women's soccer team performed five drop vertical jumps (DVJ) immediately prior to and following offseason training. For the DVJ, participants stepped off a 30 cm plyometric box, landed simultaneously on each limb, and then immediately performed a maximal vertical jump. During each DVJ, reactive strength index (RSI) was quantified by dividing the flight time of the maximal vertical jump by contraction time of the box landing (i.e., time from initial contact to takeoff). Participant-based RSI means were quantified and submitted to a two-way ANOVA to determine the main effect of and interaction between time (pre- vs post-training) and group (first-year vs non-first year), with alpha level 0.05. **RESULTS:** There was no significant time and group interaction (p = 0.300) or main effect of training (p=0.082, pre: 0.924±0.057 vs. post: 0.983±0.053) on RSI. But, first-year athletes exhibited a significantly lower RSI (p=0.043) compared to non-first year athletes (0.841±0.088 vs. 1.066±0.057). **CONCLUSION:** First-year athletes were approximately 24% less explosive than non-first year athletes. But, all female athletes exhibited a similar, non-significant (6%) increase in explosiveness following their off-season training.

DOCTORAL STUDENT PRESENTATIONS

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THE EFFECT OF PRE-CONDITIONING RESISTANCE EXERCISES ON VENTILATORY THRESHOLD AND VO_{2MAX}: A PILOT STUDY

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Research suggests that heavy resistance tasks (HRTs) potentiate skeletal muscle and increases power output during subsequent exercises, specifically during rapid, short duration movements such as countermovement jumps (CMJs) and sprinting. Few studies have demonstrated this potentiating effect in endurance sports (e.g., cycling and rowing), however, this phenomenon has not been investigated during endurance running. **PURPOSE:** To investigate the effects of pre-conditioning HRTs on ventilatory threshold 1 and 2 (VT1 and VT2) and maximal oxygen consumption (VO_{2max}) during a graded exercise test (GXT) to volitional exhaustion on a treadmill. METHODS: Three recreational distance runners (age 24.3 ± 5.5 y, body mass 70.4 ± 3.6 kg, height 178.6 ± 3.9 cm) performed 4 GXTs following 3 different HRTs (sled-pull, sled-push, Bulgarian split-squat) and 1 exercise control (no pre-conditioning task). VT1 (concomitant rise in V_E/VO_2 and $P_{ET}O_2$), VT2 (concomitant rise and fall in V_E/VCO_2 and $P_{ET}CO_2$, respectively), and VO_{2max} were measured using indirect calorimetry (Parvo Medics TrueOne 2400, Sandy, UT). Effect sizes (ES) and observed powers (OP; lower-bound) were calculated for VO_{2max}, time-to-exhaustion, and time at VT1 and VT2 following each pre-conditioning task using a repeated measures analysis of variance. **RESULTS:** Mean VO_{2max} values during the GXTs following the sled-push (SPs), sled-pull (SPu), split-squat (SS), and control (C) were 63.5 ± 7.9, 59.8 ± 8.4, 63.0 ± 6.5, 57.1 ± 10.2 $ml \cdot kg^{-1} \cdot min^{-1}$ (ES = 0.787, OP = 0.338), respectively. Mean time-to-exhaustion values were SPs: 15.1 ± 0.9, SPu: 15.2 ± 1.6, SS: 15.4 ± 1.3, and C: 14.5 ± 1.2 min (ES = 0.732, OP = 0.272). Mean times at VT1 were SPs: 10.3 ± 1.8, SPu: 9.9 ± 1.9, SS: 9.9 ± 1.7, and C: 9.3 ± 1.7 min (ES = 0.838, OP = 0.427). Mean times at VT2 were SPs 13.2 ± 1.6, SPu: 12.2 ± 2.2, SS: 12.9 ± 2.5, and C: 11.9 ± 2.1 min (ES = 0.630, OP = 0.195). **CONCLUSION:** VT has been correlated with the onset of blood lactate accumulation and may be associated with endurance performance. The results observed in this pilot study suggest that pre-conditioning HRTs may delay the onset of VT1 and VT2 during a treadmill GXT. Future research will incorporate a true performance measure (e.g., time trial), and a larger sample size to achieve adequate statistical power.

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WILDLAND FIREFIGHTERS' BODY COMPOSITION, MACRONUTRIENT AND MICRONUTRIENT INTAKE PRE AND POST WILDFIRE SEASON

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Wildland firefighters (WLFF) occupational demands are arduous requiring a combination of muscular strength and endurance activities for long durations in adverse environmental conditions. Previous data suggests WLFF body weight (BW) and fat mass (FM) significantly increase and lean soft tissue (LST) does not change as a result of a wildfire season. WLFF nutrient intake has been reported as 2700-4500 kcals/d during wildfire suppression, however micronutrient (micro) intake has yet to be described. **PURPOSE:** To examine body composition (BC), macronutrient (macro), and micro intake in WLFF pre and post wildfire season. **METHODS:** WLFF (N = 26) completed testing sessions pre and post season (June and October). Testing included anthropometrics, completion of a dual energy x-ray absorptiometry (DXA) scan (Hologic Horizon™; Marlborough, MA), and a Diet History Questionnaire (DHQ-111; previous 30 days). Body composition index (BCI= $(LST_{post}-LST_{pre})+(FM_{pre}-FM_{post})$) was calculated to evaluate BC changes. Statistical analyses were completed using SPSS Statistics 24 and data were reported as mean±SD. Paired t-tests were used to assess differences in BC and nutrient intake by time. Significance was accepted at $p<0.05$. **RESULTS:** Participants consisted of male (M; n=21) and female (F; n=5) WLFF (26±6 yrs) who averaged 33±21 days engaged in wildfire suppression. BCI was positive for both M (0.2±1.9) and F (1.7±2.5). No significant differences in BW, LST, or FM were observed for M or F. However, significant decreases in energy intake (-314±181kcals/d), protein (-25±31g and -0.3±0.4g/kg), and fat (-15±19g) were observed post season for M. WLFF were below the recommended daily allowance (RDA) for fiber (M:24±15 g; F:23±21 g),Vitamin E (M:14.2±8.5 mg; F:9.3±5.2 mg), and Vitamin D (M:7.4±4.9 mcg; F:2.8±1.1 mcg), and above the RDA for Sodium (M:4348.8±1682.5 mg; F:2461.4±1073.6 mg). Additionally, F were below the RDA for Calcium (930.8±762.5 mg) and Iron (11.9±8.6 mg). **CONCLUSION:** WLFF demonstrated no significant changes in BC over a wildfire season. Macro and micro intake fell below the RDA to support overall health pre and post season. Therefore, nutrition education is necessary to support optimal fueling strategies to meet the demands of wildfire suppression, as well as maintain overall health.

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METFORMIN-LEUCINE TREATMENT FOLLOWING DISUSE INCREASES MUSCLE SATELLITE CELLS AND REDUCES FIBROSIS IN AGED MICE

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The hospitalization of older adults is predicted to increase within the next 15 years. The aging population is growing, and the majority will deal with prolonged and incomplete muscle and strength recovery. An inability to fully regain lost muscle after inactivity drives the diminished response to rehabilitation and is accompanied by muscle fibrosis. **PURPOSE:** Thus, the purpose of this study was to investigate how combination therapy of metformin and leucine effects muscle recovery following disuse in aged mice. **METHODS:** Aged mice (22-24 mo) underwent 14 days of hindlimb unloading (HU) then 7 or 14 days of recovery. Age and weight-matched mice did not undergo HU and were used as ambulatory comparators (AMB). Mice assigned to each time point received either standard drinking water (control), water with metformin (MET), or water with metformin and leucine (MET+LEU) throughout the HU and recovery period. Hindlimb muscles were dissected, snap frozen, sectioned and stained for histological analysis. **RESULTS:** HU decreased gastrocnemius and soleus muscle mass and fiber cross sectional area in all groups vs. AMB ($P<0.05$). After 7 days of recovery gastrocnemius muscle mass of control mice was still decreased vs. AMB ($P=0.006$) while MET+LEU mice were not different vs. AMB ($P=0.085$). Following HU, MET+LEU mice had increased Pax7+ cells in gastrocnemius vs. control ($P=0.05$); after 7 days of recovery in soleus there were also increased Pax7+ cells ($P=0.019$) compared to control. Additionally, after 7 days of recovery gastrocnemius of MET+LEU mice had increased central nuclei compared to control ($P=0.015$). Lastly, after HU and throughout the recovery period, MET+LEU mice had increased collagen turnover (main effect $P<0.001$) and decreased total fibrosis vs. control (Tukey's post-hoc $P=0.033$). **CONCLUSION:** Metformin-leucine treatment improves recovery in aged mice following muscle disuse by promoting regenerative cells and decreasing fibrosis but does not affect fiber size.

Support provided by University of Utah Sports Medicine & Science Grant

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FEMALE'S POSTURAL STABILITY FOLLOWING A SIX WEEK OFF-SEASON TRAINING CYCLE IN DIVISION I COLLEGIATE SOCCER

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Female athletes have 4 to 6 times greater incidence of non-contact ACL injury than males. Decreased dynamic postural control, which reportedly results from acute neuromuscular fatigue, is purportedly a predictor for ACL injury and may contribute to female's injury rate. Injury rates tend to be higher later in prolonged training, yet, it is currently unknown if the cumulative fatigue of high intensity off-season training decreases dynamic postural control. **PURPOSE**: This study examined the effect of a six-week off-season training program on postural stability in female athletes, and whether stability differed between limbs. **METHODS**: 27 female NCAA Division I soccer players performed a series of forward single-leg hops immediately prior to and following their off-season training. Participants performed 5 successful single-leg hops with each limb, which required they stand a distance equal to their leg length from a force platform, before jumping over a 17 cm box and landing with either dominant (D) and non-dominant (ND) limb on the force platform. During landing time to stabilization (TTS) and dynamic postural stability index (DPSI) were calculated. TTS was the first instance that GRF was within 5 SD of baseline (average GRF for 0.5 sec of quiet standing) for 0.5 sec. DPSI was calculated from initial contact to time to stabilization. Limb asymmetry was calculated as symmetry angle between D and ND. A Two-Way ANOVA tested main effect and interaction of training and limb, while a paired T-Test compared limb asymmetry. **RESULTS**: Neither training, nor limb had a significant effect on TTS ($p=0.199$, $p=0.528$) or DPSI ($p=0.098$, $p=0.193$). Additionally, limb asymmetry was not significantly different for TTS ($p=0.830$) or DPSI ($p=0.291$) following training. **CONCLUSION**: Cumulative fatigue of high-intensity training did not significantly alter dynamic postural stability for female athletes. Rather, athletes exhibited an insignificant 5% improvement in time to stabilization after training, despite performing 10% worse on the dynamic postural stability index. D and ND limbs, however, exhibited directionally similar changes in dynamic postural stability following high-intensity off-season training. Additionally, athletes exhibited no significant asymmetry between limbs.

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GENDER DIFFERENCES IN BODY MASS SCALING OF METABOLIC RATE DURING SUBMAXIMAL STEADY-STATE MOTORIZED TREADMILL CLIMBING

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Avid rock climbers and the research literature commonly agree that body mass (M_B, kg) is the primary determinant of the energy cost of climbing. Given that gravitational resistance is the primary external force being worked against when climbing, it is presumed that the energy cost, as measured by steady-state oxygen uptake (VO_2, l/min), should be proportional to both *body mass* (M_B, kg) and the *total mass* of a climber and their gear (M_T, kg) – i.e., $VO_2 \alpha M_B^b \alpha M_T^b$, where *b* is the theoretical mass exponent value of +1.0. The research literature, however, has never formally addressed the issue of mass exponents for climbing energy expenditure. **PURPOSE:** To begin understanding the relationship between mass and steady-state climbing VO_2, this study determined M_B and M_T scaling exponents for energy cost during motorized treadmill climbing. It was hypothesized that both mass exponents would scale to the +1.0 power. **METHODS:** Data for 16 men and 4 women (Mean±SD: 25±4 yrs age; 22.7±1.5 kg/m^2 BMI) from a previously published study (Heil IJPEFS 2019) were used for these analyses. Each climber performed five mins of steady-state climbing at six combinations of "slow" and "fast" climbing speeds (4.6-9.1 m/min) across three treadmill grades: vertical (0°), overhang or negative incline (-5 to -10°), positive inclines (+5 to +10°). Steady-state VO_2 data collected with a portable indirect calorimetry system were analyzed using standard log-linear multiple regression analyses using treadmill speed and grade, a dummy-coded gender term, and either M_B or M_T as independent variables (α=0.05). Derived mass exponents were then compared to the theoretical value of +1.0 using 95% CIs. **RESULTS:** Without the gender term in the regression model, mass exponents for both M_B (*b*; 95%CI: 1.28; 1.11-1.45) and M_T (+1.32; 1.14-1.49) were significantly higher than +1.0 (model P<0.001; R^2 = 0.79). With the gender term, however, mass exponents for neither M_B (1.05; 0.85-1.25) nor M_T (1.09; 0.89-1.29) differed from +1.0 (model P<0.001; R^2 = 0.82). **CONCLUSION:** The mass exponents for both M_B and M_T did not differ from the theoretical +1.0 value attributed to gravitational resistance when accounting for gender. The reason for the need to include the gender term, however, is not clear and may be an artifact of the imbalance between men (n=16) and women (n=4) in this study.

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METFORMIN INGESTION PARTIALLY RESTORES AGE-RELATED IMPAIRMENT OF MYOGENIC POTENTIAL FROM MYOBLASTS ISOLATED FROM HUMAN DONORS

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Age-related impairments to myogenicity, or fusion potential, of myoblasts have negative implications for the ability of these cells to contribute to muscle repair after myofiber damage. This age-related deficit has been connected to impaired NAD biosynthesis; however RNA sequencing of muscle biopsies demonstrate insulin sensitizer Metformin, has the potential to alter NAD biosynthesis pathways. **PURPOSE:** Therefore, the purpose of this study was to determine if 2 weeks of Metformin ingestion improves the fusion potential of primary myoblasts isolated from muscle biopsies extracted from older adults and how this compares to young. **METHODS:** Muscle biopsies were extracted from young controls (<30yo; n=5) that did not receive metformin and from elderly subjects (60+yo; n=5) before and after 2 weeks of Metformin ingestion (2g/day). Primary myoblasts were isolated and expanded to passage 3 prior to experimentation. Cells were plated at equal densities between groups, and upon 95% confluence were differentiated in 2% serum for 8 days, in duplicate. Cells were stained for MyHC (MF20) and Nuclei (DAPI) and imaged at 10x magnification, in a 10x10 field of view mosaic (100 images), allowing for the capture of 10-20,000 nuclei per assessment. Co-occurrence of DAPI and MF20 were determined using the BioVoxxel Toolbox and Particle Analyzer (Image J) plugins. Fusion index was determined as [#DAPI co-occurring with MF20]/[Total #DAPI]*100. **RESULTS:** Fusion index of elderly subjects (27% ± 13SD) was significantly less (One Way ANOVA, P = 0.015, Old Pre vs Young: P=0.012, Tukey's) than that of young subjects (61% ± 20SD), however Metformin partially rejuvenated this response (46% ± 9SD; Old Post vs Young: P=0.3, Tukey's). **CONCLUSION:** The ability of Metformin to improve myogenicity of aged myoblasts provides valuable information on the "anti-aging" therapeutic effects of Metformin, as well as implications for regenerative medicine in geriatric populations.

Supported by ADA #1-19-ICTS-107 & by NIH Ruth L. Kirschstein NRSA 1T32HL139451.

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ELECTROLYTE BALANCE AND HYDRATION STATUS DURING WILDLAND FIRE SUPPRESSION

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Our laboratory has previously demonstrated the total energy fluid demands of wildland firefighters (WLFF) during arduous fire suppression. However, it remains unclear how current hydration strategies, occupational activity, and fire line provisions may alter overall hydration and electrolyte balance. **PURPOSE:** To determine WLFF fluid retention and urine production as influenced by environmental conditions, self-selected hydration practices, and work output during fire suppressions shifts. **METHODS:** 59 WLFF (9 female, 50 male; 29±6 yr) from various crew types were deployed to fire incidents across the United States during the 2019 fire season and were observed throughout a single work shift. Before and after shifts, a measure of nude body weight was obtained. In a subset of subjects (n=25), pre and post-shift blood samples were also drawn to evaluate serum electrolytes. Fireline-certified researchers monitored fluid intake and urine output parameters (frequency, specific gravity [USG], volume) in real-time via observational data capture using graduated cylinder, refractometer, and mobile tablets. Dependent t-tests were performed for all comparative analyses and statistical significance was established at $p<0.05$. **RESULTS:** WLFF worked shifts of 13.9±1.1 hr, during which 4.7±1.6 L of water was consumed. WLFF eliminated 2.3±1.1 L via 5.7±2.7 voids (412±192 $mL \cdot void^{-1}$). There were no noted differences in USG from morning voids compared to those measured post meridiem (1.0106±0.0147 and 1.0106±0.0187 for AM and PM USG, respectively; $p>0.05$). No changes in nude body weight were observed across the work shift (80±13.4 and 79.8±13.2 kg for pre- and post-shift, respectively; $p>0.05$). Serum sodium and potassium did not change between pre- and post-shift blood draws (pre = 142±2 and 4.3±0.3, post = 141±2 and 4.2±0.3 mmol/L, respectively; $p>0.05$). **CONCLUSION:** These results demonstrate adequate fireline electrolyte provisions and currently employed WLFF hydration strategies. Moreover, the uniformity of pre- and post-shift measures (body weight, serum electrolytes) demonstrates that USG alone is not adequately indicative of hydration status during extended occupational stress.

Supported by National Technology & Development Program, USDA Forest Service

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THE ENERGY COST OF SUCCESSIVE MATCH PLAY EVENTS FOR THE SINGAPOREAN MEN'S WALKING FOOTBALL TEAM

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Competitive walking football, an international sport that is less than 10 years old, has great potential to help address the international problems of sedentarism and obesity as a unique form of team-based competitive exercise. While recent research has documented the energy cost of women engaged in match play walking football (Heil et al. IJPEFS 2017), no such data yet exists for men's teams. **PURPOSE:** This study sought to characterize the metabolic intensity of match play walking football for one men's team during successive matches at the 2019 International Walking Football Federation World Cup competition. It was hypothesized that metabolic intensity (i.e., metabolic equivalents, or METs) during match play would meet or exceed the established thresholds for improving physical health and disease risk (≥3.0 METs). **METHODS:** The Singaporean men's team (Mean±SD: 58±6 yrs age; 26.6±5.4 kg/m^2 BMI; n=9) was monitored during a semi-structured warm-up (WU) and then during 7 successive 15-min competitive matches (M1-M7), all of which happened during a single day. All matches were played at the Leyton Orient outdoor football stadium (East London, England) that was split into four regulation mid-sized fields (40 m x 20 m) under warm and mildly humid ambient conditions (79-81° F; 38-43%). Predicted METs were derived from accelerometry-based activity monitors (AM) that were worn by each player within a neoprene waist pack. The AM data were later downloaded, transformed to units of energy expenditure, and then converted to METs using standard algorithms. A one-sample t-test was used to compare each mean predicted MET value (WU + M1-M7) to the 3.0 MET threshold and a Bonferroni corrected alpha of 0.006 (0.05 overall alpha). **RESULTS:** Average MET values for the WU (Mean±SE: 4.3±0.06 METs), as well as all seven matches (M1: 4.3±0.09, M2: 4.1±0.07, M3: 4.2±0.09, M4: 4.4±0.10, M5: 3.9±0.12, M6: 3.9±0.14, M7: 4.1±0.10 METs, respectively) exceeded the 3.0 MET threshold ($P<0.001$). **CONCLUSION:** The results of this study support previous research with women's walking football that the metabolic intensity of competitive walking football typically meets or exceeds the 3.0 MET threshold for promoting positive changes in both metabolic fitness and cardiovascular health risk.

Support provided by Edith Cowen University to the lead author.

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THE EFFECTS OF PLYOMETRIC TRAINING ON MUSCLE ACTIVATION CHARACTERISTICS IN POST-PUBESCENT ADOLESCENT FEMALES

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Previous research has demonstrated that females are at an increased risk for anterior cruciate ligament (ACL) injury. One modifiable risk factor proposed is neuromuscular control. Coactivation of the quadriceps and hamstrings is suggested to be a favorable movement strategy, thereby, reducing the risk of ACL injury. **PURPOSE:** To determine how a 6-week plyometric training intervention may influence muscle activation onset, duration, and time to peak activation in the right (R) and left (L) vastus lateralis (VL), vastus medialis (VM), biceps femoris (BF) and semitendinosus (SEM), during a jump-landing task in post-pubescent adolescent females. **METHODS:** Electromyography was used to record onset, duration, and time to peak muscle activation of the right and left limbs during a jump-landing task, prior to and following a 6-week plyometric training intervention in 19 post-pubescent adolescent females. Repeated-measures ANOVAs were used to identify if significant differences in activation characteristics. **RESULTS:** Following a six-week plyometric training intervention, participants demonstrated decreased time to peak activation. Time to peak activation was approximately 0.55 ms earlier in the RSEM than in the RVL (2.67±.691, p = .017), 0.39 ms earlier in the RBF than in the RVM (2.81±.770, p = .049), .053 ms earlier in the RSEM than in the RVM (2.67±.691, p = .029), 0.85 ms earlier in the LBF than in the LVL (2.69±.942, p = .006), 0.89 ms earlier in the LSEM than in the LVL (2.40+1.08, p = .019), and 1.03 ms earlier in the LBF than in the LVM (2.69±.942, p = .006). **CONCLUSION:** Following plyometric training, participants exhibited a shortened time to peak activation of the hamstrings, an antagonist, generally responsible for terminal deceleration. The noticeable reduction in time to peak activation as seen in the hamstrings following plyometric training, is indicative of a modified recruitment pattern and likely a result of the prescribed neuromuscular training.

PRESIDENTS CUP POSTER SESSION
FRIDAY, FEBRUARY 28TH 5:00-7:30 PM, JORDAN AB, JORDAN C

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THE EFFECT OF PRE-CONDITIONING RESISTANCE EXERCISES ON VENTILATORY THRESHOLD AND VO_{2MAX}: A PILOT STUDY

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Research suggests that heavy resistance tasks (HRTs) potentiate skeletal muscle and increases power output during subsequent exercises, specifically during rapid, short duration movements such as countermovement jumps (CMJs) and sprinting. Few studies have demonstrated this potentiating effect in endurance sports (e.g., cycling and rowing), however, this phenomenon has not been investigated during endurance running. **PURPOSE:** To investigate the effects of pre-conditioning HRTs on ventilatory threshold 1 and 2 (VT1 and VT2) and maximal oxygen consumption (VO_{2max}) during a graded exercise test (GXT) to volitional exhaustion on a treadmill. **METHODS:** Three recreational distance runners (age 24.3 ± 5.5 y, body mass 70.4 ± 3.6 kg, height 178.6 ± 3.9 cm) performed 4 GXTs following 3 different HRTs (sled-pull, sled-push, Bulgarian split-squat) and 1 exercise control (no pre-conditioning task). VT1 (concomitant rise in V_E/VO_2 and $P_{ET}O_2$), VT2 (concomitant rise and fall in V_E/VCO_2 and $P_{ET}CO_2$, respectively), and VO_{2max} were measured using indirect calorimetry (Parvo Medics TrueOne 2400, Sandy, UT). Effect sizes (ES) and observed powers (OP; lower-bound) were calculated for VO_{2max}, time-to-exhaustion, and time at VT1 and VT2 following each pre-conditioning task using a repeated measures analysis of variance. **RESULTS:** Mean VO_{2max} values during the GXTs following the sled-push (SPs), sled-pull (SPu), split-squat (SS), and control (C) were 63.5 ± 7.9, 59.8 ± 8.4, 63.0 ± 6.5, 57.1 ± 10.2 $ml \cdot kg^{-1} \cdot min^{-1}$ (ES = 0.787, OP = 0.338), respectively. Mean time-to-exhaustion values were SPs: 15.1 ± 0.9, SPu: 15.2 ± 1.6, SS: 15.4 ± 1.3, and C: 14.5 ± 1.2 min (ES = 0.732, OP = 0.272). Mean times at VT1 were SPs: 10.3 ± 1.8, SPu: 9.9 ± 1.9, SS: 9.9 ± 1.7, and C: 9.3 ± 1.7 min (ES = 0.838, OP = 0.427). Mean times at VT2 were SPs 13.2 ± 1.6, SPu: 12.2 ± 2.2, SS: 12.9 ± 2.5, and C: 11.9 ± 2.1 min (ES = 0.630, OP = 0.195). **CONCLUSION:** VT has been correlated with the onset of blood lactate accumulation and may be associated with endurance performance. The results observed in this pilot study suggest that pre-conditioning HRTs may delay the onset of VT1 and VT2 during a treadmill GXT. Future research will incorporate a true performance measure (e.g., time trial), and a larger sample size to achieve adequate statistical power.

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EFFECT OF STATIC HIP FLEXOR STRETCHING ON STANDING PELVIC TILT AND LUMBAR LORDOSIS

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Pain and dysfunction of the lumbar spine has been shown to be related to excessive lumbar lordosis, especially during upright positions like standing. In particular, anterior pelvic tilt has been associated with increased lordosis and posterior pelvic tilt related to reduced lordosis. **PURPOSE:** To determine if an acute bout of static stretching of anterior hip muscles can produce a measurable change in sagittal pelvic and lumbar position during actively aligned standing. **METHODS:** Following completion of consent form and a brief survey to quantify participant habitual stretching habits, participants performed a moderate warm-up on a stationary bike. Reflective markers were placed on the skin/clothing on the right side of the participant by palpation of the posterior and anterior superior iliac spines (PSIS & ASIS respectively), greater trochanter of the femur, and three along the spinous processes; T7, T12, L4 vertebrae. Pelvic and lumbar position were assessed while the participant stood in an actively-aligned body position with their arms overhead being asked to 'stand as straight and tall as possible'. Experimental intervention involved participants stretching in a half-kneeling lunge position, commonly used to stretch the anterior hip musculature, performed for 30 sec each leg for three repetitions bilaterally. A single photograph of the standing position, pre and post-acute stretch, recorded pelvic and lumbar position to determine if a change in position occurred. From the photographs, 2D coordinate locations of the reflective markers were determined using the software IC Measure. **RESULTS:** Following stretching, participants significantly decreased lumbar lordosis ($t = 3.72$, $p < 0.05$) between pre and post stretch angles of the Perry lumbar (LUM_P) landmarks (L4, ASIS, and greater trochanter). The Crowel pelvic tilt landmarks (PSIS, ASIS, & horizontal line through ASIS) and McNeal lumbar lordosis landmarks (T7, T12, L4, & PSIS) were not significantly changed. **CONCLUSION:** Participants were able to significantly decrease the LUM_P angle, reducing lumbar lordosis from an acute bought of stretching. The information from this study suggests that individuals with excessive or undesirable lordosis while standing could benefit acutely from a bout of static stretching of the anterior hip musculature.

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MUSCLE SORENESS AND DAMAGE DURING WILDLAND FIREFIGHTER CRITICAL TRAINING

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Wildland firefighters (WLFF) undergo a critical training (CT) period immediately prior to the firefighting season. The intensive nature of preparatory CT exercise regimen could lead to muscle damage, as previously reported cases of rhabdomyolysis in WLFF have been documented. **PURPOSE:** To establish the effects of a two-week critical training period on acute markers of muscle damage in WLFF. **METHODS**: Eighteen male (29.4±1.1 years, 182.1±1.6 cm) and three female (26.7±2.6 years, 169.5±4.2 cm) Type I Interagency Hotshot (IHC) WLFF were studied during a 13-day critical training period. Daily body weight (BW), upper body (US), and lower body (LS) muscle soreness scales were collected. Venous blood was collected from the antecubital region on Days 1, 4, 8, and 11 to measure creatine kinase (CK) and lactate dehydrogenase (LDH). Skin fold measurements were taken on Day 1 and Day 11 to calculate body fat (BF). Fitness was assessed by the BLM fitness challenge (pushups, pullups, situps, 1.5-mile run). One-way repeated measures ANOVA were used to analyze CK, LDH, US, and LS. Paired samples t-tests were used to identify differences in BW and BF. Data presented as mean±SEM. **RESULTS**: No differences in body weight were observed between Day 1 and 11 ($p=0.065$). BF significantly decreased from Day 1 and 11 (15.3±1.4% vs. 14.1±1.3%, $p=0.002$). US and LS showed a main effect of time, elevated from baseline for subsequent days, with a peak on Day 3 (US: 3.8±0.5 cm, $p<0.001$; LS: 4.3±0.3 cm, $p<0.001$). CK showed a significant effect of time, elevated from baseline, with a peak on Day 4 (73.4±14.4 $U \cdot L^{-1}$ vs. 132.8±15.4 $U \cdot L^{-1}$, $p=0.001$). LDH showed a significant effect of time, where Day 11 significantly increased from Day 1 (159.4±5.5 $IU \cdot L^{-1}$ vs.164.4±6.9 $IU \cdot L^{-1}$, $p=0.04$). Fitness was negatively correlated with the change in muscle soreness from baseline to peak ($r=-0.72$, $p=0.013$). **CONCLUSION:** These data suggest that WLFF undergo significant physiological stressors that result in muscle soreness and damage during CT. Fitness appears to attenuate the soreness induced by CT. Careful preparation and monitoring of the training stimulus is key to avoid clinical ramifications.

Funded by the USFS 16-CR-11138200-005

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MUSCLE PROTEIN METABOLISM EFFECTS OF ACUTE DIETARY INGESTION OF CHEDDAR CHEESE

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Dietary protein is fundamental to maintain muscle mass. Muscle protein synthesis transiently increases following protein ingestion; the magnitude and duration of which is dictated by the amino acid profile, type of protein, and protein digestion. No studies have evaluated the acute skeletal muscle protein response to cheese ingestion especially since it is rich in leucine content (~10%). **PURPOSE:** The purpose of this study was to determine the blood amino acid profile to the acute ingestion of cheddar cheese and how this responds to that of milk of the same protein amount. We hypothesized in healthy young male (n=12, 27 ± 4, 24.6 ± 3.8) and female (n=12, 26 ± 4, 21.9 ± 2.8) adults that a single dose of cheddar cheese, equivalent to 20g of protein, would acutely increase the blood branched-chain amino acids (particularly leucine) compared to baseline. Furthermore, we hypothesized that the blood branched-chain amino acid in response to cheese would demonstrate a similar response when compared to a single dose of an equivalent amount of protein in the form of 2% bovine milk. **METHODS:** We conducted a randomized cross-over clinical study in young men and women such that participants completed both nutrient product experiments within 1-4 weeks of each other. Blood samples were assessed in plasma for essential and non-essential amino acids before and repeatedly after nutrient ingestion (5h) following milk or cheese. **RESULTS/CONCLUSION:** We found that an acute ingestion of both cheddar cheese and milk (20g of protein) increased BCAA and NEAA plasma levels to a similar extent over a 5h period following ingestion in young healthy adults. Though milk demonstrated an acute peak response that was greater than cheese, cheddar cheese demonstrated a slow release of amino acids such that the total amino acid appearance over 5h was similar between the two products. Our next step is to evaluate the protein anabolic response in skeletal muscle following before and following the ingestion of these two protein-dense food products.

Support provided by Build Dairy and Glanbia Nutritionals

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MEASURES OF COMPETENCY OVER SIX-WEEKS OF TRAINING: DOES IT PAY TO COMMIT TO HIIT?

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The appropriateness of high-intensity interval training (HIIT) for inactive individuals has been questioned due to its challenging nature and potential low adherence. Yet, little is known about changes in measures of competency across a period of training which may be related to long-term adherence. **PURPOSE:** To determine the effect of 6 weeks of HIIT and moderate-intensity continuous training (MICT) on measures of psychological and physiological competence. **METHODS:** Physically inactive young adults (n=11; 21.5±1.9 years) were randomized to the HIIT or MICT training group. Before and after the intervention, all participants completed an incremental exercise test on a cycle ergometer. Participants completed a total of 18 training sessions over 6 weeks, with the first 3 weeks of training supervised and the latter 3 unsupervised. Perceived competence, autonomy, and self-efficacy were measured after the first, ninth, and eighteenth training sessions. Differences were analyzed using 2 (group) x 3 (time) repeated measures ANOVAs for psychological variables and 2 (group) x 2 (time) repeated measures ANOVAs for physiological variables. **RESULTS:** Adherence to the intervention was good (HIIT: 99%; MICT: 100%). There were no significant differences in perceived competence (p=0.13), autonomy (p=0.22), or self-efficacy (p=0.99) due to time. However, MICT (96.5±4.3) had significantly higher self-efficacy scores than HIIT (84.0±3.2; p=0.04). There were no group differences in competence (p=0.13) or autonomy (p=0.36). Peak oxygen uptake (p<0.01) and peak power output (Pre: 225.1±20.7 watts; Post: 239.4±27.4 watts; p<0.0001) improved significantly across the training intervention with no differences between groups (p>0.05). **CONCLUSION:** Physiological measures of competency improved across the intervention irrespective of training group; although, there were no differences in psychological competency due to time. Our findings suggest that both HIIT and MICT may improve physiological competency over 6 weeks in previously inactive, young adults. However, psychological competency may change at a different rate and could be more sensitive to training intensity. Future research may be important to determine the effects of prolonged training on measures of psychological competency in inactive individuals.

Supported by an ACSM Northwest Student Research Award

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PROTOCOL FOR TESTING BEETROOT JUICE ON ANAEROBIC POWER AND PERFORMANCE

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The nitrates found in beetroot juice (BR) are known to be a precursor of nitric oxide (NO). NO is a known vasodilator which allows more oxygen to travel in the blood and may improve muscle efficiency. **PURPOSE:** This study aims to set up a testing protocol to evaluate the effects of beetroot juice on anaerobic power and performance in trained CrossFit athletes. **METHODS:** The protocol was a randomized, cross-over, double-blind, placebo-controlled design to measure 500-meter row time, countermovement jump (CMJ), and blood lactate levels before and after the row. Participants consumed either 2.7 oz shot of BR (6.5 mmol nitrate) or a placebo nitrate-free beetroot juice (PL). Two hours later, they rowed 500 meters at maximum capacity. Measurements of blood lactate and the highest of 3 CMJs were recorded before and after the row. After a 7-day washout period, athletes repeated this sequence with either BR or PL for comparison. This study was performed in Fall 2019 at Mercer Island CrossFit with athletes who had at least six months CrossFit experience and were very familiar with the Concept 2 Rower. **RESULTS:** Twenty five athletes over age 18 (18 females, age range 25 to 60, average age 44) participated. The range of 500-meter row time was 1:28.8 – 2:26.4 (1:50.9 median). Blood lactate ranged from 0.8 to 5.6 (1.6) mmol before the row and 5.0 to 21.2 (10.2) mmol post row. Net CMJ ranged from 7.5 to 23.9 (11.9) inches pre row to 7.6 to 19.8 (11.4) inches post row. The median of the CMJ remained fairly stable pre and post row as not all athletes experienced muscle fatigue after the row. **CONCLUSION:** There were some inconsistencies in the measurement of the CMJ as athletes used chalk on their fingers to mark the spot on the wall next to a ruler. Most athletes tolerated the BR, though some had GI distress and others did not like the taste. All athletes were enthusiastic about participating and all but two participants agreed to measure their blood lactate. Overall this protocol for measuring anaerobic power and performance was successful, though modifying the CMJ procedure could eliminate some inconsistencies.

Supported by Bastyr student research funding

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METABOLIC AND CARDIOVASCULAR ALTERATIONS DURING CRITICAL TRAINING IN WILDLAND FIREFIGHTERS

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Wildland firefighters (WLFF) are confronted with numerous physical and mental stressors. Pre-fire season includes an intense 2-week critical training (CT) period; a preparatory phase that can result in injury, illness, and rhabdomyolysis. **PURPOSE:** To identify physiologic changes in metabolic biomarkers that occur during 2 weeks of CT in WLFF. **METHODS:** Eighteen male (29.4±1.1 yr, 182.1±1.6 cm) and three female (26.7±2.6 yr, 169.5±4.2 cm) participants were recruited from a Type I interagency hotshot fire crew and monitored over their 2-week CT. Fitness was assessed via BLM Fitness Challenge (push-ups, pull-ups, sit-ups, 1.5 mi run). Subjects were asked to fast and abstain from caffeine for blood draws on days 1, 4, 8, and 11. Plasma was analyzed for changes in the metabolic profile and oxidative stress markers 3-Nitrotyrosine (3NT), 8-Isoprostane (8ISO), and Lipid Hydroperoxides (LOOH). A one-way repeated measures ANOVA was used to analyze 8ISO, 3NT, and LOOH. Paired samples t-tests were used to compare metabolic biomarkers. Data presented as mean±SEM. **RESULTS:** CT elicited a decrease in total cholesterol (TC) (173.6±12.1 to 153.4±8.6 $mg \cdot dL^{-1}$, p=0.01), hemoglobin A1c (5.2±0.1 to 5.1±0.1 %, p=0.003), hemoglobin (15.5±0.4 to 14.3±0.3 $g \cdot dL^{-1}$, p=0.003), and estimated plasma volume (53.8±0.7 to 50.7±1.4 %, p=0.005) from day 1 to 11. No difference was observed in high-density lipoprotein cholesterol. A main effect for time was observed in 8ISO (p<0.001), 3NT (p=0.033), and LOOH (p=0.001). A significant decrease was observed in 8-ISO at day 4 and 8 when compared to day 1 (day 1: 15.5±1.3, d4: 11.8±1.0, d 8: 12.9±1.1 $pg \cdot mL^{-1}$). 3NT was significantly elevated from day 4 to day 8 (d4: 2.4±0.6, d8: 2.9±0.6 $mg \cdot mL^{-1}$). LOOH showed a significant increase across all days (d1: 2.2±0.4, d4: 2.8±0.5, d8: 3.4±0.5, d11: 4.0±0.6 mM). Fitness was significantly correlated with DTC (r=0.58, p=0.046) and D8ISO (r=0.60, p=0.050). **CONCLUSION:** These data suggest the exertion required of WLFF during CT results in positive alterations to the metabolic profile. The changes in oxidative stress markers may reflect rapid adaptation to the CT stressors. These data suggest that WLFF are able to adapt quickly to the physical stress of CT, where fitness may be a protector of metabolic perturbations.

Funded by the US Forest Service 16-CR-11138200-005.

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THE IMPACT OF TEMPERATURE ON CRITICAL POWER DETERMINED BY A THREE MINUTE ALL-OUT TEST

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Critical Power (CP) separates the heavy and severe exercise domains, and work above CP (defined as W') results in an inexorable progression to maximal oxygen uptake and a rise in blood lactate concentration to fatigue. The thermoregulatory demands accompanying a rise in body core temperature (Tc) compounded with the cardiovascular challenges presented by maximal exercise in a hot environment may impact CP and W'. To date, no study has explored the effects of Tc and environmental temperature on CP and W'. **PURPOSE:** The purpose of this study is to determine the effect of high environmental and Tc on CP. **METHODS:** CP was estimated as end test power (average of the last 30 sec) from a series of three-min "all out" tests (3MT). Volunteers (n=5, 3F) performed a 3MT on a familiarization visit and two experimental study days (thermoneutral and hot) in a randomized crossover design. Prior to the 3MT in both experimental conditions, subjects were immersed in either thermoneutral (36°C for 30min) or hot (40.5°C) water until Tc was ≥ 38.5°C. All 3MT were performed in an environmental chamber controlling for both temperature and humidity (18°C and 45% RH; 38°C and 40% RH for hot). **RESULTS:** Although variable, CP (mean ± SE) was modestly reduced from thermoneutral (226 ± 25W) to hot (223 ± 30W). Total work (mean ± SE) performed was moderately reduced between thermoneutral (51 ± 6 kJ) and hot (47 ± 5) conditions. Peak Power (mean ± SE) was comparable between thermoneutral (737 ± 174W) and hot (736 ± 125). W' (mean ± SE) was reduced from thermoneutral (10 ± 1 kJ) to hot (7 ± 1). **CONCLUSION:** These preliminary data suggest that high Tc and environmental temperature appear to have a modest impact on CP as estimated by a 3-minute all-out test.

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SEX DIFFERENCES IN THE HEMODYNAMIC RESPONSE TO ACUTE PASSIVE HEAT EXPOSURE

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Increased conduit vessel shear stress acutely improves vascular function in a dose-dependent manner and potentiates many of the beneficial vascular adaptations that accompany chronic heat therapy. However, physical and physiologic differences exist between sexes which influence thermoregulation and may alter the adaptive shear stimulus accompanying a single bout of passive heat stress. **PURPOSE:** To compare the hemodynamic response to acute passive heat exposure (APHE) between sexes. **METHODS:** 10 women (W) and 11 men (M) completed a one-hour APHE session immersed to the level of the sternum in 40°C water. Rectal temperature (T_{re}), mean arterial pressure (MAP), and brachial artery hemodynamics (ultrasound) were measured at baseline (seated rest before APHE) and every 15 min throughout APHE. Subject characteristics were compared using unpaired t-tests. A 2 X 5 mixed model ANOVA was used to compare T_{re}, MAP, and brachial hemodynamics across time and between sexes. **RESULTS:** Both body mass (W: 62.9 ± 8.1 kg, M: 74.2 ± 5.1 kg, $P < 0.01$) and body surface area (W: 1.71 ± 0.14 m^2, M: 1.93 ± 0.10 m^2, $P < 0.001$) were lower in W compared to M. W had a higher T_{re} than M ($P < 0.05$) at baseline (W: 37.5 ± 0.1°C, M: 37.2 ± 0.1°C) and after 60 min APHE (W: 38.7 ± 0.03°C, M: 38.5 ± 0.1°C). W had a lower MAP than M ($P < 0.05$) at baseline (W: 85 ± 2 mmHg, M: 88 ± 2 mmHg) and throughout APHE (W: 74 ± 2 mmHg, M: 82 ± 3 mmHg at 60 min APHE). W and M had a similar baseline brachial shear rate (W: 170 ± 30 1/s, M: 105 ± 19 1/s). Brachial shear rate was elevated to a greater extent in W than M during APHE ($P < 0.01$), reaching 651 ± 49 1/s and 396 ± 24 1/s at 60 min APHE, respectively. The sex difference in brachial shear response to APHE was the result of a greater increase in brachial velocity seen in W (+47 ± 6 cm/s) compared to M (+35 ± 4 cm/s) with APHE ($P < 0.1$). This elevated brachial velocity allowed for a similar increase in brachial blood flow between sexes with APHE (W: +339 ± 53 mL/min, M: +369 ± 37 mL/min) despite the smaller brachial diameter in W compared to M ($P < 0.0001$) at baseline (W: 0.31 ± 0.01 cm, M: 0.41 ± 0.01 cm) and throughout APHE (W: 0.37 ± 0.01 cm, M: 0.46 ± 0.01 cm at 60 min APHE). **CONCLUSION:** These data indicate the presence of a sex difference in the hemodynamic response to a single bout of passive heat stress and may have implications for sex-specific vascular adaption accompanying chronic heat therapy.

Supported by APS Porter Pre-Doctoral Fellowship

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STEPS TOWARDS EXERCISE IS MEDICINE ON CAMPUS: A POINT OF DECISION SIGNAGE STUDY

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Mixed evidence exists to support physical activity (PA) interventions on campus. Several strategies to promote PA demonstrate some initial promise, including point of decision stair use prompts (PODS) and Exercise is Medicine™ on Campus (EIMoC). More research is needed to evaluate their general effectiveness and message design on campus PA behavior. **PURPOSE:** To determine the effect of gain-framed PODS messaging and an EIMoC campaign on university stair use behavior. **METHODS:** Infrared sensors were installed in four buildings at a midsized Northwest University. Data was collected at baseline, during a PODS intervention, and PODS plus our EIMoC campaign. EIMoC consisted of a series of university-wide emails with gain-framed stair use messaging as well as numerous student-led EIMoC activities. Our control site received no PODS but was exposed to EIMoC. The PODS intervention was placed at all three treatment sites (health and wellness, student living, and workplace settings). The control site consisted of a combination of offices and classrooms. **RESULTS:** A generalized linear mixed model was used to analyze the random effects of building and treatments. Effect range variance estimates increased across all building and with the introduction of treatment conditions. Control site variance increased with exposure to EIMoC. Variance-Partitioning-Coefficients (VPC) suggest building accounted for 9% of the variance (Conditional $R^2 = .097$). Treatment VPC suggests that only 0.28% is accounted for by PODS and EIMoC. Day of the week explained a small amount of the variance (Marginal $R^2 = .004$) with less activity on weekends than weekdays. **CONCLUSION:** PODS and EIMoC using gain-framed messages were shown to have an effect on stair use PA behavior across campus settings. In general, buildings have substantial effect on the variance of stair use. EIMoC initiatives should consider using gain framed messages and multiple mediums to promote PA.

Supported by the ACSM NW Student Research Grant

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RELATIONSHIP BETWEEN FUNCTIONAL HOP PERFORMANCE AND QUADRICEPS RATE OF TORQUE DEVELOPMENT IN ACL RECONSTRUCTED FEMALES

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Greater quadriceps rate of torque development (RTD) is associated with sagittal-plane landing strategies that are consistent with lesser ACL injury risk. While it is recommended to include quadriceps RTD in return to play testing, the necessary equipment is inaccessible to many clinicians. Therefore, quantifying absolute performance (AP) in a single-leg triple hop (SLTH) that requires the quadriceps to both control landing and to propel the body forward could provide an accessible measure for quadriceps RTD. **PURPOSE:** To determine the relationship between SLTH AP and quadriceps RTD from 0-100ms and 0-200ms. **METHODS:** Nineteen physically active females who have undergone ACLR (Age: 19.2 ± 1.8 years, Height: 164.1 ± 7.0 cm, Mass: 63.8 ± 7.6 kg) were included. RTD was calculated from isometric torque-time curves averaged over three trials of the ACLR limb by fitting a line of best fit through 100ms and 200ms after onset and normalized to body mass. AP for the SLTH was quantified by taking the average distance traveled across three trials and normalized to body height. Relationships between AP and RTD were assessed via Pearson correlation coefficients ($\alpha \leq 0.05$). **RESULTS:** Means and standard deviations for AP and RTD are included in Table 1. No significant relationships were identified between AP and RTD (Table 1). **CONCLUSION:** While a requisite level of quadriceps strength is needed to perform a SLTH, these results suggest that AP is not indicative of improvements in quadriceps RTD. Because RTD is influenced by the intent to move fast, the lack of relationship could be explained by the nature of the task. A SLTH is measured by distance traveled with no instruction on the intent to move fast. Additionally, compensatory propulsion strategies through the hip or ankle can also influence AP. Therefore, future research should assess multi-joint propulsion strategies and whether functional hop tasks that are measured by time-to-completion and that instruct the individual to move quickly (i.e. 6-m hop for time) are associated with RTD.

Supported by the NATA Research and Education Foundation Doctoral Grant

Table 1. Correlations for Single-Leg Triple Hop Performance and Quadriceps Rate of Torque Development

		Single-Leg Triple Hop AP 2.14±0.37 body heights	
Criterion Variable	Mean±SD	*r*	*p-value*
0-100ms RTD (N·m/s/kg)	7.94±3.62	*r* = 0.309	0.198
0-200ms RTD (N·m/s/kg)	7.14±2.38	*r* = 0.187	0.442

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RISING FROM A SUPINE POSITION AFFECTS PHYSICAL FUNCTION IN OLDER ADULTS

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Rising from supine to an upright position has the potential to evoke dizziness, and thereby presents a risk of falling. Surprisingly, little evidence is available to characterize the functional consequences of rising from a supine position. The Timed Up-and-Go (TUG) test is commonly used to describe the risk of falling in older adults. Recently, we have established that the percentage of time spent in the active propulsion (APT) phase of the gait cycle is inversely associated with history of falls. **PURPOSE:** To determine the reliability of TUG time and APT following supine and seated rest, and to assess the main effect of position on TUG time and APT. **METHODS:** 40 older adults (age=73.5±1.0 yrs, height = 165.8±7.9 cm, weight = 74.0±16.2 kg) completed the TUG after at least 10mins of seated and supine rest on two separate days, one week apart. The order of the conditions was randomized. TUG time to completion was recorded and gait data were collected using a force-plate embedded walkway. APT was derived as the proportion of the gait cycle when center of gravity exceeded the base of support in single limb stance to contralateral heel contact. Intraclass correlations (comparing day 1 to day 2 values) were used to determine the reliability of our measures. The main effect of resting condition (seated v. supine) was tested by applying repeated measures ANOVA to day 1 observations. **RESULTS:** ICC of TUG time after seated rest was 0.91, $p<0.001$, and after supine rest was 0.95, $p<0.001$. ICC of APT after seated rest was 0.74, $p<0.001$ and 0.74, $p<0.001$ after supine rest. There were significant main effects of condition on time to complete the TUG (10.3±0.4 seconds versus 11.9±.7 seconds after seated and supine rest respectively, $p<0.001$) , and APT (69.3±4.1% and 56.3±4.9% after seated and supine rest, respectively, $p<0.05$). **CONCLUSION:** TUG time and APT during the TUG are reliable following either supine or seated resting conditions. These data support the hypothesis that physical function is poorer and risk of falls is heightened immediately after rising from supine rest compared to seated rest. The risk of falls following supine rest is further evident by an average TUG time approaching 12 seconds. These results may assist clinicians in more appropriate screening, and in developing treatment strategies to reduce falls risks and falls.

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ACUTE EFFECTS OF 3 HOURS OF UNINTERRUPTED SITTING ON HEMODYNAMICS IN MIDDLE-AGED AND OLDER ADULTS

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Previous research has consistently demonstrated that a bout of uninterrupted sitting induces endothelial dysfunction in young, healthy men. However, there is little research examining the acute effects of uninterrupted sitting in other groups, especially women. **PURPOSE:** To investigate the effects of a single bout of uninterrupted sitting on hemodynamics in middle-aged and older men and women. **METHODS:** Thirty adults (14 men, 16 women; age, 46.6±8.8 y; body fat, 28.9±8.7%) performed a 3 h bout of uninterrupted sitting in a controlled laboratory environment. Body composition was assessed using multifrequency bioelectrical impedance analysis. Hemodynamic variables including blood pressure (BP), heart rate (HR), and calf circumference were measured at baseline, 1 h, 2 h, and 3 h of sitting. Additionally, superficial femoral artery (SFA) diameter and blood velocity were measured using Doppler ultrasound. SFA blood flow and shear rate were calculated using standard equations. Repeated measures ANOVA were utilized to understand changes in hemodynamic variables over time and between men and women. **RESULTS:** Systolic BP, diastolic BP, and calf circumference increased ($p<0.01$ for all), whereas HR decreased ($p<0.001$) over 3 h of sitting. SFA blood flow decreased over time with a quadratic trend ($p<0.001$; baseline: 76.1±47.9, 1 h: 46.2±28.8, 2 h: 39.0±19.7, 3 h: 34.7±18.5 mL/min). SFA arterial diameter did not change ($p=0.12$), however, SFA blood velocity decreased ($p=0.03$) over 3 h. Lastly, shear rate decreased over 3 h ($p<0.001$; baseline: 30.0±4.5, 1 h: 19.2±3.8, 2 h: 18.4±2.8, 3 h: 15.3±3.0 s^{-1}). No differences were found between men and women for all variables. **CONCLUSION:** A single bout of uninterrupted sitting induced unfavorable changes in BP, calf circumference, and SFA blood flow, velocity, and shear rate in middle-aged and older men and women. Unfavorable changes in hemodynamic variables from repeated exposure to uninterrupted sitting throughout the lifespan may help explain the increased risk for cardiometabolic disease and premature mortality with excessive amounts of sedentary behavior.

Supported by: University of Idaho Webb Education Faculty Endowment and University of Idaho Exercise Physiology Research Laboratory

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METFORMIN-LEUCINE TREATMENT FOLLOWING DISUSE INCREASES MUSCLE SATELLITE CELLS AND REDUCES FIBROSIS IN AGED MICE

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The hospitalization of older adults is predicted to increase within the next 15 years. The aging population is growing, and the majority will deal with prolonged and incomplete muscle and strength recovery. An inability to fully regain lost muscle after inactivity drives the diminished response to rehabilitation and is accompanied by muscle fibrosis. **PURPOSE:** Thus, the purpose of this study was to investigate how combination therapy of metformin and leucine effects muscle recovery following disuse in aged mice. **METHODS:** Aged mice (22-24 mo) underwent 14 days of hindlimb unloading (HU) then 7 or 14 days of recovery. Age and weight-matched mice did not undergo HU and were used as ambulatory comparators (AMB). Mice assigned to each time point received either standard drinking water (control), water with metformin (MET), or water with metformin and leucine (MET+LEU) throughout the HU and recovery period. Hindlimb muscles were dissected, snap frozen, sectioned and stained for histological analysis. **RESULTS:** HU decreased gastrocnemius and soleus muscle mass and fiber cross sectional area in all groups vs. AMB ($P<0.05$). After 7 days of recovery gastrocnemius muscle mass of control mice was still decreased vs. AMB ($P=0.006$) while MET+LEU mice were not different vs. AMB ($P=0.085$). Following HU, MET+LEU mice had increased Pax7+ cells in gastrocnemius vs. control ($P=0.05$); after 7 days of recovery in soleus there were also increased Pax7+ cells ($P=0.019$) compared to control. Additionally, after 7 days of recovery gastrocnemius of MET+LEU mice had increased central nuclei compared to control ($P=0.015$). Lastly, after HU and throughout the recovery period, MET+LEU mice had increased collagen turnover (main effect $P<0.001$) and decreased total fibrosis vs. control (Tukey's post-hoc $P=0.033$). **CONCLUSION:** Metformin-leucine treatment improves recovery in aged mice following muscle disuse by promoting regenerative cells and decreasing fibrosis but does not affect fiber size.

Support provided by University of Utah Sports Medicine & Science Grant

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FLUID DELIVERY SCHEDULE AND COMPOSITION: FLUID BALANCE, PHYSIOLOGIC STRAIN, AND SUBSTRATE USE IN THE HEAT

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Hydration position stands propose exogenous volume intake considerations but remain ambiguous regarding frequency parameters. **PURPOSE:** To determine the effects of micro-dosing or bolus-dosing plain water or a carbohydrate-electrolyte solution (MW, BW, MCE, BCE, respectively) on fluid retention, heat stress, and carbohydrate (CHO) oxidation during exercise in the heat. **METHODS:** In a repeated measures cross-over design, males (n=12, 77.6±11.3 kg, VO_2 peak 55.4±6.6 $ml \cdot kg^{-1} \cdot min^{-1}$) completed four 2-hour trials (treadmill, 1.3 $m \cdot s^{-1}$, 5% grade) in a heat chamber (33°C, 30% RH) outfitted with a 15 kg pack and standardized USFS uniform. Fluid delivery during the experimental trials was based on 100% of calculated loss from a pre-experiment familiarization trial under identical conditions. Micro-dosed fluids were provided at 22 $doses \cdot h^{-1}$ (46±11 $ml \cdot dose^{-1}$), while bolus-dosed fluids were provided as a single $dose \cdot h^{-1}$ (1005±245 $ml \cdot dose^{-1}$). CE trials delivered 62±15 g $CHO \cdot hr^{-1}$ and 878±214 mg $Na^{+} \cdot hr^{-1}$. Nude body weight (BW) and urine volume were recorded pre, during, and post exercise. Heart rate and core temperature were recorded to determine physiologic strain index (PSI), while steady state expired air samples were collected to determine VO_2 and CHO oxidation rates. Sweat rate was calculated from BW, urine output, fluid intake, and estimated respiratory water loss. A two-way repeated measures ANOVA was used to determine differences. Statistical significance was established at $p<0.05$. **RESULTS:** Total BW loss (n=11, -0.56±0.25 kg, $p>0.05$), cumulative urine output (n=10, 729±427 ml, $p>0.05$), and sweat rate (0.79±0.20 $L \cdot h^{-1}$, $p>0.05$) were similar across trials. PSI at hour 1 was significantly lower than hour 2 (3.6±0.7, 4.5 ±0.9, respectively, $p<0.05$), however there were no differences across trials. CHO oxidation was significantly higher in the CE trials when compared to the W trials (1.5±0.3, 0.8±0.2, $g \cdot min^{-1}$, respectively, $p<0.05$), but was not different between dosing styles of identical composition. **CONCLUSION:** These data demonstrate that physiological strain, sweat rate, fluid retention, and CHO oxidation during continuous work in the heat are unaffected by varied fluid delivery schedules of equal volume.

Supported by the United States Forest Service (USFS), National Technology and Development Program

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PRE-SEASON CHARACTERISTICS OF DIVISION I CROSS-COUNTRY RUNNERS AND ASSOCIATION WITH PERFORMANCE: A PILOT STUDY

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The pre-season aerobic capacity (VO_{2max}) of cross-country (XC) runners influences race performance (RP), yet research is limited on the association of VO_{2peak} with race placement (R-PL). Energy intake (EI; kcal), percent body fat (%BF), and perceived social support (PSS) also influence RP; thus, pre-season evaluations may have practical implications for resolving deficits before competition. **PURPOSE:** To examine associations between pre-season VO_{2peak} and RP in XC runners. Sufficiency of EI, %BF, and PSS were also assessed. **METHODS:** Division I male (M; *n*=10; 19.7 ± .7 yrs) and female (F; *n*=8; 18.5 ± .9 yrs) XC runners completed a maximal graded treadmill test to establish VO_{2peak}. The Automated Self-Administered 24-hour Dietary Assessment Tool (ASA24®) estimated daily EI. Air displacement plethysmography (BOD POD®) estimated %BF. The 16-item Perceived Available Support in Sport Questionnaire (PASS-Q) assessed PSS. Two weeks post-testing, athletes competed in their first race (M: 5.75-km; F: 4-km). RP measures included race time (RT; min) and R-PL (M: 85 total competitors; F: 79 total competitors). Descriptive statistics were calculated for all variables, and simple linear regression tested for associations between VO_{2peak} and RP measures. Sufficiency of EI was determined by estimating daily energy expenditure from body composition and daily activity level. **RESULTS**: Relative VO_{2peak} (M: 68.6 ± 3.6; F: 55.1 ± 4.4 ml/kg/min) significantly predicted R-PL among total competitors (M: 48.3 ± 23.2; F: 37.6 ± 15.2) in males (β = -.646, p = .044) and females (β = -.738, p = .038). Relative VO_{2peak} was not a significant predictor of RT (M: 20.2 ± .9; F: 16.2 ± 1.2 min) in males (p > .05) but was in females (β = -.758, p = .029). Insufficient EI was observed in 73% of athletes. Deficits averaged 532 ± 983 (M) and 522 ± 669 kcal/day (F). Males achieved a risky %BF (5.9 ± 4.1%), while females were in healthy range (20 ± 5.8%). Athletes reported adequate PSS (M: 12.4 ± 2.1; F: 13 ± 1.3). **CONCLUSION**: This study suggests that VO_{2peak} is a predictor of R-PL in XC runners; yet, additional variables have further practical implications. The caloric deficit observed across athletes and risky %BF in males suggest these constructs should be addressed in the pre-season. Future research should assess these factors and their contribution to RP over a XC season.

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PREVALENCE AND ASSOCIATIONS BETWEEN TESTOSTERONE DEFICIENCY AND BONE MINERAL DENSITY IN MALE COLLEGIATE ATHLETES

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Research has identified that endurance runners are at an increased risk for relative energy deficiency in sports (REDS). Testosterone (T) deficiency and low bone mineral density (BMD) are common symptoms among those experiencing REDS. However, a lack of research exists on the prevalence of T deficiency and low BMD among a wider variety of male athletes. **PURPOSE:** To assess the prevalence and associations of T deficiency and BMD in male collegiate athletes. **METHODS:** Male collegiate cross-country (CC) runners, track and field (TF) sprinters/jumpers, and club rugby (R) athletes, completed one visit to the Human Performance Lab at the end of their sports off-season. Participants arrived fasted (8 hours), abstained from exercise (12 hours), and arrived within 60 minutes of waking. Testing included collection of a saliva sample (Salimetrics SalivaBio Oral Swab), height and weight using a digital scale and stadiometer (APEX Deteco, Webb City, MO), a 24-hour dietary food recall (ASA-24), and 3 dual-energy x-ray absorptiometry scans (whole-body, lumbar spine (LS), left femoral neck (LFN); Horizon Hologic, Marlborough, MA). Statistical analyses were completed using SPSS Statistics v. 24 and data were reported as mean±SD. Significance was accepted at $p \leq 0.05$. **RESULTS**: Saliva samples are currently being analyzed for T levels at Salimetrics. CC had a higher caloric intake than R but not TF (CC: 3,813±1,239 kcal; R: 2,402±589 kcal; TF: 3,117±647 kcal, p=0.005, p=0.278 respectively). CC had lower LS BMD when compared to R but not TF (CC: 0.99±0.07 g/cm^2; R: 1.14±0.07 g/cm^2; TF: 1.12±0.16 g/cm^2, p=0.023, p=0.059 respectively). Additionally, CC had lower LFN BMD than R but not TF (CC: 0.99±0.08 g/cm^2; R: 1.12±0.14 g/cm^2; TF: 1.11±0.06 g/cm^2, p=0.046, p=0.069 respectively). One of eight CC athletes (12.5%) had low BMD (z-score < -1.0) in LFN, and two of eight CC athletes (25%) had low BMD in LS. Meanwhile, none of the R or TF athletes had low BMD in LS or LFN. **CONCLUSION:** Our findings support previous research findings demonstrating low BMD in endurance runners. Even though CC had a higher caloric intake, CC had a higher prevalence of low BMD in LS and LFN compared to R and TF indicating that caloric intake may not be the only contributing factor toward bone health in athletes. BMD associations with T levels will be determined upon analysis completion.

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FEMALE'S POSTURAL STABILITY FOLLOWING A SIX WEEK OFF-SEASON TRAINING CYCLE IN DIVISION I COLLEGIATE SOCCER

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Female athletes have 4 to 6 times greater incidence of non-contact ACL injury than males. Decreased dynamic postural control, which reportedly results from acute neuromuscular fatigue, is purportedly a predictor for ACL injury and may contribute to female's injury rate. Injury rates tend to be higher later in prolonged training, yet, it is currently unknown if the cumulative fatigue of high intensity off-season training decreases dynamic postural control. **PURPOSE**: This study examined the effect of a six-week off-season training program on postural stability in female athletes, and whether stability differed between limbs. **METHODS**: 27 female NCAA Division I soccer players performed a series of forward single-leg hops immediately prior to and following their off-season training. Participants performed 5 successful single-leg hops with each limb, which required they stand a distance equal to their leg length from a force platform, before jumping over a 17 cm box and landing with either dominant (D) and non-dominant (ND) limb on the force platform. During landing time to stabilization (TTS) and dynamic postural stability index (DPSI) were calculated. TTS was the first instance that GRF was within 5 SD of baseline (average GRF for 0.5 sec of quiet standing) for 0.5 sec. DPSI was calculated from initial contact to time to stabilization. Limb asymmetry was calculated as symmetry angle between D and ND. A Two-Way ANOVA tested main effect and interaction of training and limb, while a paired T-Test compared limb asymmetry. **RESULTS**: Neither training, nor limb had a significant effect on TTS (p=0.199, p=0.528) or DPSI (p=0.098, p=0.193). Additionally, limb asymmetry was not significantly different for TTS (p=0.830) or DPSI (p=0.291) following training. **CONCLUSION**: Cumulative fatigue of high-intensity training did not significantly alter dynamic postural stability for female athletes. Rather, athletes exhibited an insignificant 5% improvement in time to stabilization after training, despite performing 10% worse on the dynamic postural stability index. D and ND limbs, however, exhibited directionally similar changes in dynamic postural stability following high-intensity off-season training. Additionally, athletes exhibited no significant asymmetry between limbs.

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ALTERATIONS IN COLLEGIATE FEMALE SOCCER ATHLETE EXPLOSIVENESS FOLLOWING OFFSEASON TRAINING

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The new, increased training demands of collegiate sports produce greater injury rate and reduced physical performance for first-year collegiate athletes compared their non-first-year counterparts. Reactive Strength Index (RSI) is reportedly a measure of athletic "explosiveness" that is easily obtained from ground reaction force data and may provide insight into athlete performance and response to training. However, alterations in explosiveness for female, in particular first-year, athletes following offseason training is unknown. **PURPOSE:** To determine if first-year athletes exhibit similar alterations in athletic explosiveness (i.e., RSI) following off-season training as their non-first year counterparts. **METHODS:** Twenty-seven athletes (8 first-year) from an NCAA Division I women's soccer team performed five drop vertical jumps (DVJ) immediately prior to and following offseason training. For the DVJ, participants stepped off a 30 cm plyometric box, landed simultaneously on each limb, and then immediately performed a maximal vertical jump. During each DVJ, reactive strength index (RSI) was quantified by dividing the flight time of the maximal vertical jump by contraction time of the box landing (i.e., time from initial contact to takeoff). Participant-based RSI means were quantified and submitted to a two-way ANOVA to determine the main effect of and interaction between time (pre- vs post-training) and group (first-year vs non-first year), with alpha level 0.05. **RESULTS:** There was no significant time and group interaction (p = 0.300) or main effect of training (p=0.082, pre: 0.924±0.057 vs. post: 0.983±0.053) on RSI. But, first-year athletes exhibited a significantly lower RSI (p=0.043) compared to non-first year athletes (0.841±0.088 vs. 1.066±0.057). **CONCLUSION:** First-year athletes were approximately 24% less explosive than non-first year athletes. But, all female athletes exhibited a similar, non-significant (6%) increase in explosiveness following their off-season training.