Welcome to the

40th Annual Meeting

of the

Southwest Regional Chapter

of the

AMERICAN COLLEGE of SPORTS MEDICINE SM

Presented Virtually

October 28 – November28, 2020

Jointly sponsored by the American College of Sports Medicine and the Southwest Chapter of the American College of Sports Medicine

The Southwest ACSM annual meeting has been approved for up to 16 Continuing Education Credits by the American College of Sports Medicine. There is no separate fee for CECs. Please download the CEC checklist from the Southwest ACSM website and submit it to the Executive Director to obtain a CEC Certificate.

2020 SWACSM Virtual Program

Pre-Recorded Symposium Presentations

Topic	Speakers and Presentation Titles
Fitness: Industry Insights	***Telling them the good or bad news: Informing clients of fitness test results*** Eric Martin, PhD, California State University Monterey Bay ***Habits of successful weight losers*** Jason Karp, PhD, Chief Running Officer, Run-Fit ***Data and population health in exercise*** Eric Durak, MS, President, Medical Health and Fitness
Physical Activity Assessment: Wearable Activity Monitors	***Validity of consumer wearable sensors*** Albert Mendoza, PhD, California State University, East Bay ***Introduction of student researchers*** James Navalta, PhD, University of Nevada, Las Vegas ***The evolution of wearable devices*** Robert Salatto, University of Nevada, Las Vegas ***The current state of technology devices in applied settings*** Brenna Barrios, University of Nevada, Las Vegas ***The needed considerations in current testing models*** Brayden Jolley, School of Medicine, Tulane University ***The future of wearable exercise testing*** Bryson Carrier, University of Nevada, Las Vegas
Neurobiology: Repetitive Head Impacts	***Repetitive Head Impacts: What are they and why should we care?*** Nicholas Murray, PhD, University of Nevada, Reno ***Best practices for measuring head impact exposure*** Nicholas Cecchi, Stanford University ***Clinical labwork and actionable recommendations for athletes*** Laura Kunces, PhD, RD, Thorne, Scottsdale, AZ

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Topic	Speakers and Presentation Titles
Neurobiology: Neurological Disorders & the Effect of Exercise	***Pathophysiological alterations to exercise in adults with Cerebral Palsy: From musculoskeletal to cardiovascular systems*** Areum K. Jensen, PhD, San Jose State University ***Relationship between physical activity and dementia in older adults: Findings from observational and interventional studies*** Janina Krell-Roesch, PhD, Mayo Clinic, Scottsdale, AZ; Karlsruhe Institute of Technology, Germany
Biomechanics: Running	***Marathon racing shoes: It's more than just the color**** Iain Hunter, PhD, Brigham Young University ***Gait Retraining and Performance: Friend or Foe?*** Jenevieve Roper, PhD, Loyola Marymount University
Metabolism: Diet and Exercise	***Can you outrun a bad diet?**** Glenn Gaesser, PhD, FACSM, Arizona State University
Metabolism: Female Athlete Challenges	***Effects of oral contraceptives on exercise performance and bone health*** Gretchen Casazza, PhD, California State University, Sacramento ***Decreased energy availability and suppressed ovarian function in overreached female runners**** Karine Schaal, PhD, California State University, Sacramento; University of California, Davis ***Research gaps and perspectives: Menstrual cycle phase effects on resistance training adaptations, performance, and recovery*** Gwenaelle Begue, PhD, California State University, Sacramento
Environmental Physiology	***Heat Stress and Solar Load: Implications for Endurance Runners and Cyclists*** Khalil Lee, PhD, Gatorade Sport Science Institute

* Speaker will be participating in the live Q and A sessions on Friday, October 30th. Conference goers should plan to view the pre-recorded presentation prior to attending the live Q and A session.

Topic	Speakers and Presentation Titles
Nutrition: Plant-based Diets and Athletic Performance	***Plant-based diets: what are they, and why should athletes care?**** Heidi Lynch, PhD, RDN, Point Loma Nazarene University ***Effects of soy protein on hormone levels and gains in muscle mass and strength*** Mark Messina, PhD, Soy Nutrition Institute; Nutrition Matters, Inc ***How athletes excel on plant-based diets: The science and practice**** Nanci Guest, PhD, RD, University of Toronto ***Sustainability integration into sports nutrition: Practical applications from field to plate*** Alba Reguant Closa, RD, University of Andorra
Athlete Care: Paralympic Athletes & Performance	***Return to Performance for the Adaptive Athlete: The Multidisciplinary Approach*** Amber Donaldson, DPT, United States Olympic and Paralympic Committee, Colorado Springs, CO ***Sports Nutrition Challenges for Paralympic Athletes*** Jacque Scaramella, United States Olympic and Paralympic Committee, Chula Vista, CA
Undergraduate Student Research Competition	**Finalists will be selected in early October and record a 10-minute oral presentation***
Graduate Student Research Competition	**Finalists will be selected in early October and record a 10-minute oral presentation***

* Speaker will be participating in the live Q and A sessions on Friday, October 30th. Conference goers should plan to view the pre-recorded presentation prior to attending the live Q and A session.

Live Q and A Zoom Sessions: Friday, October 30th

Undergraduate and Graduate Research Competitions
Health & Performance Q and A Panel

Time (PDT)	Session Title	Speakers and Talk Descriptions
12:00 – 12:30pm	**Undergraduate Student Research Competition**	**All finalists will participate in the live session** Co-Moderators: Sarah L. Dunn, PhD, California State University, San Bernardino and Jenevieve Roper, PhD, Loyola Marymount University
1:00 – 1:30pm	**Graduate Student Research Competition**	**All finalists will participate in the live session** Co-Moderators: Sarah L. Dunn, PhD, California State University, San Bernardino and Jenevieve Roper, PhD, Loyola Marymount University

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Live Q and A Zoom Sessions: Friday, October 30th

Time (PDT)	Session Title	Speakers and Talk Descriptions
4:00 – 5:00pm	**Health and Performance Q and A Panel**	**Glenn Gaesser, PhD, FACSM, Arizona State University:** ***Can you outrun a bad diet?*** Dr. Gaesser's presentation will address the literature that focuses on whether exercise can offset the deleterious effects of poor dietary habits. He will use data from epidemiological studies and RCTs of short-term interventions to answer the question: "If one exercises regularly (primarily vigorous intensity), does diet matter?" **Nanci Guest, PhD, RD, University of Toronto:** ***How athletes excel on plant-based diets: The science and practice*** Research shows that a well-planned, appropriately supplemented plant-based diet can effectively support endurance, and power/strength sports in addition to optimizing body composition goals. The current science surrounding the need for special foods and specific supplements beyond the well-known micronutrients (i.e. iron, vitamin B12), such as creatine, carnitine, and choline for specific populations will be reviewed. Dr. Guest will also briefly share some of her experiences working with high performance plant-based vegan athletes. **Iain Hunter, PhD, Brigham Young University:** ***Marathon racing shoes: It's more than just the color*** Dr. Hunter's presentation will focus on the latest styles of marathon racing footwear. He has recently published on aspects of shoe construction and will summarize what is currently known from his own research and others. **Heidi Lynch, PhD, RDN, Point Loma Nazarene University:** ***Plant-based diets: what are they, and why should athletes care?*** Plant-based diets are becoming more mainstream among the general public and athletes, yet confusion about the meaning of this term and the nutritional adequacy of such diets for athletes remain. Dr. Lynch's talk will explore reasons for following a plant-based diet, and will provide and overview of the literature about exercise performance for athletes following plant-based diets. **Karine Schaal, PhD, California State University, Sacramento; University of California, Davis:** ***Decreased energy availability and suppressed ovarian function in overreached female runners*** Dr. Schaal's presentation will provide the results from a recent study in which she and colleagues aimed to compare the changes in energy intake (EI), exercise energy expenditure (ExEE), and resulting EA among runners completing a 4-week phase of intensified training (IT) followed by 2-week recovery period. She will discuss how study results compare to the original hypothesis that runners becoming overreached by IT would show decreased EA and signs of energy conservation such as suppressed ovarian function and plasma leptin, compared to those adapting positively (well-adapted, WA) to the IT period.

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2019	Jack Young
2020*	Ben Yaspelkis, III

*To be presented at 2021 Annual Meeting

Southwest Regional Chapter of the American College of Sports Medicine

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SWACSM 2020 Virtual Undergraduate Student Research Competition

Oral Presentations

1. Comparing Positions for Handgrip Dynamometry

Pilotzi, Kevin and Eric Martin, PhD

California State University, Monterey Bay

Introduction: Different textbooks state different hand grip positions for measuring grip strength, including having the arm at the side, at the front, or at 90 degrees. While all three measure muscular force, there is limited research that determines which version is more reliable.

Purpose: The purpose of this study was to see if there was a significant difference between the three positions and what the intertrial reliability of each position was.

Methods: We measured both dominant and non-dominant hand using all three positions: arm at the side, at the front, and at a 90-degree angle. Subjects performed two maximal grip squeezes of a Hydraulic Hand Dynamometer with a 60-90 second rest between trials. If there was more than a 10% difference between the first two trials, a third trial was done.

Results: With the three different arm positions that were performed, there was no significant difference with the grip strength ($p = 0.983$). There was a difference between the dominant and non-dominant hands ($p=0.103$). There was a significant difference between men and women ($p < 0.001$). The multiple trials for each arm position were strongly related showing its reliability.

Discussion: The three different arm positions were shown to not have a significant difference. There was a significant difference in the generated force between the dominant and non-dominant hands. Both men and women did show a significant difference in handgrip strength.

Conclusion: All three arm positions are useful to measure grip strength for both dominant and non-dominant hands.

2. Ground Reaction Forces Generated by a Lower Body Negative Pressure Exercise Device for Space Flight

Poudel, Alisha[1], Ashari, Neeki[1,2], Kong, Mitchell[1,2], Friend, James[3,4], Hargens, Alan[1]

[1]Department of Orthopaedic Surgery, [2]Department of Bioengineering, [3]Department of Mechanical and Aerospace Engineering, [4]Department of Surgery, University of California, San Diego

Purpose: Loss of bone and muscle are leading concerns among astronauts during prolonged space flight. Force generated by bodyweight due to gravity is important for maintenance of musculoskeletal health. Increased muscle atrophy in microgravity environment creates a lot of musculoskeletal injuries. These muscle injuries do not only impact the work of astronauts' in International Space Station (ISS) but also leave a long-lasting impact on the astronauts' health after returning to gravity gifted earth. Lower body negative pressure (LBNP) chambers generate gravitational and cardiovascular stresses to maintain musculoskeletal strength and fitness by means of suction pressure. LBNP, a vacuum-based device provides negative pressure generating Ground reaction forces (GRFs). GRFs generated underneath the user's feet are directly proportional to the level of negative pressure applied. However, the exact mechanism of GRF generation remains unresolved. It is important to better understand GRFs because GRFs represent the effectiveness of the machine on generating force from bodyweight. We hypothesize that increasing the cross-sectional area (CSA) of the user's waist in contact with a flexible waist seal will increase the GRFs generated at a given vacuum pressure.

Methods: To test our hypothesis, we collected GRFs generated by 6 healthy subjects under two conditions: original (unchanged) CSA of their waist and a greater waist CSA using expanded cushioning around waist of the same subjects (Figure 1). Subjects were instructed to use the same supine LBNP chamber for both conditions. The CSA was increased for the latter condition in the LBNP opening using a neoprene material. A weight scale was attached vertically inside the LBNP chamber where the subjects were able to comfortably place their feet. GRFs were measured with LBNP levels ranging from 0 (ambient pressure) to 50 mmHg with subjects lying in supine position to simulate microgravity. We used MATLAB software to perform statistical tests including ANOVA test and Pearson correlations.

Results: The original CSA of 467.7 cm2 ± 69.0 cm2 generated 118 % ± 31 % body weight at -50 mmHg. However, the larger CSA of 1,451.0 cm2 ± 331.0 cm2 generated a mean GRF of 146 % ± 31% body weight at -50 mmHg. A one-way ANOVA test resulted in p-values < 0.05 for all pressures, denoting statistically significant increases in larger compared with original CSA GRF. The GRF generated with larger CSA followed this equation GRF = -1.8211 (LBNP) + 0.7899 while the GRF generated with original CSA followed the equation: GRF = -1.5079 (LBNP) + 0.3995.

Conclusion: These data support our hypothesis that GRFs generated by LBNP are directly proportional to the waist CSA. Using this new concept, astronauts may generate GRFs at lower LBNP levels to prevent pre-syncopal symptoms during exercise in space. The ability to adjust the GRFs generated by changing CSA allows astronauts flexibility in using LBNP device without constantly changing the LBNP levels. As our admiration for space evolves, it is important that we further study such innovative ways to simulate bodyweight to protect our astronauts' health and prevent permanent physiological damages.

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3. Relationship Between Walking Speed and Key Vital Signs in Young Adults

Rosalba Saavedra[1], Kevin Pilotzi[1], Claire Ebersole[1], Brian Bischoff[1], Steven Kim, PhD[2], and Eric Martin, PhD[1]

[1]Kinesiology Department, [2]Mathematics and Statistics Department, California State University, Monterey Bay

Purpose: Walking speed tests predict functional independence and health outcomes for older adults, however research has not demonstrated the same validity in younger adults. The primary purpose of this study was to determine the relationships between walking speed and classic vital signs in young adults. The secondary purpose of this study was to compare normal vs fast gait speed and to compare acceleration vs stable walking speed in young adults.

Methods: Participants were assessed for resting blood pressure, body fat percentage (BF%), and waist circumference. Participants underwent two separate randomized trials walking through Brower timing gates set up at the starting line and at 5m, 10m, and 20m at either normal or fast space. Normal and fast acceleration were calculated as the time to walk the first 5 meters divided by 5; normal and fast steady speed were calculated as the time to walk from the 5-10 meter gates divided by 5. Outcome relationships were calculated using Pearson's correlations with two-tailed significance of α = 0.05 separately for each sex.

Results: Among female participants, all measures of blood pressure significantly correlated with all measures of body composition ($p < 0.01$; $r = 0.345$-0.572), and fast acceleration correlated with both body composition measures ($p < 0.05$, $r = -0.251$ to -0.338). However, among male participants, no relationship was seen between blood pressure and body composition, fast steady speed and acceleration only correlated with BF% ($p < 0.05$; $r = -0.349$ to -0.414), and normal steady speed and acceleration only correlated with waist circumference ($p < 0.05$, $r = -0.333$ to -0.335). No relationships were seen between walking and blood pressure.

Discussion: Fast walking speed relates to body composition in younger adults but does not relate to blood pressure. Accordingly, young adults can relate fast walking speed tests to their health.

Conclusions: Acceleration at a fast pace is recommended when testing young adults.

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4. Changes in Gait Kinematics after Strength Rehabilitation for Medial Tibial Stress Syndrome: A Preliminary Case Study

Vargas, Nicole[1], Cheung, Jasmine B.A.[2], Wiegand, Kristyne Ph.D.[1], Van Oosbree, Trish Ph.D.[1]

[1]Whittier College, [2]Des Moines University

Introduction: Medial tibial stress syndrome (MTSS), characterized by exercise-induced lower leg pain, is common among runners. However, there is a lack of consensus regarding proper treatment. This case study examined the effect of strength rehabilitation on lower extremity kinematics of a runner with chronic MTSS.

Methods: A female collegiate track and field athlete aged 19 diagnosed with MTSS reported to the Yao Yuan Sze Movement Laboratory twice. During the first visit, questions regarding injury history, treatment, and footwear were completed. The Navicular Drop Test was conducted during the second visit. A 3D gait analysis was completed on a treadmill during each session using six 3D motion capture cameras (100Hz). Three recordings of 6 strides each were collected at 13.5mph. Kinematic data were exported to Visual3D to calculate bilateral ROM and peak angles for the hip and knee in all three planes during stance. Between sessions (one month), the athlete completed strengthening exercises focused on hip, leg, and intrinsic foot musculature as prescribed by sports medicine staff.

Results: The athlete reported a history of MTSS which was more pronounced in the right limb, with no improvement between sessions. Orthotics to mitigate pronation were prescribed four years prior, which the athlete used in her training shoes and replaced annually. ND was greater in the right foot (12mm vs. 5mm, unilateral standing). The bilateral difference in hip IR/ER ROM increased from pre to post-treatment, with a left to right shift (R-L: -0.75° pre and 3.9° post). Right knee ABD/ADD ROM increased from pre (1.5°) to post-treatment (2.9°). Right peak hip ADD increased from pre (7.6°) to post-treatment (13.8°). Left peak hip ADD increased from pre (6.2°) to post-treatment (14.0°).

Conclusion: Though data collections were interrupted (COVID19), preliminary results indicate a shift in compensatory movement with no decrease in pain. After treatment, the athlete exhibited contrasting peak angles and ROM between limbs, suggesting that treatment emphasized right limb strength. To ensure muscle strength balance and reduce gait compensations, the athlete should focus on strengthening both limbs equally. Frequent follow-ups should be conducted to examine long-term effects of treatment on the athlete's symptoms and gait.

SWACSM 2020 Virtual Graduate Student Research Competition

Oral Presentations

1. Acute Strength Loss Following Strength Training and Cycling Interval Training at Low and Preferred Cadences

Chatlaong, Matthew [1], Theodorides, Harry [2], and Parker, Daryl L. [2]

[1]University of Mississippi, [2]California State University, Sacramento

Governed by the force-velocity relationship, cycling efficiency is compromised at very high cadences. Efficient power production by increased cadence is limited making sustained high power output highly dependent on force production. Traditional strength training has been repeatedly shown to improve cycling performance. Since exercises like a leg press do not replicate an "aerobic" sport like cycling, low-cadence interval training is widely applied with the intent of gaining strength. Typical prescription of LC (40-60 rpm) consists of twenty to thirty total minutes of three- to six-minute intervals. It is not known if this is effective for strength development.

Low loading can lead to comparable strength gain to high loading when fatigue is reached each set. If LC is an effective low-load training method for increasing strength, it is expected that sets would be fatiguing - leading to greater post-exercise strength loss. The purpose in conducting this study was to compare the decrement in MVC following both typically prescribed low-cadence interval training and strength training to evaluate the degree of neuromuscular fatigue.

18 trained male cyclists from local cycling clubs (Age 36.7 ± 12.8, Weight (kg) 74.8 ± 7.7, Height (cm) 179.3 ± 5.7, VO2max (mL/kg/min) 61.3 ± 6.8), Years Training 12.0 ± 5.6, Perform Strength Training n = 11) completed one bout of WT, LC, and workload matched interval training at normal or preferred cadences (NC). MVC was measured before and at 2- and 30- minutes post- exercise. WT was 4 sets of 10 repetitions of leg press at 80% of 1RM. LC (40-50 rpm) and NC (90-100 rpm) consisted of 5 sets of 4 minutes at 90% RCP.

Decrement in MVC following WT (9.2% ± 9.7) was greater than LC (2.1% ± 6.1), ($p = 0.05$), but not NC (5.7 ± 4.9). Fatigue was greater at 30-min post exercise. ($p = 0.00$) LC fatigue was correlated with the relative load per repetition (% MVC) that the prescribed power output required ($r = 0.58$, $p < 0.05$).

Based on the results of this study, it is not likely that typically prescribed moderate-intensity low-cadence interval training leads to comparable strength development with typically prescribed strength training in cyclists. Greater intensity during LC could provide different results, as it is possible that each set could be fatiguing, making it a more viable method of low-load strength training.

2. The Effects of Exercise on Beta-Hydroxybutyrate Concentrations Over a 36-Hour Fast: A Randomized Crossover Study

Landon S. Deru, MS, MBA, ATC[1], Benjamin T. Bikman, Ph.D.[2], Lance E. Davidson, Ph.D.[1], Larry A. Tucker, Ph.D.[1], Gilbert Fellingham, Ph.D.[3], Ciera L. Bartholomew[1], Holly L. Yuan[2], and Bruce W. Bailey Ph.D.[1]

[1]Dept. of Exercise Science, Brigham Young University, [2]Dept. of Physiology and Developmental Biology, Brigham Young University, [3]Dept. of Statistics, Brigham Young University

This study assessed beta-hydroxybutyrate (BHB) concentration during a short-term fast and the degree to which an initial bout of exercise influences the rate of ketogenesis. 20 adult subjects (11 Male, 9 Female) completed two 36-hour fasts, with one protocol requiring the subject to complete a treadmill exercise session at the beginning of the fast. BHB levels were assessed via portable meter every two hours, along with mood and hunger ratings. Venipuncture was performed every 12 hours to assess plasma insulin and glucagon. The mean area under the curve for BHB concentration was 19.19 ± 2.59 mmol/L (nonexercised) and 27.49 ± 2.59 mmol/L (exercised), yielding a significant 8.30 mmol/L difference between conditions (95% PPI (posterior probability interval) = 1.94 to 14.82 mmol/L). The mean time to ketosis was 21.07 ± 2.95 hours (nonexercised) and 17.5 ± 1.69 hours (exercised) (95% PPI = -2.11 to 10.87 hours). A significantly larger area under the curve was not observed between conditions for insulin and mood states. Completing aerobic exercise at the beginning of a 36-hour fast significantly increases BHB concentration with no significant impact on hunger, discomfort or moods. A difference in time to achieving ketosis between conditions may exist but was not observed in this study.

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3. Physical Inactivity Does Not Impair the Insulin-Lowering Effects of Moderate-Intensity Exercise, Yet It Does Impair Fat Metabolism

Dial, Michael[1], Hong, Sungmo[2], Braden, Rebecca[2], Coyle, Edward[2]

[1]University of Nevada, Las Vegas, [2]University of Texas at Austin

Acute exercise and physical activity improve insulin sensitivity, glucose tolerance, and postprandial lipemia, although recent research suggests that physical inactivity may attenuate some of these healthy metabolic benefits of exercise. This study aimed to determine how two days of physical inactivity and physical activity affected exercise-induced changes in plasma insulin, glucose, and triglyceride concentrations during an oral glucose tolerance test (OGTT) performed the next morning. Five untrained men (n=2) and women (n=3) completed three five-day trails in a randomized crossover design. Each trial began with two days of normal activity levels, followed by two intervention days. Two days of physical inactivity (3,666 ± 100 steps) without exercise (SIT) were compared to two days of physical inactivity (3,077 ± 141 steps) with a 1-hr bout of moderate intensity cycling at 65% of VO2peak (SIT + EX). Finally, two intervention days of high activity (12,270 ± 408 steps) were performed with a 1-hour bout of moderate cycling (ACTIVE + EX). The following morning, subjects completed a 120-min OGTT, during which plasma was collected and analyzed for glucose, insulin, and triglycerides. No changes were observed in plasma glucose. Compared to SIT, insulin total area under the curve (AUCT) was 39% lower in SIT+EX (p=0.18) and 21% lower in ACTIVE+EX (p=0.48), demonstrating that exercise had an insulin-lowering effect. Plasma triglyceride AUCT in ACTIVE+EX was 26% lower than SIT (p=0.10) and 28% lower than SIT+EX (p=0.03), and fasting plasma triglyceride concentration in ACTIVE+EX was 34% lower than SIT (p=0.06) and 20% lower than SIT+EX (p=0.43). These data indicate that the insulin-lowering effect of physical activity is influenced to a greater extent by an acute bout of moderate exercise (65% VO2peak) than the background daily steps. Conversely, the triglyceride lowering effect of physical activity appears to be contingent upon higher physical activity (daily step count) and not acute moderate-intensity exercise. This also was the case with postprandial whole-body fat oxidation as ACTIVE+EX was 26% higher when compared to SIT+EX. Taken together, insulin sensitivity appears to be improved by prolonged moderate-intensity exercise (i.e. 65% of VO2peak), while postprandial triglyceride concentration and fat oxidation are improved by increasing daily step count (i.e.; from < 4,000 to >11,000 per day).

4. The Average Macronutrient Composition and Calorie Content of Fueling Station Snack Selections of NCAA Division I Athletes

Teitelbaum, Gabrielle, Quintanilla, Alyssa, Blaine, Rachel, Dekofsky, Brooke, Barrack, Michelle

California State University, Long Beach

The NCAA Deregulation of Feeding in 2014 increased opportunities for feeding collegiate athletes; however, research addressing the nutritional content of snack selections from collegiate fueling stations is limited.

PURPOSE: This study aimed to evaluate the average caloric, macronutrient, and sodium content of the snacks selected from the athlete fueling station at a NCAA Division 1 school in Southern California.

METHODS: Snack selections from the fueling station, during a representative 2-week (10-day) period during the fall sports season, were tracked, using a web-based application, and analyzed for energy, carbohydrate, protein, fat, and sodium. Athlete participants were classified according to sport and predominant energy system(s): phosphocreatine (PCr) system; the PCr and anaerobic glycolysis (PCr/AG) systems; PCR, AG, and oxidative phosphorylation (PCr/AG/OP) systems.

RESULTS: During the study period, 329 (n= 147 male, n= 182 female) athletes visited the fueling station 1,879 times (athlete-days) and selected 3,592 snacks. Athletes visited the fueling station on an average of 5.7 ± 2.3 days. On average, athlete snack selection(s) contained 345.2 ± 150.7 kcals, 49.3 ± 24.9g of carbohydrates, 16.3 ± 9.5g of protein, 10.5 ± 6.8g of fat, and 308.2 ± 186.8mg of sodium. A total of 24.7% of athletes met the recommendations for both carbohydrate (≥60g) and protein (≥15g). Male, compared to female, athlete snack selections contained significantly more calories (366.1 ± 149.0 kcals vs. 329.1 ± 150.0 kcals, $p < .001$), carbohydrate (52.0 ± 24.3 grams vs. 47.3 ± 25.3 grams, $p < .001$) and protein (18.3 ± 10.0 grams vs. 14.8 ± 8.8 grams, $p < .001$). The PCr/AG athlete group selected snacks with the most calories and carbohydrates (353.99 ± 154.5 kcals, 50.79 ± 25.6 g CHO, $p < .001$), while, the PCr/AG/OP group selected snacks with the least amount of protein (14.16 ± 8.0 g, $p = .002$).

CONCLUSIONS: Findings suggest that athlete snack selections may lack adequate nutrients for optimal recovery, an issue particularly relevant during periods of high-volume or high-intensity training. This research supports the potential benefit of educational materials addressing snack selections that facilitate intake of post-training fueling recommendations.

General Poster Presentations

1. **Effects of Percussion Therapy (Theragun™) on Athletic Performance and Range of Motion**

Fany Alvarado, Kevin Valenzuela, Amanda Finn, Elizabeth Avila, Jill A. Crussemeyer and Mikiko Nakajima

California State University, Long Beach

Purpose: Athletes are beginning to use myofascial release techniques as part of their warm-up but there is minimal research on the effects it has on performance. The purpose of this research was to assess the effects of myofascial release (via percussion therapy) on athletic performance and passive range of motion (ROM).

Methods: Twenty subjects with mean weight 71.13 + 14.89kg and height 1.69 + 0.10m were recruited from California State University, Long Beach (CSULB) to participate in two days of testing. Day one consisted of baseline testing of passive (ROM), countermovement jump (CMJ) and drop jump landing (DJ) mechanics. On day two of testing percussion therapy was performed bilaterally for 30 seconds per muscle group (gluteus maximus and medius, hamstrings, quadriceps, calves, peroneals) and 10 seconds on the plantar surface. Passive ROM (hip, knee, ankle) and jump mechanics were measured immediately after treatment. Raw marker and force data were collected using a 15 camera Qualisys system and two Bertec force plates, respectively. Data were imported into Visual 3D. A Butterworth second-order bidirectional low-pass filter with cutoff frequencies of 6Hz and 25Hz were utilized to filter raw marker data and ground reaction force (GRF) data, respectively. A paired-sample t-test ($p<0.05$) was used to compare pre- and post-treatment measurements.

Results: In the CMJ, no significant differences were found in peak knee flexion angles ($p = 1.0$), knee extension moments ($p = 0.49$), and jump height ($p = 0.65$). In the DJ, no significant differences were found in peak knee flexion angles ($p = 0.79$), peak knee abduction angles ($p = 0.52$), and peak knee abduction moments ($p = 0.62$). Percussion treatment increased ROM measurements: Thomas test improved 4.9° ($p < 0.001$), 90-90 hamstring improved 3.6° ($p = 0.001$), and ankle lunge improved 3.9° ($p < 0.001$). No significant change was found on the rectus femoris ROM ($p = 0.399$).

Conclusion: Athletes who use percussion treatment prior to physical activity will not have any adverse effects on performance or increase risk of injury. Muscles with lower levels of flexibility might be more susceptible to a strain or injury. Percussion treatment increased ROM, which might help decrease the chance of injury.

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2. Frontal Plane Knee Mechanics During Loaded and Unloaded Drop Landings in Individuals With and Without Patellofemoral Pain

Andani, Maria, Quiroz, Kayla, and Roper, Jenevieve, PhD

Department of Health and Human Sciences, Loyola Marymount University

Individuals with patellofemoral pain (PFP) are known to have modified lower extremity kinematics, especially during loaded exercises. The altered kinematics, when paired with additional weight, could increase the risks of serious injuries.

Purpose: Our objective was to compare the lower extremity kinematics during a loaded (SL) and unloaded (UL) drop landing test of individuals with PFP to healthy controls.

Methods: Eighteen physically active adults were assigned to either the control (n = 10) or experimental (n = 8) group. Participants were allocated depending on whether the presence of PFP was confirmed after a physical examination by a clinician prior to experimentation. During the SL condition, participants performed drop landings using weighted vests with a load of 10% body mass. Participants performed eight drop-landings from their maximum jump height while three-dimensional kinematic and kinetic data were obtained. A two-way repeated measures ANOVA was used to measure group differences in knee abduction. The alpha level was set at 0.05.

Results: Both groups displayed similar landing mechanics. There was a significant time effect ($P = 0.001$). Knee abduction increased from initial contact to the end of the loading response during both conditions. There were no significant interaction effects ($P > 0.05$).

Conclusions: Individuals with PFP display similar landing mechanics to healthy controls.

3. The Effects of a University Fitness & Wellness Course on Physical Activity Intentions and Behaviors

Antunes, Sabrina, Flores, Sara, and Cooper, Stephanie, Ph.D.

University of San Francisco

Purpose: The purpose of this study was to analyze physical activity and sedentary behaviors, the intentions to change behaviors, and the stage of behavior change over the course of a semester for students enrolled in a university health and wellness course.

Methods: Twenty-five participants, aged 19 to 24, completed three self-report questionnaires at three points during the semester. The questionnaires obtained information about the participants' physical activity and sedentary behaviors, intentions to engage in physical activity, and the stage of behavior change they were experiencing based on the Transtheoretical Model.

Results: Preliminary analyses showed significant changes in the affective domain of intention to exercise during the semester [$F(2, 48) = 3.3$, $p = .047$)], with contrasts indicating a significant increase in effect related to exercise from Week 6 to Week 13 ($p = .047$). Though non-significant, there was a tendency for perceived opportunity to exercise, as well as, intentions to exercise to decrease across the semester. There were significant, moderate correlations ($r = 0.41 – 0.52$) between students' intentions to be physically active and their future physical activity levels. However, there were no significant changes in physical activity nor sedentary behavior across the semester. Lastly, 64% of participants differed from their original stage of physical activity behavior change during the semester.

Conclusion: Engaging in a university fitness and wellness course enhanced positive perceptions of physical activity; however, physical activity behaviors and intentions were not modified. Extraneous factors seem to be responsible for the lack of change observed based on personal reflections obtained from students.

4. Kinematics and Kinetics During Side-Step Activity with Varying Band Placement

Avila, Elizabeth, Bouman, Mary Jane, Walters, Kellie, & Valenzuela, Kevin

California State University Long Beach

Elastic resistance bands (RB) are a low-cost and convenient alternative to traditional weighted resistance exercises and are particularly useful in large group exercise classes, rehabilitation settings, and home exercise programs. Several studies have found RB exercises to be an effective alternative to resistance training.

PURPOSE: To examine the differences in joint mechanics of the hip and the force development during varying placements of a resistance band while performing a resisted band side-step (RBSS).

METHODS: Nine subjects (1.68 ± 0.07m, 74.59 ± 15.40kg and 21.77 ± 1.55 years old) with at least six months of RB training experience were recruited. Kinematic and kinetic data were collected using a 15-camera Qualisys Oqus system (240Hz) and two Bertec force plates (1200Hz). Participants performed a sidestep exercise (RBSS) with four different placements in randomized order: above knee (AK), below knee (BK), ankle (AN) and feet (FT). Visual 3D was used to process raw marker and force data. Kinematic and kinetic data were filtered using a low-pass Butterworth filter at 8Hz and 25Hz, respectively. Internal frontal and transverse plane joint moments at the hip were calculated using the push-off leg beginning when the lead leg left the ground and ending when the trail leg left the ground.

RESULTS: The hip experienced peak abduction and external rotation moments that progressively increased as the band moved distally (AK=-1.00 ± 0.22Nm/kg, BK=-1.10 ± 0.19Nm/kg, AN=-1.01 ± 0.27Nm/kg, FT=-1.22 ± 0.30Nm/kg). The hip had an internal rotation angle that decreased from AK (8.92 ± 0.31°) to BK (8.69 ± 0.31°) to AN (8.08 ± 0.30°) but had the highest value at FT (9.22 ± 0.24°) position.

CONCLUSION: The results indicate that an increase in external rotational moment is required to counter the increased internal rotational torque produced by the band in the FT condition. The difference experienced in the peak and mean moments indicate that during the majority of the trail leg stance phase the muscles of the hip joint were working to counter the abduction and external rotation moments. The decrease in hip angles could be attributed to a decreased step length. Although step length was not measured in this study, it was observed decreasing as placement of the band moved distally.

5. **The Effects of Physical Fatigue on the Selection of Gaze Strategies during an Obstacle Navigation Task.**

Ayala, Maria E., Cho, Andrew Y., Dang, Kyle, Depur, Pranavi L., Stoehr, Nicole M., Rogers, Sean M., D.A.T., Hinkel-Lipsker, Jacob M., Ph.D.

California State University, Northridge

Purpose: Physically-demanding professions situated in unpredictable environments (e.g., firefighting) can have greater risk of trips and falls. This study analyzed how exercise-induced fatigue can impact gaze strategies during an obstacle navigation task. We hypothesized that fatigued subjects would make greater use of central gaze (CG) to visualize the obstacle, indicating possible narrowing of their peripheral visual field (PV). This perceptual deficit may lead to a reduction in spatial awareness and obstacle recognition, which can be detrimental to clearance ability and injury risk.

Methods: 21 young, healthy subjects performed five rested trials and five fatigued trials requiring them to walk through a dark path over a randomly placed obstacle. A motion detector would illuminate the obstacle, requiring them to quickly recognize and step over it. Eye-gaze data was collected for all trials at 100 Hz using wearable eye-tracking glasses with an embedded 3D accelerometer to quantify head rotation. The data was used to quantify eye movements and reaction time based on when rotation of the head, eyes, or both was initiated following illumination.

Results: Reaction time (RT) between the rested and fatigued states was not significant. However, three distinguishable gaze patterns emerged: the immediate gaze strategy (IGS; RT < 400 ms), the delayed gaze strategy (DGS; 400 ms > RT > 1000 ms), and no gaze strategy (NGS; no reaction). As time between obstacle illumination and subject clearance was approximately 500ms, IGS seemingly had subjects directing their CG towards the obstacle, DGS signified a strategy of using PV to recognize the obstacle and CG to look past the obstacle, and NGS making full use of PV. During the rested state, IGS was most prevalent among subjects, followed by DGS and then NGS. Following exercise, there was significantly less reliance on DGS and an increased reliance on IGS, which may show reductions to use of PV. This may contribute to a greater adherence to IGS reliance for keeping the obstacle within one's CG.

Conclusion: The use of DGS could be indicative of planning future steps beyond the obstacle. It is interpreted that following exercise, decreased DGS and increased IGS could be evidence of the need to rely on one's central gaze to avoid tripping or falling following fatiguing exercise.

6. Upper Extremity Angular Kinematics of an American Football Long Snap

Balentine, Sam and Peterson, Travis

California Lutheran University

Introduction: There is a lack of empirical data to determine which variables of an American football long snap primarily influence the resultant ball velocity. However, upper extremity kinematic measures have been strongly related to the outcome of the initial ball velocity (Chizewski & Alexander, 2015). Understanding the relationship between upper extremity angular kinematics and long snap velocity can provide evidence-based principles for football players to produce faster long snaps.

Purpose: This study aimed to determine which angular kinematic variables are most strongly related to long snap velocity.

Methods: Ten experienced football long snappers (5 high school; 5 collegiate) participated in the study. Athletes performed six long snaps directed at the Wizard Kicking Solo-Snap net placed 13.3 meters (15 yards) behind the anterior tip of the football. Trials were video recorded from a sagittal view placed on the left side of the subject (30 Hz). Ankle, knee, hip, shoulder, and elbow joint angular kinematic variables were tracked throughout the snap (Kinovea v0.8.27). Correlational analyses were conducted between angular kinematic variables and initial ball velocity (α=0.05).

Results: The timing of peak elbow flexion was significantly correlated to ball velocity for the whole group (r=0.829, p=0.002) and for just the college players (r=0.907, p=0.020). Additionally, college athletes produced larger ball velocities when the elbow maximum angular velocity was larger (r=0.881, p=0.032). For high school snappers, more extended elbow release angles were correlated with larger ball velocities (r=0.970, p=0.002). Lastly, shoulder angle in the stance phase (prior to the snap initiation) was not significantly correlated to ball velocity for high school (r=0.666, p=0.197) or college athletes (r=0.313, p=0.599).

Conclusions: Football long snappers should focus on maximally extending their elbow at release from the most flexed position later in the snap. This makes the arm easier to swing as the elbow is flexed, and allows for larger elbow angular velocity as the elbow extends through a larger range over a shorter duration to release the ball. This study found higher long snap horizontal velocities under those conditions and has the potential to increase overall long snap performance.

7. Effects of Vibration Training on Lower Extremity Strength: A Systematic Literature Review

Baloy, R. Kirby, PT, DPT, EdS, MS[1] and Kwan, Erwina, BS, SPT[2]

[1]The College of St. Scholastica, [2]The University of St. Augustine, Miami Campus

Purpose: Strength training of the lower extremity has been shown to improve overall leg musculature strength. The combination of vibration training (VT) and strength training (ST) has been increasing in popularity among various populations. Evidence, however, is scant on how this combined training regimen influences lower extremity muscle strength. Data Sources Systematic literature searches for randomized controlled trials between 2000-2020 were performed in the databases of PubMed, PEDro Database, Ovid, Cochrane Library, EBSCO (Medline) between April 30 to July 26, 2020.

Methods: Nineteen randomized controlled trials (full text available, PEDro score > 6, and conducted in the past 10 years) with a total of 987 subjects met methodological quality guidelines using the PEDro scale.

Results: A total of forty (40) articles were screened, and nineteen (19) studies with a total population of n = 987 were included in the systematic review. With heterogeneity in modality and vibration intensity/frequency including dosing and prescriptions, no meta-analysis was conducted. There were no significant differences found between VT + ST vs ST alone in eleven (11) of the randomized controlled trials (n= 678). There were statistically significant improvements reported in terms of improved strength outcomes in VT + ST vs ST alone in eight (8) of the randomized controlled trials (n= 309). Our results revealed that during lower leg musculature training, the addition of VT does not significantly elicit improvements in lower extremity muscular strength in majority of the studies.

Conclusion: The studies presented limited evidence for recommending the use of VT as an adjunct ST in improving lower extremity musculature strength. The use of VT does not significantly affect strength and performance gains when compared to traditional strengthening exercises for the lower extremities. Higher quality methodological studies are recommended in the field of VT.

AMERICAN COLLEGE of SPORTS MEDICINE
Southwest Chapter

8. Evaluating the Concurrent Validity of a Web-based Nutrition Screening Survey Among Pre-Adolescent Student Athletes

Belarde, Christina, MS, RD, Barrack, Michelle, PhD, RD, CSSD, Gray, Virginia, PhD, RD, and Blaine, Rachel DSc, MPH, RD

California State University, Long Beach

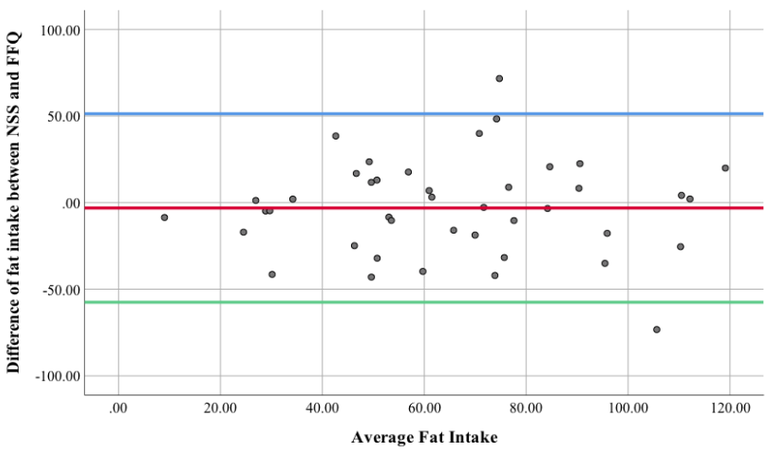
Purpose: To evaluate the concurrent validity of the novel 61-item Nutrition Screening Survey (NSS) against the validated 127-item 2014 Block Food Frequency Questionnaire (FFQ), specifically for the estimation of dietary energy (kcal/day), carbohydrate (g/day), protein (g/day), fat (g/day), and fiber (g/day) among physically active preadolescent students.

Methods: Seventh grade participants (n=42), age= 12.2 0.4 y, BMI= 18.5 2.6 kg/m2, body fat= 17.2 7.1%, completed the web-based NSS and 2014 Block FFQ during a period of three weeks during the academic year. Objective measurements of height, weight, and body composition using bioelectric impedance analysis (Tanita DC-430U) were obtained. Pearson's correlations, paired samples t-tests, and a Bland-Altman Plot assessed the concurrent validity of the NSS compared to the 2014 Block FFQ.

Results: Pearson's correlation analyses indicated significant moderate associations between values for energy (kcal/day; r= .58; p<.001), protein (g/day; r= .58; p< .001), and dietary fat (g/day; r= .58; p< .001) and weak correlations for carbohydrate (g/day; r= .48; p< .001) and fiber (g/day; r= .49; p< .001). The paired samples t-tests showed dietary fat mean values did not significantly differ between the NSS and FFQ (63.79 g SD vs. 66.89 g SD, p= 0.47) and the Bland-Altman Plot indicated no proportional bias for fat intake (Figure 1).

Conclusion: These findings support the limited validity of the novel NSS for this sample and that it may serve as a convenient method of evaluating nutritional risks among physically active preadolescents.

Figure 1. Bland Altman plot analysis indicating no proportional bias for fat intake.



9. Comparison of Female and Male Golf Swing Kinetics and Force Production

Birkner, Michele and Peterson, Travis Ph.D.

California Lutheran University

Introduction: Golf is a popular sport that is enjoyed by both men and women across the world. It is beneficial to understand if men and women perform the golf swing differently in order to properly match training techniques and golf equipment to enhance performance. Previous research found that men used higher joint moments in the downswing phase than women which resulted in stronger force production (Kang et al. 2018).

Purpose: This study aimed to determine if men and women generate force similarly during a golf swing.

Methods: Nine highly skilled collegiate golf players (5 females, 4 male) volunteered to participate in accordance with the local IRB. Players performed 10 golf shots toward a target downrange with a 6-iron with each foot fully supported by a force plate (1200 Hz, Kistler). Reaction forces (RFs) were calculated in the mediolateral (ML) and anteroposterior (AP) directions and normalized by body weight. Linear impulse was calculated as the area under the force-time curves and normalized by body mass. The period of interest was defined as the time when the player's target leg RF became posterior until ball contact. Statistical differences between groups were determined using independent t-tests ($\alpha = 0.05$).

Results: Females and males generated similar ML ($p = 0.408$) and AP ($p = 0.229$) net linear impulse. The average target leg ML RF was directed away from the target for females (0.066 ± 0.026 BW) and for males (0.064 ± 0.021 BW, $p = 0.843$). Average rear leg ML RF was directed towards the target for females (-0.090 ± 0.038 BW) and (-0.059 ± 0.032 BW, $p = 0.241$) for males. The average target leg AP RF was directed posteriorly for females (-0.098 ± 0.026 BW) and for males (-0.137 ± 0.032 BW, $p = 0.088$. Average rear leg AP RF pointed anteriorly for females (0.054 ± 0.019 BW) and males (0.065 ± 0.028 BW, $p = 0.511$). Females generated linear impulse over a longer duration of time (0.371 ± 0.032 s) than males (0.304 ± 0.051 s, $p = 0.046$).

Conclusion: Females may be using the extra time as a mechanism to generate the required linear impulse or they could be utilizing different swing strategies to achieve the same outcome. Future research with larger samples will further understand these sex differences. This information is beneficial to both players and coaches to help tailor golf training programs to the individual.

AMERICAN COLLEGE of SPORTS MEDICINE
Southwest Chapter

10. The Development and Implementation of a Reliable and Valid Oral Fat Tolerance Test (OFTT) for Research and Clinical Purposes

Bodell, Nathaniel G, Ph.D.[1], Navalta, James W, Ph.D.2, Kawi, Jennifer, Ph.D.[2], Bungum, Timothy, Ph.D.[2]

[1]California State University of San Bernardino, [2]University of Nevada, Las Vegas

Introduction: Increased feeding regularity raises the risk of developing atherosclerosis; due to higher circulating triglycerides (TG) which damage the endothelial lining. Research into lipid metabolism commonly employs an oral fat tolerance test (OFTT), however there is no accepted standardized OFTT. The purpose of this investigation was to determine an optimal fat load for a standardized, reliable, valid, and reproducible OFTT.

Methods: All participants (N=20) were free of any known cardiovascular or metabolic disease. Participants were allotted 20 minutes to consume the OFTT. Baseline and subsequent blood analysis post-feeding were collected at 1, 2, 3, and 4-hours. One of three OFTT of varying fat concentrations were administered in randomized-crossover design, containing fat loads of 150g, 100g, and 50g of fat.

Results: The test-retest reliability of the OFTT loads, the 150g, 100g, and 50g were all significant ($p<0.001$) with ICC at 0.745, 0.923, and 0.715, respectively.

Conclusion: The 100g OFTT load has proved to be the most reliable and valid measure for observing TG elevation over time. Further, the 100g load would be a reliable tool for research and clinical purposes. To our knowledge, this is the only investigation examining the reliability and validity of an OFTT.

11. The Effects of Heel Strike Loading Magnitude on Hip and Lumbar Spine Bone Mineral Density in Male Distance Runners

Allison Burdullis, Marcus McKinnon, Steven Hawkins, Ph.D., FACSM, and Michele LeBlanc, Ph.D.

California Lutheran University

Previous research has reported that while male long distance runners have normal bone mineral density (BMD) at their hip, their lumbar spine BMD values are lower than that of the general population (Fredericson et al., 2007; Hind et al., 2006). In fact, approximately 40% of the runners in these studies have lumbar spine T-scores < -1.0. While investigations into ground reaction forces and tibial stress fractures have been completed, an understanding of how early loading characteristics of these forces might influence lumbar spine BMD values is lacking.

Purpose: The purpose of this study was to examine the effects of early impact loading rates on hip and lumbar spine BMD in male long-distance runners.

Methods: Forty injury-free male runners aged 18-30 years were recruited. Participants ran across a Kistler force plate (1000 Hz) at a self-selected pace with each foot making contact for three trials per foot. Whole-body, hip, and lumbar spine scans were completed with a Hologic dual-energy X-ray absorptiometry machine. Participants who consistently exhibited a heel-striking pattern were divided into two groups (n = 16 each) based on their average early loading rate (ELR) values obtained with Bioware software.

Results: The Low and High group ELR values were statistically different (86.0 ± 18.3 kN/s vs. 175.3 ± 48.9 kN/s; $p < 0.001$). There was no difference between the two group's mass or weekly mileage. The normalized peak impact force, stance time, time to the peak vertical impact force, and time to the peak vertical active force were different between the two groups. There was no difference in the normalized peak active vertical force. The High ELR group had greater BMD values at all anatomical locations analyzed, significantly so at the Ward's triangle and total lumbar regions ($p=0.023$ and $p=0.002$, respectively). The lumbar spine T-scores for the Low group were significantly different than that of the High group (-1.4 ± 0.6 vs. -0.4 ± 1.0; $p = 0.003$) with 14 subjects in the Low group and 2 subjects in the High group having T scores < -1.0.

Conclusion: The results suggest that a higher early impact loading rate may be desirable to obtain adequate BMD for the spine and thus prevent future osteoporic injuries. This research was funded by the Swenson Summer Research Fellowship Program.

12. Stress Amongst College Students and Coping with Drugs and Alcohol

Calhoun, Amanda[1], and Dunn, Sarah L., Ph.D.[2]

[1]University of La Verne, [2]California State University, San Bernardino

Most college students undergo high levels of perceived stress. Learning to cope with their negative stress may have an impact on a college students' academic success as there are various ways to manage their stress and not all are positive or healthy.

Purpose: The purpose of this study was to assess college students perceived stress and coping with their perceived stress through drug or alcohol usage.

Methods: The data for this study was collected across 3 weeks from University of La Verne undergraduate students (N=59, age 25.20±8.05 years) across all majors in Spring 2020 (pre COVID-19). An Institutional Review Board approved online survey (Qualtrics, Utah, USA) was used to collect data which included two measures (48-item Perceived Stress Inventory, PSI, and 28-item Brief Cope) along with basic demographic questions. The PSI was divided into five categories; financial, family, academic, time management and social stressors and each item was measured using a 10-point Likert scale (1 = no stress and 10 = high stress). Two questions from the Brief Cope validated measure were used to assess coping behaviors related specifically to drug and alcohol usage, measured on a Likert scale between 1 and 4; 1 = no use of alcohol or drugs when coping and 4 = use of drugs and alcohol to cope a large amount of the time. Average PSI and coping responses were calculated then analyzed in Statistical Package for Social Sciences version 26.0 using a non-parametric Spearman Rank Order Correlation Test. This observational study had a p-value of = 0.05 with a 95% confidence interval.

Results: The average coping score (specifically for drug and alcohol usage) was significantly and positively related to PSI scores *(rho* = 0.415, *p* = 0.001).

Conclusion: Based on the significant findings, elevated perceived stress scores indicated greater use of drugs and alcohol as a coping measure in University of La Verne college students in the Spring 2020 semester (prior to COVID-19 transition).

AMERICAN COLLEGE of SPORTS MEDICINE
Southwest Chapter

13. The impact of moderate and vigorous exercise on neurophysiological indices of food-related inhibitory control and cognitive control: A randomized cross-over event-related potential (ERP) study

Coleman, Jacob[1], Muir, Alexandra M.[2], Bartholomew, Ciera L.[1], Christensen, William F. Ph.D.[3], Larson, Michael J. Ph.D.[2,4], Bailey, Bruce W. Ph.D.[1]

[1]Department of Exercise Science, Brigham Young University, [2]Department of Psychology, Brigham Young University, [3]Department of Statistics, Brigham Young University, [4]Neuroscience Center, Brigham Young University

Food-related inhibitory control, or the ability to withhold a dominant response towards highly palatable foods, may influence an individual's daily dietary decisions. Food-related inhibitory control abilities may increase following a bout of aerobic exercise; however, how varying intensities of exercise affect food-related inhibitory control is currently unclear. The current study aimed to quantify how relative intensity of aerobic exercise influenced both the neural indices of food-related inhibitory control and general inhibitory control as indexed by the event-related potentials N2 and P3. Two hundred and thirteen participants completed a randomized, cross-over design in which they completed two separate exercise conditions (35% [moderate] or 70% [vigorous] of VO2 max) along with a seated rest condition. Directly following exercise, participants completed a food-based go-/no-go task and a flanker task while electroencephalogram data were recorded to quantify food-related and general inhibitory control. Linear mixed models were fit to determine how exercise intensity directly influenced both behavioral and neural measures of inhibitory control. N2 and P3 amplitude was larger following vigorous exercise for the food-based go/no-go task. There were no differences in N2 amplitude during the flanker task, but there was an increase in P3 amplitude following vigorous exercise. Overall, these results suggest that vigorous exercise induces general changes to cognitive control.

14. Evaluation of Rating of Perceived Exertion During Mountain Biking

Cruz, Kyle, Salatto, RW Davis, Dustin W., Carrier, Bryson, Barrios, Brenna, Cater, Peyton, Farmer, Heather, and Navalta, James W.

University of Nevada, Las Vegas

Purpose: Previous unpublished work from our laboratory showed that test-retest reliability of Rating of Perceived Exertion (RPE) was poor (ICC = 0.473) during repetitive mountain biking trials. We performed a secondary data analysis to determine the possible explanation. The purpose of this investigation was to evaluate the effects of repeated uphill mountain biking trials on RPE responses.

Methods: Twenty novice mountain biking participants (10 male, 10 female) completed two 1.6km mountain biking trials (44m elevation gain) separated by 10 minutes. Participants completed the Borg Rating of Perceived Exertion (6-20) scale immediately before and after completing each trial. Data were analyzed using a 2 (time: pre, post) x 2 (test: trial 1, trial 2) repeated-measures ANOVA. Significance was accepted at $p < 0.05$.

Results: A significant interaction was observed between time and test ($p = 0.006$, $\eta p2 = 0.331$). Perception of exertion at the outset of the trials was different (Pre Trial 1 RPE = 6.7 ± 1.4 [Mean ± SD], Pre Trial 2 RPE = 9.2 ± 2.6, $p = 0.001$, $d = 1.20$), with RPE being significantly higher at the beginning of the second trial. RPE was not observed to be different at the conclusion of the mountain biking sessions (Post Trial 1 RPE = 14.2 ± 2.1, Post Trial 2 RPE = 14.5 ± 1.73, $p = 0.439$, $d = 0.18$).

Conclusion: It should be noted that the obtained RPE in the current investigation was specific to the novice mountain bikers. These results indicate that a longer rest period between repeated mountain biking trials is necessary from a perceived exertion standpoint in order to obtain increased reliability measures in this green exercise setting.

AMERICAN COLLEGE of SPORTS MEDICINE
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15. Cerebral and Peripheral Arterial Hemodynamics Following Anaerobic, High Intensity Aerobic, and Resistance Exercise

Diaz, Michael[1], Liu, Jie, MD, PhD[2], and Knox, Allan, PhD[1]

[1]California Lutheran University, [2]Rutgers New Jersey Medical School

Purpose: High intensity aerobic and resistance exercise is a popular and necessary mode of exercise training for recreational and professional athletes, respectively. The profound sympathetic activation and anaerobic pathways engaged in response to the physiological stress of intense exercise may be reflected in the hemodynamic properties of the vasculature. These responses may also be dependent on the vascular network as cerebral and peripheral circulations demonstrate unique reactivity patterns to endogenous and environmental stressors. The purpose of this investigation was to explore the cerebral and peripheral arterial hemodynamic characteristics following repeated anaerobic and resistance bouts, plus acute high intensity aerobic and resistance exercise.

Methods: Peak systolic velocity (PSV), end diastolic velocity (EDV), and time average maximum velocity (TAMAX) were determined the brachial artery (BA), common carotid artery (CCA), and internal carotid artery (ICA) using Doppler ultrasound prior to and within five minutes after the cessation of a maximal aerobic capacity exercise test (VO2 Max), lower body strength test (1RM), repeated anaerobic bouts (AERO), and repeated high intensity lower body resistance exercise bouts (RES).

Results: BA PSV approached an increase following AERO ($p=0.071$). BA EDV increased following AERO ($p<0.001$) and RES ($p=0.032$). BA TAMAX approached an increase following VO2 Max ($p=0.059$) and RES ($p=0.090$), but increased following AERO ($p<0.001$). No differences were observed in percent change relative to baseline (%Δ) in PSV, EDV, or TAMAX between any exercise within the BA, CCA, ICA ($p>0.05$ for all). EDV %Δ was significantly higher following AERO in BA in comparison with CCA ($p<0.001$) and ICA ($p<0.001$). TAMAX %Δ was also higher in the BA following VO2 Max when compared with CCA ($p=0.025$) and ICA ($p=0.029$). Similar trends were observed in %Δ AERO as BA TAMAX was higher when compared with CCA ($p=0.001$) and ICA ($p<0.001$).

Conclusions: The current data demonstrate differences in peripheral and cerebral arterial hemodynamics ten minutes following the cessation of acute high intensity aerobic exercise and repeated bouts of anaerobic exercise.

AMERICAN COLLEGE of SPORTS MEDICINE
Southwest Chapter

16. Effects of the COVID-19 Quarantine on Physical Activity within the Undergraduate Community

Doan, Alan; Nitahara, Kayla; Vitale, Kenneth M.D. FACSM

University of California, San Diego and Columbia University

Purpose: After the pandemic quarantine began, many lost access to their regular means of exercise, and there was reasonable concern that this would adversely impact moderate intensity (MI) and high intensity (HI) exercise. This survey was created and released online in May to assess any changes in physical activity and mental health, specifically for the undergraduate population.

Methods: Non-athlete/athlete participants from both the University of California, San Diego and Columbia University completed an online questionnaire with questions about age, sex, and location of residence during the pandemic, as well as questions about the amount/type of regular exercise that the participants performed before/after pandemic. Some questions were modelled after Dr. Adam Tenforde's worldwide survey on the effects of COVID-19 on physical activity and well-being. Statistical analyses were performed to assess any potential relationships between the aforementioned factors.

Results: There was no significant difference found between sexes/institutions of attendance with regards to changes in exercise. For both athletes and non-athletes, there was a significant decrease ($p<.05$) found between their times spent on MI exercise during the quarantine. When comparing the extent of non-athlete MI and athlete MI decreases, there was a significant difference found ($p<.01$) between the two groups' changes in exercise. With HI exercise, non-athletes were found to experience a significant decrease in activity ($p<.05$) after the pandemic inception, while there were no such changes found for athletic patterns of HI exercise. With regards to the locations of residences, there was no significant difference found between rural/urban/suburban/city residences and the change in MI/HI exercise activity surveyed.

Conclusions: Our data supports a general decrease in exercise within the undergraduate community after the quarantine began. This is especially concerning, given that the quarantine has not been fully lifted and given the high frequency of sedentary activity that has already permeated the lives of many individuals in the undergraduate community and beyond, even before the pandemic. And while we noted no significant differences between the individuals' exercise decreases in different locations, there are likely many differing factors that contribute to these individuals on a case-by-case basis that can be further explored.

17. Evaluation of the Felt Arousal Scale During Mountain Biking

Farmer, Heather, Salatto RW, Davis, Dustin, Carrier, Bryson, Barrios, Brenna, Cater, Peyton, Cruz, Kyle, Navalta, James W.

University of Nevada, Las Vegas

Purpose: Previous unpublished work from our laboratory showed that test/retest reliability of the Felt Arousal Scale was poor (ICC =0.416) during repetitive mountain biking trials. A secondary data analysis was performed to determine the possible explanation. The purpose of this investigation was to evaluate the effects of repeated uphill mountain biking trials on Felt Arousal responses.

Methods: Twenty novice mountain biking participants (10 male, 10 female) completed two 1.6 km uphill (44m elevation gain) mountain biking trials separated by 10 minutes. Participants completed the Felt Arousal Scale after completing each trial. Data were analyzed using a 2 (time: pre, post) x 2 (test: trial 1, trial 2) repeated measures ANOVA. An alpha level of $p < 0.05$ was used to indicate significance.

Results: No time x test interaction was present ($p = 0.186$, $\eta p2 = 0.090$), nor was a main effect for test trial ($p = 0.408$, $\eta p2 = 0.036$). A main effect for exercise time point was observed ($p < 0.001$, $\eta p2 = 0.700$). The mountain biking sessions significantly increased arousal following exercise compared to measures obtained before (Pre = 3.28 ± 1.28 [Mean ± SD], Post = 4.68 ± 1.05).

Conclusion: When evaluating arousal using the Felt Arousal Scale, it was observed that arousal scores increased post-mountain biking trial when compared to those measured before. Based on these results other factors are likely responsible for the reliability measure of arousal, and future investigations targeting such are warranted.

18. Influence of Varying Crank Length on Knee Range of Motion and Compressive Forces

Fisk, Abigail, Newman, Avery, O'hara, Christiane, and Clark, Robert D.

California Polytechnic State University, San Luis Obispo

Purpose: The relationship between knee joint forces, moments, and range of motion (ROM) can have an influence on knee joint health (i.e. osteoarthritis, patellofemoral disorder, ligament damage, etc.). Knee joint compressive forces and ROM may differ based on varying crank lengths (CL) on a bicycle. The purpose of this study was to examine the effects of four different CL (155, 165, 175, and 185 mm) on ROM and resultant compressive forces on the knee.

Methods: 24 non-cyclists (11M, 13F, aged 18-55) participated in a single blind randomized cross-over experiment with four CL. An Enhanced Helen Hayes marker protocol was used to place 32 retroreflective markers on anatomical landmarks to track kinematic data using a 12-camera 3D motion analysis system with Cortex software (Motion Analysis Corp., CA, USA). Kinetic data were collected using a stationary bike (SRM IndoorTrainer, Germany) retrofitted with custom pedals containing 6-axis load cells (AMTI, MA, USA). A 3 minute warm-up for each CL was performed at 1.5 W/kg and 70 rpm. 4x1 minute trials were conducted at 2 W/kg. The first two trials were at a constant cadence of 70 rpm and the second two trials were at a constant pedal speed (PS) of 1.47 m/s. There were 10 seconds of rest between trials and 5 minutes of recovery between each condition. Kinematic data was processed using Cortex software and filtered (4th order Butterworth, cutoff 6 Hz). Kinetic data was filtered using MATLab (MathWorks, MA, USA). All data was averaged from 30 seconds of each trial.

Results: During submaximal cycling, the 155 mm CL had a significantly smaller knee ROM compared to the 185 mm CL (73 deg vs. 80 deg, $p<0.05$). No significant differences were found at a cadence of 70 rpm: 155 mm CL peak knee compressive force (2.8 N/kg) vs. 185 mm CL (2.6 N/kg). No significant differences were found at a PS of 1.47 m/s: 155 mm CL peak knee compressive force (2.4 N/kg) vs. 185 mm CL (2.5 N/kg).

Conclusion: Knee ROM was significantly greater with a longer CL. There are no significant differences in knee peak compressive forces. Implementation of a shorter CL at a PS of 1.47 m/s may minimize peak knee joint compressive forces.

19. Using Physical Activity as a Coping Mechanism and How Stress Levels are Impacted

Francisco, Joren[1], and Dunn, Sarah L., Ph.D.[2]

[1]University of La Verne, [2]California State University, San Bernardino

College students may have increased levels of stress due to a variety of aspects, such as an increased amount of responsibility, academics, social, and familial obligations. One of the ways that students may choose to combat this stress is by utilizing coping mechanisms. Coping behaviors can range from self-distraction, denial, and substance abuse to physical activity. For the purposes of this study, the coping mechanism analyzed was engaging in physical activity.

Purpose: The objective of this research was to investigate how physical activity as a coping mechanism impacted stress levels in undergraduate University of La Verne students.

Methods: Participants (N=55, age 21.0+/-2.8 years, male n=20, female n=35) of this study were undergraduate University of La Verne students, during the Fall 2019 semester, who took part in an online survey (Qualtrics, Utah). The analyzed measures included perceived stress (Perceived Stress Inventory), life events (Life Events Scale) and coping mechanisms (Brief COPE). The independent variable of the study was physical activity as a coping mechanism and the dependent variable was the sum score for perceived stress plus life events. A Mann-Whitney U Test and a Spearman Correlation with a p-value of 0.05 were used for statistical analysis in SPSS v.26.

Results: No significant relationship between stress/life events or physical activity as a coping mechanism was found. No significant differences were noted between students that indicated they were physically active when coping compared to those that weren't. Students who indicated participation in physical activity as a coping mechanism had a mean rank of 27.36 for levels of perceived stress/life events, while individuals who did not participate in physical activity had a mean rank of 29.31 for perceived stress/life events.

Conclusion: While physical activity has been shown to decrease levels of stress in individuals, no significant differences or associations were found in this group of college students. Furthermore, those participants who used physical activity as a coping mechanism and indicated higher levels of stress, could be experiencing aspects of body dysmorphia or viewing a physically active lifestyle as a chore or inconvenience which were not assessed. Future studies investigating the use of physical activity as a coping mechanism in college students experiencing stress and major life events are needed.

20. Modes of COVID-19 Spread and Effective Methods of Control

Thushara Galbadage[1], Brent M. Peterson[1] and Richard S. Gunasekera[2]

[1]Department of Kinesiology and Health Science, Biola University, [2]Department of Chemistry, Physics, and Engineering, Biola University

The novel coronavirus disease 2019 (COVID-19) pandemic has negatively affected nations throughout the world with great ferocity. Governments and their respective public health leaders have been forced to execute drastic measures to contain the spread. Yet, despite the aggressive preventative measures in place, COVID-19 continues to spread throughout the world. Currently, a widely-accepted mechanism of action is that COVID-19 may be transmitted by respiratory droplets containing the virus. However, mounting evidence suggests that aerosol transmission may also play an essential role in spreading this disease. We evaluated epidemiological evidence and molecular mechanisms of Severe Acute Respiratory Syndrome- Coronavirus-2 (SARS-CoV-2) infection to better understand the different modes of COVID-19 transmission. In addition, we critically examine the different modes of transmission for COVID-19 and their implication on public health preventative measures. We describe the effectiveness of various preventive measures that address droplet spread and those that mitigate aerosol spread. Our investigation results have demonstrated that despite the wide-scale implementation of aggressive droplet precautionary measures, the continuance of spread suggests that additional measures would be beneficial for the further reduction of COVID-19 spread. Finally, our study indicates that when combined with other widely-utilized public health measures such as hand washing and physical distancing, appropriate use of facemasks may help effectively reduce the transmission of COVID-19 by both droplets and aerosolization. Educating the public on the importance of using facemasks and creating awareness could help prevent further spread of the COVID-19 pandemic.

21. Self-quarantine from COVID-19 and the Implications of Altered Eating Behaviors on Weight Gain

Jacqueline Guillen, Mykah McMillian, Brianna Lopez, and Zachary Zeigler

Grand Canyon University

Purpose: The purpose of this observational study was to assess the impact of sustained quarantine recommendations on eating behaviors and weight gain during the COVID-19 pandemic.

Methods: This was a quantitative descriptive/observational research design. A research announcement was sent out via Facebook to 1200 possible participants. Six surveys were condensed into a single Survey Monkey questionnaire for participants to complete. Surveys asked questions relating to eating behaviors linked to weight gain.

Results:157 participants (40 male, 117 female) completed the surveys. Participants had an average age of 30.3 ± 13.5 years and an average BMI of 27.7 ± 7.4 kg/m2. Roughly 67% reported they have either lost weight or remained weight stable. The remainder 33% reported gaining weight. Roughly 53% of participants reported increased “eating with friends and family,” 57% reported increased “eating in response to sight and smell,” 69% reported increased “eating because I crave certain foods,” 53% reported increased “eating when depressed or upset,” 57% reported increased “eating when stressed,” 66% reported increased “eating when bored,” and 54% reported increased “snacking after dinner.” When all the eating behaviors were placed into an ordinal regression model, only “snacking after dinner” (odds ratio:1.153, 95% CI: 1.006 – 1.321) and “eating too much food” (odds ratio: 1.333, 95% CI: 1.095 – 1.623) were found to independently increase the odds of gaining weight during the COVID-19 pandemic.

Conclusion: Care should be taken to curb overeating and evening snacking to maintain body weight during self-quarantine.

22. Does Heat and Cooling Precondition Change Skeletal Muscle Function in Human Model?

He, Feng, Weston Soudan, Nathan Chang, and James Pernetti

California State University, Chico

Heat and cold exposure have shown to affect muscle function in both animal and human studies. However, the functions of skeletal muscles treated with heating cycles have not thoroughly illuminated.

Purpose: For the human model, to explore the effect of 4 weeks of local skeletal muscle heating and cooling (heat/cooling precondition) during isometric training focusing on forearm muscle function and hypertrophy.

Methods: For the human model, 12 college-aged males completed non-dominate forearm maximum volunteer contraction (MVC) and time to exhaustion at moderate-intensity (60% MVC) handgrip testing before and after four weeks of local muscle heating (40℃, 15 min) and cooling treatment (12℃, 15 min) followed by isometric exercise training. Dominate arms were served as a control group without precondition. Forearm skinfold thickness and circumference were measured to estimate the fat-free cross-section area (FFCSA).

Results: In human model, heat/cooling preconditioning arm has a significantly improvement in MVC (kg) (pre: 41.0±10.7 vs post: 43.6±10.7 kg, $p<0.05$) and time to fatigue (sec) (pre: 21.0±5.5 vs post: 37.3±13.2, $p<0.05$). In addition, MVC is moderately highly correlated with FFCSA only in the intervention group ($r=0.78$, $p<0.05$).

Conclusion: Heat/cooling preconditioning can markedly improve muscle strength and endurance based on the human model.

23. Differences in Fitness between Law Enforcement Cadets and Officers Across Two Agencies

Hernandez, Erika, B.Sc. [1], Orr, Robin M. Ph.D.[2], Dawes, J. Jay Ph.D.[3], Goad, Kiyoshi S.[2], Holmes, Ryan[4], Kornhauser, Charles[4], and Lockie, Robert G., Ph.D.[1]

[1]California State University, [2]Fullerton, Bond University, [3]Oklahoma State University, [4]Colorado State Patrol

INTRODUCTION: Law enforcement officers have great variety in occupational demands, ranging from periods of inactivity to moments of maximal physical exertion. Fitness is a focus for cadets during academy training, but with extreme variation in job demands, adequate levels of fitness can of be hard to maintain. Inadequate fitness may cause increased injury rates, and potentially lesser job task performance. Furthermore, occupational requirements and demands may differ between law enforcement agencies (LEAs) with differences in jurisdictions; e.g. rural and metropolitan departments. It is important to document fitness differences between cadets and officers, and whether this is consistent across LEAs.

PURPOSE: Determine whether differences existed in fitness levels of law enforcement cadets when compared to officers across two LEAs.

METHODS: Retrospective data were received from two separate US LEAs (LEA1: 66 male, 18 female cadets; 72 male, 7 female officers; LEA2: 91 male, 8 female cadets, 316 male, 4 female officers). Age, height, body mass, and fitness testing results from each LEA were provided, including: 1-min push-ups and sit-ups; vertical jump (VJ); 1.5 mile run (LEA1); and 20-m multistage fitness test (LEA2). VO2max was derived from the 1.5 mile run and multistage fitness test for analysis. Independent samples t-tests identified any differences between cadets and officers for both LEAs (both sexes combined, males, and females).

RESULTS: With both sexes combined for both LEAs, cadets were younger and lighter ($p<0.001$) than officers. Cadets significantly ($p<0.001$) outperformed officers in all fitness tests for both LEAs, except the VJ for LEA2. These results were consistent for males across the LEAs. For females, the clearest difference was for push-ups, where cadets completed ~14-17 more repetitions than officers.

CONCLUSIONS: Overall, significant differences in age, body mass, and fitness between cadets and officers across the two agencies was found. Officers' lost fitness regardless of their LEA. This indicates the need for maximization of fitness levels amongst cadets to minimize the impact of these decreases. Further, interventions should be put into place for officers to assist with fitness maintenance. Such interventions should focus on fitness aspects which maximize job task performance.

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24. The Influence of Jumping Rate of Force Development on Bone Mineral Density in Runners

Abby Hiller, Marcus McKinnon, Steven Hawkins, Ph. D., and Michele LeBlanc, Ph. D.

California Lutheran University

Previous research has reported that bone strength and density are known to increase in response to both ground reaction forces (GRFs) and muscle forces made on the bone (Beck, 2009). The purpose of the present study was to determine if the rate of force development (RFD) during a squat jump was a factor in hip and lumbar spine bone mineral density (BMD) values in male long distance runners. Forty male distance runners between the ages 18-30 who ran at least 30 miles per week were recruited. Each participant performed three maximum effort vertical squat jumps off of a Kistler 9281CA force plate (1000 Hz). Dual X-ray absorptiometry (DXA) scans were performed on the lumbar spine and hip. Ground reaction forces were collected with the participant running at a self-selected pace across the force plate. Bioware software was used to determine the average RFD from the lowest position until the maximum vertical force during the jump. Two distinct groups of subjects were formed based on average squat jump RFD. The groups were created with a cutoff of 2.00 kN/s with participants near this value being removed from the analysis to ensure the two groups were statistically different (Low group RFD = 1.52 ± 0.23 kN/s vs. High group RFD = 3.28 ± 1.27 kN/s; $p < 0.001$). T-tests were used to determine differences between the two groups with $p < 0.05$ indicating significance. There was no difference in the two group's height, mass or weekly mileage run. The greater RFD for the High group was created by both a larger peak vertical force (1,454.4 ± 133.7 N vs. 1,238 ± 135.2 N; $p = 0.001$) and a shorter time to the peak force ($p < 0.001$). There were no significant differences in peak vertical ground reaction forces (impact or active forces) during the running trials between the groups. DXA data revealed no differences in any of the BMD values between the two groups. It appears that the differences in the runners' ability to generate during a jump does not affect their BMD values. It is likely that force factors other than just the size of the vertical ground reaction forces during running may be more of a factor than the runner's ability to generate force quickly during this other movement.

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25. Relationship between Self-reported Physical Function and Exercise Effort during a Digital Exercise Intervention

Christian Hipolito[1], Kyle Hogg[1], Alec Sequeira [1,2], Vy Nguyen, Albert Weng [3], Taylor Sillekens [3], Justin Isaacs [3], Andrew Delehoy [3], Alison Ede, PhD1, Ayla Donlin, EdD [1,2], and Jackie Dawson, PhD [3]

[1]Department of Kinesiology, [2]LifeFit Center, [3]Department of Physical Therapy, California State University, Long Beach

Digital health interventions involving consumer-based wearable sensors and mobile apps are a promising strategy for promoting exercise in a home environment. However, the effectiveness of these programs may be influenced by self-perception of physical function.

Purpose: This ongoing pilot trial investigated whether a baseline measure of reported physical function status was related to exercise frequency and effort during 8 weeks of high-intensity functional training delivered over a digital platform in sedentary adults.

Methods: Fourteen sedentary (< 30 min/week of exercise) university workers (32.1 ± 11.0 yr) were randomized to 8 weeks of synchronous group exercise classes livestreamed over Zoom (SYNC, n=7) or pre-recorded exercise videos (ASYNC, n=7). Both groups performed the same 35-min workout led by an instructor 3x/week. Participants were also encouraged to perform self-directed physical activity (PA) outside of the study. A chest strap sensor (Myzone MZ-3) was worn during activity to capture exercise intensity, duration and frequency. The MZ-3 also acts as an activity tracker, calculating PA levels in the form of Myzone effort points (MEPs; heart rate x time). Physical function status was assessed through SF-36 physical function subscale (PFS) score. Differences were tested with independent t-tests while Pearson correlation was used to assess the relationship between SF-36 PFS and MEPs.

Results: At baseline, significantly higher SF-36 PFS score was reported in ASYNC compared to SYNC (Mean ± SE, p, effect size d; 93.6 ± 4.8 vs. 68.6 ± 8.3, p = 0.023, d = 1.4). Therefore, data was analyzed separately for each group. No relationship was observed between baseline SF-36 PFS score and mean MEP score over 7 weeks for SYNC (p =0.65) or ASYNC (p =0.39), nor was baseline SF-36 PFS score correlated with mean exercise sessions for SYNC (p=0.25) or ASYNC (p=0.61).

Conclusion: In a small cohort of sedentary adults, perceived physical function before beginning an online exercise program was not correlated with exercise effort or frequency. These results tentatively suggest that determinants other than subjective reporting of physical function contribute to adherence during an online exercise program. Future work will investigate the role of socioeconomic factors and perceived barriers to exercise adherence.

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26. Dietary Intake Behavior and Bone Mass in Male Collegiate Runners According to Disordered Eating Status

Elika Imandel, B.S.[1], Michelle Barrack, Ph.D., RD, CSSD[1], Michael Fredericson, MD, FACSM[2], Emily Kraus, MD[2], Andrea Kussman, MD[3], Kristen Gravani, MS, RD[2], Beth Miller, MS, RD, CSSD[3], Lauren Papanos, MS, RD[3], Megan Roche, MD[2], Rachel E. Blaine, DSc, MPH, RD[1], Aurelia Nattiv, MD, FACSM[3]

[1]California State University, Long Beach, [2]Stanford University, [3]University of California, Los Angeles

Purpose: This study aimed to evaluate nutrient intake, eating patterns, and bone mass in male collegiate runners with and without disordered eating (DE).

Methods: Ninety-two male collegiate endurance runners from two NCAA Division I cross-country and track and field programs completed a baseline survey evaluating demographic characteristics, dietary restraint and pathologic behaviors, exercise training, and related health behaviors. Runners also underwent a pre-participation physical exam, one-on-one dietitian meeting including a 24-hour dietary recall, and completed an online survey evaluating food intake and eating patterns. DE was evaluated during the annual preparticipation exam and dietary restraint and pathologic behavior questions of the Eating Disorder Examination

Questionnaire. The Mann-Whitney U and Chi-square tests evaluated between-group differences.

Results: Of 92 athletes (age= 19.8 ± 1.4y; BMI= 21.2 ± 1.5 kg/m2), running on average 60.8 ± 17.2 miles/week, 13% (n=12) met criteria for disordered eating. No differences were identified between runners based on DE status for age, BMI, weekly running volume, and running pace. A subset of runners (n=20) had complete data for energy availability (EA); 35% (n=7) had an EA <30.0 kcal/kgFFM/day. The one runner with DE and EA assessment exhibited an EA of 27.9 kcal/kgFFM/day, compared to 42.2 ± 23.1 kcal/kgFFM/day in the non-DE group. A higher proportion of runners meeting the criteria for DE failed to meet carbohydrate intake recommendations (6-10 g/kg/day) and trended towards lower intake of carbohydrate compared runners not classified with DE (4.5 ± 0.7 vs. 6.2 ± 2.0, p= 0.065). Dietary fat and protein intake did not significantly differ between groups. More runners with, compared to without, DE met criteria for low bone mineral density (BMD) (BMD Z-score < -1.0) (66.7% vs. 11.8%, p= 0.01) and exhibited lower lumbar spine BMD Z-scores (-1.17 ± 0.45 vs. -0.25 ± 0.81, p= 0.03).

Conclusions: Runners with DE are at an increased risk of inadequate carbohydrate intake and low BMD. Findings from this study suggest that a subset of males, like females, are susceptible to DE and subsequent health outcomes. Future research should aim to clarify patterns of disordered eating in male runners, relationships with energy availability, and risk of low BMD.

27. Use of Pressure-Measuring Insoles to Characterize Center of Pressure in Simulated Reduced Gravity Conditions

Ison, Christian, M.S.[1], Neilsen, Conner, [2], DeBerardinis, Jessica, Ph.D. [2], Trabia, Mohamed, Ph.D. [2], and Dufek, Janet S., Ph.D., FASCM, [1]

[1]Department of Kinesiology and Nutrition Sciences, University of Nevada, Las Vegas, [2] Department of Mechanical Engineering, University of Nevada, Las Vegas

Purpose: Reduced gravity exercise is used by clinicians and rehabilitation specialists as an alternative modality for aerobic exercise for recovering patients and athletes. Researchers have observed the effect of reduced gravity exercise on kinetics and kinematics of lower extremities and plantar pressure. However, the relationship between variation in the center of pressure (COP) and locomotion under reduced gravity conditions is not well understood, which will be the focus of this study using pressure-measuring insoles.

Methods: Twenty-nine healthy, (age 24.7 ± 4.04, mass = 72.36 ± 13.52 kg, height = 1.67 ± 0.04 m) volunteers participated in this cross-sectional experimental investigation. After providing informed consent (IRB#1510671-2), all participants were fitted with pressure measuring insoles (Medilogic GmBH, Schonefeld, GE). Participants completed two 3.5-minute walking trials on the treadmill (AlterG, Inc., USA) at 100% (normal gravity) bodyweight (BW) and 20% (reduced gravity) BW. The plantar pressure insole data recorded was analyzed to obtain the COP variables: anterior-posterior and medial-lateral path length and width.

Results: There was a significant difference in COP path length between the 100% BW condition (1.47 ± 0.16 mm) and the 20% BW condition (0.91 ± 0.47 mm); $p<0.05$. A significant difference was also observed between COP path width for the 100% BW condition (0.081 ± 0.02 mm) and the 20% BW condition (0.12 ± 0.04 mm); $p<0.05$. These results suggest that COP length is shown to decrease in reduced gravity conditions while COP width increases.

Conclusion: Change in COP length and width in reduced gravity may indicate a decrease in overall stability. Future studies should expand on the results of this work to quantify stability during locomotion under reduced gravity conditions.

28. Peak Power and Body Mass as Indices of Bone Loading in a Healthy Adult Population

Juhala, Candace C., Denys, Andrew T. M.S., Bugayong, Jastine C. B.S., Ma. Eric J., Kwong, Sarah M. B.S., Carvalho, Katelyn E. B.S., and Vanessa R. Yingling Ph.D, FACSM

California State University East Bay

Repeated and intentional loading of the skeletal system stimulates an adaptive osteogenic response. Body mass and bone strength are strongly associated because an increase in body mass increases loading on the skeletal system during locomotion. However, effective loading for bone adaptation includes dynamic loading and higher load rates, suggesting that a neuromuscular muscle fitness test may be a stronger predictor of bone strength (Rantalainen et al 2010).

PURPOSE: To examine whether peak vertical jump power at take-off is more predictive of bone strength indices (BSIc and SSIp) than body mass. We hypothesized that peak vertical jump power at take-off would be a more appropriate index of skeletal loading than body mass.

METHODS: 142 participants (79 F, 63 M) performed a maximal vertical jump test. Peak vertical jump power at take-off was calculated from maximal jump height using the Sayer's equation. Bone strength index in compression (BSIc) and polar strength strain index (SSIp) were measured using peripheral quantitative computed tomography (pQCT) on the dominant tibia at the 4% and 50% sites respectively. Two hierarchical multiple regression analyses were performed with bone strength indices (BSIc and SSIp) as dependent variables. In the first step age, height, body mass, and sex were entered into the model as the predictor variables, while peak vertical jump power at take-off was entered in the second step.

RESULTS: The correlations between peak power with BSIc and SSIp ($r= 0.643$, $r= 0.711$, $p< 0.001$) were higher than those between body mass with BSIc and SSIp ($r= 0.435$, $r= 0.658$, $p<0.001$). The first step of the regression model including sex, height, and body mass explained 42% ($p<0.001$) of BSIc variance and 58.7% ($p<0.001$) of SSIp variance. The addition of peak power to the regression model increased the explanatory power by 7.2% ($p<0.001$) for BSIc and by 1.1% ($p<0.001$) for SSIp. For BSIc, peak power contributed more to the model than body mass (i.e. 0.541 vs. -0.102 standardized β-values). For SSIp the contribution of body mass decreased by 12.9% and was similar to the effect of peak power (i.e. 0.257 ($p=0.006$) vs. 0.213 ($p=0.051$)).

CONCLUSIONS: Peak power, calculated from vertical jump height assessments, is a better surrogate for assessing and predicting bone strength compared to body mass.

29. Stress Levels in Relation to Indoor or Outdoor Physical Activity

Kamrani, Sheree[1], and Dunn, Sarah L., Ph.D.[2]

[1]University of La Verne, [2]California State University, San Bernardino

Purpose: The topic of mental health has recently become increasingly more prevalent due to the continuous rise of individuals suffering with different forms of mental illness. Stress can have both positive and negative effects which are constructed on one's perceptions, expectations, experiences, moods, and evaluations of the stressors. Despite the large number of research studies stating both physical activity (PA) and the natural outdoors (nature itself) independently can decrease an individual's stress, few previous studies have examined the links in the relationship between objectively measured outdoor PA and health outcomes. This allows for the further investigation to assess the influence PA (indoor or outdoor) would have on the perceived stress levels of undergraduate students.

Methods: Participants (N=12) were randomly invited to volunteer information for this research study. An electronic survey (Qualtrics, Provo, UT) was emailed out and was available to undergraduate participants for 4 weeks in the Fall 2019 semester at the University of La Verne. The perceived stress inventory measured the stress levels of a college students in addition to demographic questions developed by the researcher and the amount of time spent performing PA (vigorous, moderate and walking) indoors and/or outdoors in the last 7 days, using the International Physical Activity Questionnaire. Individuals were assigned to specific groups based upon which category they listed spending the most time in for PA with a difference of five minutes or more since benefits can occur within five minutes of exposure according to the literature.

Results: A nonparametric Mann-Whitney U Test indicated there was not a statistically significant difference, (P=0.07), although trending in overall perceived stress levels of both groups (outdoor/indoor PA). However, this study did indicate that individuals categorized as outdoor PA participants had a lower overall mean stress level (172.7 ± 61.2) than individuals categorized as indoor PA participants (276.0 ± 95.3), supporting the trending significance.

Conclusion: This study generated valuable insight on the factors influencing stress levels and how PA (outdoor/indoor) may help combat high stress levels. Future studies should consider that PA may be an effective clinical tool to combat stress and depression, supporting the idea that medical professionals should recommend regular PA as an alternative method to treating various mental illnesses.

30. Thoracic Spine Compression Fracture at T3: A BMX Biker Case Study

Kirchberg, Tyler BS[1] and Vitale, Kenneth, MD FACSM[2]

[1]University of California San Diego School of Medicine, [2]University of California San Diego, Department of Orthopedic Surgery

Background: Compression fractures are the most common fracture to the spine, often occurring as a result of high-energy forces or falls. Ninety percent of spinal fractures occur within the thoracolumbar junction (T11-L4), however they can occur throughout the spinal column. In sports related spinal injuries, Return to Play (RTP) protocol is important to ensure safe return to sports.

Case: A 24-year-old male Olympic BMX biker presented with upper thoracic back pain. While landing from a jump, the patient came down on his rear wheel and fell backwards, landing on his back with his bike falling on top of him. An MRI revealed an acute T3 compression fracture with 33% height loss, no retropulsion or paraspinal hematoma, and compression fracture deformities within the T2, T4, and T5 vertebral bodies. He had no associated neurologic symptoms and no breathing difficulty or associated thoracic injuries.

Discussion: Patients involved in high-energy trauma may sustain multiple injuries to the spine and thoracic cavity. In addition to spinal fractures, the differential diagnosis includes pulmonary, cardiac, and spinal cord injury. It is important to consider the possibility of fracture throughout the thoracic and lumbar vertebrae, and to have a low threshold for further workup in patients who present with thoracic spinal injury. Treatment after injury includes calcium and vitamin D, and avoiding thoracic flexion and weighted activities. The thoracic vertebrae are stabilized by ribs, so these patients often do not require a brace. It is recommended to avoid sports for at least 6 weeks, and to avoid contact/collision sports for 3 months. If patients then feel no pain upon resuming the activity, it is generally considered safe. An Olympic caliber athlete requires return to sport as soon as possible without placing themselves at additional risk of further injury. This requires a conversation with the physician, athlete, coach, and personal trainer, to weigh the benefits and costs of the full RTP protocol.

Conclusion: Spinal fractures due to trauma can occur throughout the thoracic and lumbar vertebrae, and further workup can reveal additional injury. Choosing when to release a patient who is an elite Olympic athlete back to a collision type sport is reliant on physician gestalt – there are arguments for and against a full RTP protocol.

31. Examining the Relationship Between the Borg Rating of Perceived Exertion and Heart Rate in Dancers

Melissa Lara, BS, Kathy Reyes, BS, and Danielle N. Jarvis, PhD, ATC

California State University, Northridge

Purpose: Borg Rating of Perceived Exertion (RPE) is a scale ranging from 6-20 representing a feeling of exertion when doing an activity where 6 is no exertion and 20 is maximal exertion.

Dance uses the aerobic and anaerobic energy systems. Therefore, the purpose of this study was to examine the relationship between RPE and heart rate (HR) during a contemporary dance performance. We hypothesized no relationship between RPE and HR during a high-intensity dance performance fitness test (HIDPFT).

Methods: 17 healthy females with 5+ years of training in ballet, jazz, or contemporary dance were recruited (Table 1).

Table 1. Demographic characteristics of participants

Age	21.94 ± 3.82 years
Height	1.62 ± 0.08 m
Weight	67.06 ± 12.51 kg
Years of dance training	16.18 ± 4.54 years
Times completed dance sequence	5.18 ± 2.65

Following a five-minute rest to achieve baseline HR, participants performed the HIDPFT then provided RPE after each repetition while HR was simultaneously recorded using a Polar HR monitor. The trial ended when RPE of ≥17 was given, the dancer could not maintain correct technique, tempo, or verbally indicated they could not continue. A paired t-test was used to compare the predicted HR by using the Borg RPE scale and the actual HR. Spearman's rank-order correlation was run to establish the relationship between HR and RPE during the dance performance.

Results: There was a statistically significant difference between Borg-predicted HR and actual HR during the HIDPFT ($p<0.001$). There was a very weak positive correlation between RPE and HR, which was statistically significant ($r_s(88)=0.248$, $p=0.020$).

Figure 1 A weak positive correlation between HR and RPE

Conclusion: The data demonstrated a very weak relationship between RPE and HR during the HIDPFT. Although studies have shown a strong correlation between RPE and HR, this relationship was not seen in dancers. The Borg-predicted HR was not accurate in dancers; therefore, HR is not suitable to monitor fatigue status in dancers. Future studies could monitor fatigue in dancers by measuring blood lactate or using subjective questionnaires throughout dance performance. Analyzing HR and Borg's RPE help determine the validity and reliability of the test in dancers while also determining a method to effectively monitor dancers to prevent extreme exhaustion and increased injury risk.

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32. Effects of a 4-Week Dynamic Balance Training with Stroboscopic Glasses on Postural Control in Chronic Ankle Instability Patients

Lee, Hyunwook, M.S., Han, Seunguk, M.S., Seeley, Matthew, Ph.D., Bruening, Dustin, Ph.D., and Hopkins, Ty, Ph.D.

Brigham Young University

Purpose: Individuals with chronic ankle instability (CAI) rely more on visual information during postural control due to impaired proprioceptive function, which may increase the risk of injury. Stroboscopic glasses may help decrease visual reliance during postural control. The purpose of this study was to identify effects of the balance training on the reliance of visual information.

Methods: This study was a randomized controlled trial. Twenty-eight CAI patients were randomly assigned to one of 2 groups: a strobe group (6 males and 8 females) or a control group (8 males and 6 females). The strobe group wore stroboscopic glasses during the training, while the control group did not. There are 4 different main outcome measures including self-reported function measures, static postural control, and Dynamic Postural Stability Index (DPSI), the Star Excursion Balance Test. There were 3 visual conditions in the static postural control (eyes-open (EO), strobe vision (SV), and eyes-closed (EC)), and 2 conditions in the dynamic postural control (EO and SV). Two-way randomized block ANOVAs were used to assess changes in postural control in each group and condition by using pretest-posttest mean differences.

Results: The strobe group showed a higher difference in center of pressure velocity in medial-lateral direction (VelML) and vertical stability index (VSI) under the SV condition compared with the control group (VelML: 1.10 ± 0.85 vs. 0.32 ± 0.47 (cm/s), $p = .005$ and VSI: 0.19 ± 0.15 vs. 0.02 ± 0.08, $p = .004$). In addition, the strobe group had significant decreases in VelML (1.83 ± 0.28 vs. 1.46 ± 0.36 (cm/s), $p = .0001$), DPSI (0.48 ± 0.10 vs. 0.33 ± 0.08, $p = .01$), and VSI (0.25 ± 0.08 vs. 0.20 ± 0.07, $p = .005$) at the posttest compared with the pretest.

Conclusion: The results may indicate that when vision was partially or completely blocked, the strobe group could use other sensory information, such as somatosensory and/or vestibular information, to maintain their static postural control successfully. Thus, the 4-week dynamic balance training with stroboscopic glasses improved postural control and altered visual reliance in patients with CAI.

33. The Effect of Lumbar Support on Holding Shoulder Electromyography and Trunk Kinematics in Collegiate Violinists

Lee, Lauren Elizabeth [1], Soucy, Michael T. M.S. [2], Enstrom, Kevin M.A. [1], and Feltner, Michael E. PhD, FACSM [1]

[1]Pepperdine University, [2]Oregon State University

Instrument-specific holding mechanics in violinists likely contribute to a high incidence of playing related musculoskeletal disorders (PRMDs). The inclusion of a lumbar support while playing may alleviate potential risks for PRMDs.

PURPOSE: To investigate the effects of lumbar support on left holding shoulder musculature electromyography (EMG) activity and thigh, trunk, and hip kinematics.

METHODS: Eleven (6 F; 5 M) collegiate musicians (19.5±1.3 years, 1.71±0.1 m, 68.1±7.7 kg, playing experience: 10.0±3.9 years, weekly playing time: 14.1±8.2 hours) gave voluntary informed consent and performed Prelude from Suite No. 1 in G Major (JS Bach, BWV 1007) with and without a lumbar support. Average and normalized mean RMS EMG activation for eight shoulder muscles were determined for both the beginning (measures 1–4) and end sections (measures 39–42) of the piece. Mean absolute hip kinematic values were calculated from absolute trunk and thigh angles and computed at 20% normalized time intervals during each music section. Repeated measures ANOVAs were used to assess the effects of lumbar support and time (beginning and end sections) on shoulder musculature EMG and hip kinematics.

RESULTS: Significant differences ($p<0.05$) were observed in EMG activation between the beginning section and end section for the anterior deltoid, lower trapezius fibers, pectoralis major, and biceps brachii. A nonsignificant trend of higher EMG activation was observed in the beginning section for holding shoulder musculature EMG with the exception of the triceps brachii. Neither section nor lumbar support altered any kinematic measures.

CONCLUSION: The task of playing a violin and the resultant natural dynamic movement that occurs during a music performance was not altered by the presence of absence of a lumbar support. Thus, a lumbar support likely has minimal effect on the risk of PRMDs in violinists.

34. Mallet Thumb After Mountain Biking: Indications for Conservative vs. Surgical Treatment

Lee, Tonya, BS and Vitale, Kenneth, MD FACSM FAAPMR CAQSM

University of California, San Diego

History: A 61-year-old EM physician presented to the clinic 2 days after falling from his mountain bike onto his hand, causing a forced hyperflexion injury of the thumb. He immediately developed pain in the right thumb IP joint and feelings of weakness.

Physical Exam: Tenderness and swelling of the right thumb at the IP joint. Loss of active IP joint extension; full passive IP extension noted.

Tests and Results: Radiographs showed no fracture; mild flexion deformity seen of the thumb at the IP joint.

Treatment and Outcome: The patient was instructed to maintain splinting of the thumb in maximal hyperextension for 6 weeks, with removal only for hygiene and splint changes every few weeks. He was counseled that mild flexion deformity was still possible following splinting. As his job required significant hand dexterity, surgical options were also discussed in detail, specifically Kirschner wire pinning with the wires left either external or internal. After a consultation with an orthopedic surgeon, the patient opted to continue with conservative management and was noted to be progressing well at his most recent visit including return to mountain biking.

Discussion: While mallet finger is common, mallet thumb is a rarely seen injury resulting from hyperflexion or trauma to the thumb. Its rarity precludes a standardized protocol for treatment, but previous case reports suggest that both conservative and surgical treatment options can lead to satisfactory recovery of thumb extension. In a mallet finger injury, conservative management is used for closed injuries and surgery for open injuries or fracture of >30% of the articular joint surface. Given that mallet thumb rarely presents with subluxation, and surgery following delayed presentation does not show increased complications, conservative management may be the more suitable initial treatment. Conservative treatment involves ensuring compliance with continuous splint use, as well as educating patients about the possibility of failure of full extension after splinting. The higher cost of surgery, and surgical risks including infection, necrosis, and secondary subluxation, must also be considered. On the other hand, failure of conservative treatment and shorter recovery time are indications for surgical treatment such as Kirschner wire pinning. Multi-center studies are needed to further elucidate the best course of treatment for mallet thumb.

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35. Gestational long-term hypoxia induces metabolomic reprogramming and phenotypic transformations in fetal sheep pulmonary arteries

Leslie, Eric[1], Lopez, Vanessa[2], Anti, Nana, A.O.[3], Alvarez, Rafael[4], Kafeero, Isaac[4], Welsh, Donald, G.[5], Romero, Monica[3], Kaushal, Shawn[3], Johnson, Catherine[6], Bosviel, Remy[7], Blazenovic, Ivana[8], Song, Rui[3], Brito, Alex[9], La Frano, Michael, R.[6,8,10], Zhang, Lubo[3], Newman, John, W.[7,11,12], Fiehn, Oliver[7,13], and Wilson, Sean, M.[3,14]

[1]University of New Mexico, Albuquerque, [2]APS Stride Fellowship program, [3]Loma, Linda University School of Medicine, [4]Center for Health Disparities and Molecular Mechanisms Research Fellowship Program, [5]Robarts Research Institute, Western University, Canada, [6]California Polytechnic State University, San Luis Obispo, California, USA, [7]NIH West Coast Metabolomics Center, UC Davis Genome Center, [8]Center for Health Research, California Polytechnic State University, San Luis Obispo, [9]Laboratory of Pharmacokinetics and Metabolomic Analysis, Institute of Translational Medicine and Biotechnology, I.M. Sechenov First Moscow State Medical, University, Moscow, Russia, [10]Cal Poly Metabolomics Service Center, California Polytechnic State University, San Luis Obispo, [11]Department of Nutrition, University of California Davis, [12]USDA-ARS Western Human Nutrition Research Center, [13]West Coast Metabolomics Center, University of California Davis, [14]Advanced Imaging and Microscopy Core, Department of Basic Sciences Loma, Linda University

Purpose: Gestational long-term hypoxia increases the risk of myriad diseases in infants including persistent pulmonary hypertension. Similar to humans, fetal lamb lung development is susceptible to long-term intrauterine hypoxia, including effects of high-altitude (>3801 m), with structural and functional changes associated with the development of pulmonary hypertension including pulmonary arterial medial wall thickening and dysregulation of arterial reactivity, which culminates in decreased right ventricular output. As a preliminary exploration of the mechanisms associated with hypoxia-induced aberrations in the fetal sheep lung, we examined the premise that metabolomic changes and functional phenotypic transformations occur due to long-term intrauterine hypoxia.

Methods: To address this, we performed electron microscopy, western immunoblotting, calcium imaging, and metabolomic analyses on pulmonary arteries isolated from near-term fetal lambs that had been exposed to low- or high-altitude hypoxia for the latter 110+ days of gestation.

Results: Our results demonstrate that the sarcoplasmic reticulum was swollen with larger luminal width and distances to the plasma membrane in the hypoxic group. Hypoxic animals presented with higher endoplasmic reticulum stress and suppressed calcium storage. Metabolically, hypoxia was associated with lower levels of multiple omega-3 polyunsaturated fatty acids and derived lipid mediators (e.g. eicosapentanoic acid, docosahexaenoic acid, alpha-linolenic acid, 5-HEPE, 12-HEPE, 15-HEPE, and PGE3,19(20)-EpDPE), and higher levels of some omega-6 metabolites ($p<0.02$) including 15-Keto PGE2 and linoleoylglycerol.

Conclusions: Collectively, the results reveal broad evidence for long-term hypoxia-induced metabolic reprogramming and phenotypic transformations in the pulmonary arteries of fetal sheep, conditions that likely contribute to the development of persistent pulmonary hypertension.

Funding support from NIH.

36. Behavioral Content Analysis of Electronic Activity Monitors for Informed Device Selection

Zakkoyya H. Lewis, Ph.D., Maddison Cannon, B.S., Grace Rubio, B.S.[1], Maria C. Swartz, Ph.D.[2], and Elizabeth J. Lyons, Ph.D.[3]

[1]California State Polytechnic University Pomona, [2]MD Anderson Cancer Center, [3]University of Texas Medical Branch

Purpose: Behavioral interventions often incorporate technology to promote physical activity. One commonly used technology is the electronic activity monitor. Previous research shows that electronic activity monitors implement behavior change techniques, but the techniques available in newer monitors are unknown. Furthermore, there is limited support on selecting an electronic activity monitor that meets research needs. The aim of this study was to perform a content analysis of electronic activity monitors that also evaluates utility features, code behavior change techniques included in the monitoring systems, and align the results with intervention functions of the Behaviour Change Wheel program planning model to facilitate informed device selection.

Methods: Devices were coded for the implemented behavior change techniques and device features. Three trained coders wore each monitor for at least 1 week from December 2019-April 2020.

Results: Apple Watch Nike, Fitbit Versa 2, Fitbit Charge 3, Fitbit Ionic—Adidas Edition, Garmin Vivomove HR, Garmin Vivosmart 4, Amazfit Bip, Galaxy Watch Active, and Withings Steel HR were reviewed. The monitors all paired with a phone/tablet, tracked exercise sessions, and were wrist-worn. The battery life of devices ranged from 1-2 days to ≥7 days. On average, the monitors implemented 27 behavior change techniques each. Fitbit devices implemented the most behavior change techniques, including techniques related to the intervention functions education, enablement, environmental restructuring, coercion, incentivization, modeling, and persuasion. Garmin devices implemented the second highest number of behavior change techniques, including techniques related to enablement, environmental restructuring, and training.

Conclusion: Researchers can use these results to guide selection of electronic activity monitors based on their research needs.

37. Case Study: The Effect of Stride Frequency on the Over Ground Running Performance and Running Dynamics

Lim, Boram., and Mercer, John A. FACSM.

University of Nevada, Las Vegas

There is a gap in the literature regarding the relationships between stride length (SL), stride frequency (SF), running velocity, and running performance. The majority of research on these relationships is based upon treadmill running. Although the overall running pattern is similar when running on a treadmill vs. overground, there are unique differences. Besides, there is a little study to focus on measuring the time to completion and running dynamics depend on SF variations during overground running.

Purpose: To investigate the effect of change in SF on time to complete a specific distance and running dynamics during overground running.

Methods: One male subject (176cm, 79kg) completed total three overground running sessions at the somewhat hard intensity. The given running distance was 2.4km (1.5 miles) and the participant was instructed to run the same route in three running conditions; running with preferred SF (PSF), faster SF (PSF+5%), and slower SF (PSF–5%). The first session was running with PSF, then 2nd and 3rd sessions were running with a target SF while listening metronome sound using earbuds. Running dynamics (i.e., SL, SF, ground contact time: GCT, and vertical oscillation: VertO) were measured using a running pod (Running Dynamics Pod, Garmin), heart rate (HR) and running time were measured using an external heart rate strap (HRM-Tri™, Garmin) and a sport watch (Forerunner 735XT, Garmin), respectively.

Results: The participant ran faster at the PSF+5% than other conditions (PSF: 11 secs, PSF-5%: 1 min 33 secs). Both SL and GCT did not change noticeably across SF conditions. The VertO was highest at PSF condition and decreased in both conditions other than PSF. HR was reliable range across the SF conditions.

Conclusions: A slightly higher SF allows recreational runner to run faster in overground running (2.4km). The runner has a tendency of maintaining SL and GCT regardless of SF variations. This case study may give an insight into how SF affects running pace and running characteristics.

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38. Yes, You Can Become the Bionic Man

Liu, Steven[1] and Vitale, Kenneth FACSM[2]

[1]Eastern Virginia Medical School, [2]University of California, San Diego

Introduction: If a patient who came in with multitude of invasive procedures and fractures, what kind of condition would you expect? The expectation would be that the patient has decreased function. There is a question of how much can be regain close to normal from different injuries or procedures. Here is a patient, who had joint replacements in shoulders, hips, knees, cervical spine surgery x3, lumbar spine surgery, elbow arthroscopy, and shoulder rotator cuff arthroscopy and repair reported to having a relatively good overall quality of life and daily functioning.

Case Description/ clinical course: A healthy, elderly patient presented in 2017 with levoconvex scoliosis of the thoracolumbar. History of arthritis, atrial fibrillation and flutter, complete tear of right rotator cuff, hypertension, osteoarthritis, preoperative clearance, and prostate cancer.

L3-L5 laminectomy, foraminotomy and facetectomy, and posterior decompression, incidental durotomy at L3-4 in 2016. 3 cervical spine surgeries. Bilateral total hip arthroplasty, cardiac surgery, right elbow arthroscopy, shoulder arthroscopy and repair of the rotator cuff tear on his arthroplasty.

Diaphragm paralysis active work up with noted high risk: 42.1% pulmonary complication rate per note.

Treatment and outcome:

- PT after his diagnosis of back and right shoulder/weakness/scapular pain in 2017

- Shoe lift on the right which leveled out his hips and his walking tolerance and distance has increased.

- 2018 continued nonsurgical management with consistent active lifestyle and PT along with R T12-L1 TF ESI and R piriformis injection.

- Continued to have lower back pain considering continuing nonsurgical management vs. surgery: T12-L1 TLIF, cage, BMP, right L2-S1 laminectomies and foraminotomies

Discussion: Despite having all major orthopedic procedures on all joints of his body, the patient reported having a relatively good overall quality of life and daily functioning. While each surgery and the associated recovery was a “set him back” for several months at a time, he continues to have a positive outlook and feels that each surgery had given him a boost in overall function and quality of life.

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39. The Impact of Tactical Load and an Occupationally-Specific Mobility Task on the Marksmanship of Police Force Tactical Operations Officers

Lockie, Robert G., Ph.D.[1], Mitchell, Kyle, D.Phty.[2], Hernandez, Erika, B.Sc.[1], Ruvalcaba, Tomas J., B.Sc.[1], McGuire, Megan B., B.Sc.[1], Dawes, J. Jay, Ph.D.[3], and Orr, Robin M., Ph.D.[2]

[1]California State University, Fullerton, [2]Bond University, [3]Oklahoma State University

INTRODUCTION: Specialist tactical operations police officers need to carry heavy loads, including body armor, firearms, and communication devices. Critical job tasks must be successfully completed with these loads, even though task performance (e.g. marksmanship) could be impacted.

PURPOSE: To investigate the impact of tactical load and an occupational mobility task on the marksmanship of police force tactical operations officers.

METHODS: Six officers (service time = ~11 years; time on team = ~4 years) conducted marksmanship tests following either static or mobile trials in unloaded (UL) and tactically loaded (TL) conditions. The UL condition comprised fatigues, boots, and a primary (M4 carbine assault rifle) and secondary (9-mm Glock pistol) weapon. The TL condition also included body armor, helmet, and communications equipment (mass = ~23 kg). The static trial involved officers engaging a circular target from a 6 m distance using their secondary weapon. Officers began with their primary weapon held into the shoulder in a firing position on a designated firing line. On the command 'target up', the officer slung their primary weapon, unholstered their secondary weapon, and engaged the target with 5 shots. The mobility trial consisted of a 25 m course replicating an occupational scenario (10 m sprint, tactical move through 2 doorways, stair descent, tactical move through a doorway, target approach) while the primary weapon was held in a shouldered position. On arrival at the firing line, officers were cued as per the static trial. Marksmanship was assessed by distance to center of target (DCOT), and X and Y displacement. Paired t-tests evaluated differences between the static and mobile UL and TL conditions (conditions were analyzed separately).

RESULTS: No marksmanship differences ($p = 0.259$-0.710) were found between the UL conditions. In the TL condition, X displacement was significantly ($p = 0.048$) greater for the mobile trial (~78 mm) compared to the static trial (~46 mm). No differences ($p=0.594$-0.618) were found for DCOT and Y displacement.

CONCLUSIONS: A tactically loaded mobility task impacted marksmanship measured by X displacement. Factors related to load carriage, such as the armor width and shoulder range of motion restrictions imparted by the armor, may have had an impact on horizontal shot variation.

40. Comparison of Army Physical Fitness Test Outcomes of Reserve Officers' Training Corps Cadets Across Academic Year

McGuire, Megan B., B.S.[1], Dawes, J. Jay, Ph.D.[2], Scraper, Jacob R.2, and Lockie, Robert G., Ph.D.[1]

[1]California State University, Fullerton, [2]Oklahoma State University

INTRODUCTION: Reserve Officers' Training Corps (ROTC) programs are implemented at universities across the US in order to prepare individuals for commissioning into the US Army. Cadets in these programs follow the same fitness standards as active duty soldiers and currently must pass the Army Physical Fitness Test (APFT) in order to commission. Scores on the APFT are scaled to age and sex, and individuals must receive a total scaled score of at least 180 (out of 300) to pass. As soldiers are expected to do the same job tasks regardless of age or sex, scaling the scores could put those with lower entry scores at a higher risk of injury and attrition from basic training. Comparing ROTC cadets based on their military science (MS) level (academic year in the program) could allow the training officers to individualize the training program to the needs of the cadets.

PURPOSE: To investigate the differences in performance on APFT events across MS level of ROTC cadets.

METHODS: 107 cadets (31 F, 76 M) enrolled in a university ROTC program participated in a diagnostic APFT. The test consisted of 2 minutes of maximal push-ups, sit-ups, and a timed two-mile run. Cadets were separated according to their MS level for analysis. A one-way analysis of variance with a Bonferroni post hoc for multiple comparisons ($p \leq 0.05$) was used to compare the means of performance tests.

RESULTS: No significant differences were found when comparing MS2 to MS3 or MS4, or comparing MS3 to MS4. MS1 cadets performed significantly worse on all fitness tests compared to all other MS levels. MS1 cadets completed 27-33% fewer push-ups ($p = 0.01$-0.02), and 19-30% fewer sit-ups ($p \leq 0.01$-0.05) relative to all other MS levels. MS1 cadets were significantly outperformed on the 2-mile run task by the MS4 cadets (12% slower; $p = 0.05$). The MS1 cadets had total scaled scores 23-31% lower relative to the MS3 and MS4 cadets ($p \leq 0.01$).

CONCLUSIONS: MS1 cadets were significantly outperformed on all events when compared to all higher MS levels. On average, the MS1 cadets did not receive a passing total score (171.5 ± 70.2). As the Army transitions to a more comprehensive fitness standard, cadets entering and exiting the ROTC program must ensure that they are placing sufficient focus on their physical fitness. This is particularly important for MS1 cadets, who likely will have lower levels of fitness.

41. Impact of College Weight Gain on Central Blood Pressure and Arterial Stiffness

Joshua Miner, Riley Morton, Malia B Nowlen, Irma S Maldonado, Kyli D Alvarez, and Zachary Zeigler

Grand Canyon University

Purpose: The transition from high school to college is a critical point when the risk for weight gain is higher than at any other period. Weight gain, independent of BMI, has been shown to increase blood pressure (BP). Prior research has shown that weight gain in college students provoked an increase in peripheral BP. Central BP has proven to be superior to peripheral BP in predicting cardiovascular (CV) risk. The role of college weight gain (CWG) on central BP.

Methods: Healthy young adults ages 18-30 yr. were recruited from Grand Canyon University campus. Each subject came to the lab for a single visit and was asked to complete the WALI to assess CWG. The WALI has shown to be reliable in reporting the total amount of weight gained or lost (R=.87 P<0.001). Subjects then had resting brachial, and central BP measured using the SphygmoCor XCELTM following validated procedure.

Results: Fifty-five male and sixty-five female subjects aged 21.2±3.1 yr. completed this study. The average CWG was 13.3±16.3 lbs. Hierarchical regression analysis with age, gender, and BMI were entered into the first model. All these, combined with CWG, were used for the second model. Model one significantly predicted both systolic BP (R=0.388, P=0.001) and diastolic BP (R=0.302, P=0.027). Model two significantly added to model one in both systolic BP (R=0.429, P=0.010) and diastolic BP (R=0.337, P=0.040). Model one also significantly predicted central systolic BP (R=0.311, P<0.001) and central diastolic BP (R=0.274, P=0.013). Model two significantly explained more variance in both central systolic BP (R=0.353, P=0.020) and central diastolic BP (R=0.303, P=0.081).

Conclusion: In conclusion, in addition to BMI, age, and gender, CWG is an independent predictor of brachial and central BP.

42. Skipping Kinematics in College Students With and Without Autism Spectrum Disorder

Munoz Orozco, Isabel, Hernandez, Kimberly, Mata, Joevanie, and Jarvis, Danielle, Ph.D., ATC

California State University, Northridge

Introduction: In comparison to typically developing children, individuals with Autism Spectrum Disorder (ASD) exhibit deficits in gross motor skill performance. It is predicted that these motor skill deficits may contribute to lower levels of physical activity in the ASD population which may result in sedentary behavior. However, it is unknown if motor skill deficits persist into adulthood.

Purpose: The purpose of this study was to compare the skipping kinematics of college students with and without ASD to identify potential motor deficits.

Methods: In this case study, a total of 4 participants, 2 with ASD and 2 without ASD provided consent; they were then provided a demonstration of skipping and completed four skipping trials. Data was collected by placing reflective markers on participants' head, trunk, arms, pelvis, legs, and feet to capture data using a 12-camera motion capture system at 120 Hz. Data was processed using Cortex, Visual 3D, and Matlab software. Center of mass excursion and peak hip, knee, and ankle joint angles in the sagittal plane of the dominant leg were extracted and examined between groups. Due to the small sample size, no statistical analyses were run at this stage.

Results: We found that the two control participants notably used less side-to-side displacement than ASD participants (0.02 and 0.03 compared to 0.09 and 0.06 for ASD). Three of the participants had similar vertical displacement with one control participant using less vertical displacement. Joint angles for the hip, knee, and ankle during the stance phase of skipping demonstrated similar kinematic curves across participants, with the exception of one control participant who used a toe-strike strategy at the ankle rather than a heel-strike strategy.

Conclusions: It is important to note that any patterns seen between the participants is not conclusive as further analysis of a larger sample of participants is necessary. However, it appears there may be some trends potentially indicating deficits in skipping performance in individuals with ASD.

43. Influence of COVID-19 Pandemic on Mental Health, Stress, Energy, and Sleep in Undergraduate Students

Nitahara, Kayla[1]; Doan, Alan[2]; and Vitale, Kenneth M.D. FACSM[2]

[1]Columbia University, [2] University of California, San Diego

Purpose: We wanted to assess if there is any relationship between the COVID-19 pandemic and impact on mental health, stress levels, energy levels, and sleep habits within the college student populace.

Methods: Non-athlete and athlete participants from both the University of California, San Diego and Columbia University, volunteered to complete an online questionnaire that contained general questions (school, age, sex, location before and after the pandemic), questions about amount and type of exercise before and after pandemic, and lastly, questions regarding the pandemic's impact on each individual's mental health, stress levels, and other factors.

Results: There was no significant difference found between sexes or institutions of attendance. While, for both athletes and non athletes, there were few statistically significant relationships between change in exercise and the assessed factors (mental health, stress, energy, sleep), the correlations between the pandemic's influence on the assessed factors were all strong (>.50). Small sample size, voluntary participation, and use of questionnaires to collect data could have affected the differences between athletes and non athletes and might not have been representative of the population.

Conclusions: While most of the assessed factors did not present individually significant relationships with the participants' various changes to exercise routine, when compared to one another, there were very strong correlations noted. This suggests that the pandemic had a negative effect on all of the factors, and the factors could have a cumulative effect on exercise.

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44. 10-Year Weight Gain in 13,423 U.S. Adults: Differences Across Age, Sex, and Race

Parker, Kayla, and Tucker, Larry, Ph.D., FACSM

Brigham Young University

Purpose: To determine the extent weight gain over 10 yrs differs across levels of age, sex, and race in 13,423 women and men representative of all U.S. adults.

Methods: Data from the National Health and Nutrition Examination Survey (NHANES), 2011-2018, were used to answer the research questions. Participants were selected using a multi-stage, random sampling strategy. The study was retrospective in design. Subjects were weighed while dressed in underwear covered by a paper gown. They also reported their weight when they were 10 yrs younger. The difference between the weights was used to determine weight change across the previous decade. NHANES defined race as Mexican American (MA); Other Hispanic (OH); Non-Hispanic White (White); Non-Hispanic Black (Black); Non-Hispanic Asian (Asian); or Other Race/Multi-Racial (OMR). Adults with extreme BMIs were not included (BMI < 18.5 or > 50). Although the sample size was large, degrees of freedom (df) in the denominator for each statistical test was 62 because of nesting.

Results: Average (±SE) age was 54.6±0.2 yrs and mean 10-yr weight gain was 4.0±0.2 kg. A total of 6860 (51.6%) were female. For race, frequencies were: MA (n=1819, 7.4%), OH (n=1516, 5.8%), White (n=4740, 67.7%), Black (n=3139, 10.6%), Asian (n=1775, 5.4%), and OMR (n=434, 3.2%). N and % do not agree because “n” is the raw sample size, whereas “%” denotes weighed values, which represent the U.S. population. With sex and race controlled, age was related to 10-yr weight gain in a dose-response manner ($F=65.8$, $P<0.0001$). Mean weight gain (±SE) for each age group was: 36-39 yrs (7.3±0.5 kg); 40-49 yrs (6.0±0.3 kg); 50-59 yrs (4.2±0.3 kg); 60-69 yrs (2.0±0.4 kg); and 70-79 yrs (0.3±0.4 kg). Each age group differed significantly in weight gain from each other age group. For sex, with age and race controlled, women (5.2±0.3 kg) gained significantly more weight than men (2.4±0.2 kg) over the 10 yrs ($F=79.6$, $P<0.0001$). With age and sex controlled, 10-yr weight gain differed among races ($F=20.0$, $P<0.0001$). Blacks (5.8±0.3 kg) gained significantly more weight than each other race, and Asians (2.1±0.2 kg) gained significantly less weight than each other race, except OMR. Other races did not differ in their 10-yr weight gains.

Conclusion: In 13,423 adults, representative of all U.S. women and men, 10-yr weight gain (kg) is strongly related to age, sex, and race, with disproportionate weight gains in the young, females, and Blacks.

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45. Effects of a Personalized Six-Week Exercise Program on Senior Citizens' Physical Activity Levels and Cardiometabolic Health

Peltonen, Garrett L., Heinze Alvarado, Annely, and Sato, Takahiro

Western New Mexico University

The cardiometabolic benefits of physical activity in senior populations are well documented; however, exercise training itself may lead to a compensatory decrease in physical activity, limiting the benefits of some exercise interventions.

PURPOSE: We tested the hypothesis that a community-based, personalized, exercise program would increase physical activity levels and improve cardiometabolic health among senior citizens.

METHODS: Four senior citizens (1M/3F; 75 ± 5 years) completed a personalized, exercise training program that consisted of meeting with a trainer for 60 minutes, twice a week, for six weeks. An accelerometer quantified physical activity during the six-week exercise program and for two weeks following cessation of the program. Pre- and post-intervention physical fitness and body composition were determined with the Senior Fitness Test and anthropometric measures, respectively. Metabolic health was assessed by measuring circulating plasma lipids (total cholesterol, high-density lipoprotein, low-density lipoprotein, and triglycerides) and glucose, and determination of blood pressure.

RESULTS: In support of our hypothesis, physical activity levels were greater during the exercise program compared to the two weeks following cessation of the exercise program. (10,116 ± 2,762 vs 8,980 ± 3,241 steps/day; $p = 0.04$). Physical fitness improved as determined by the Senior Fitness Test (chair stand test: 18 ± 4 vs 29 ± 7 repetitions, $p = 0.02$; back scratch test: -3 ± 11 vs 2 ± 10 centimeters, $p = 0.04$; 8-foot up and go test: 4.6 ± 0.5 vs 3.6 ± 0.6 seconds, $p = 0.04$) and mean arterial blood pressure decreased (92 ± 13 vs 87 ± 12 mmHg, $p = 0.03$). There were no changes in circulating plasma lipids, or glucose.

CONCLUSIONS: These preliminary data indicate that a six-week, community-based, personalized, exercise program offered to senior citizens is an effective method to increase physical activity levels and improve cardiometabolic health.

Support: Western New Mexico University Research Grant

46. Delayed Interventions, Low Compliance, and Health Disparities Amplified the Early Spread of COVID-19

Aliea M. Jalali[1, 2], Sumaia G. Khoury[1], JongWon See[1], Alexis M. Gulsvig[1], Brent M. Peterson[1], Richard S. Gunasekera[1], Gentian Buzi1, Jason Wilson[1], and Thushara Galbadage[1]

[1]Biola University and [2]Grand Canyon University

The United States (US) public health interventions were rigorous and rapid, yet failed to arrest the spread of the Coronavirus Disease 2019 (COVID-19) pandemic as infections spread throughout the US. Many factors have contributed to the spread of COVID-19, and the success of public health interventions depends on the level of community adherence to preventative measures. Public health professionals must also understand regional demographic variation in health disparities and determinants to target interventions more effectively. In this study, a systematic evaluation of three significant interventions employed in the US, and their effectiveness in slowing the early spread of COVID-19 was conducted. Next, community-level compliance with state-level stay at home orders was assessed to determine COVID-19 spread behavior. Finally, health disparities that may have contributed to the disproportionate acceleration of early COVID-19 spread between certain counties were characterized. The contribution of these factors for the disproportionate spread of the disease was analyzed using both univariate and multivariate statistical analyses. Results of this investigation show that delayed implementation of public health interventions, a low level of compliance with the stay at home orders, in conjunction with health disparities, significantly contributed to the early spread of the COVID-19 pandemic.

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47. The Mechanical Interaction of Bone and Muscle in Postmenopausal Women

Prince, William, Rosas, Holli, Mejia, Ana, Iporac, Adrienne, Huatran, Johnny, Moradi, Sheida, and Chen, Zhaojing, Ph.D.

California State University, San Bernardino

During physical activity, muscle contraction exerts mechanical loading on the bone. This mechanical loading activates the Wnt/β-catenin pathway in osteocytes, which is important for the regulation of bone mass and osteocyte transmission to cells on the surface of bone (Kramer et al. 2010). Bone loss increases with aging and elderly women are at the highest risk of osteoporosis and fractures due to menopause.

Purpose: To examine the relationships between bone mineral density and muscular fitness in postmenopausal women.

Methods: Twenty-one female participants aged 50 to 77 years old completed the study. Bone mineral density at total body, lumbar spine, dual femur and dual forearms were measured by Dual Energy X-ray Absorptiometry (DXA). Muscular fitness was assessed by vertical jump, gait speed, grip strength, Fall Risk Assessment, and one-repetition maximum (1-RM, modified Ab Crunches, Hip Abduction, Chest Press, Leg Press, Lat Pulldown, and Leg Extension). Participants were classified into Normal BMD (NOR, T-score > −1) and Low BMD (LOW, T-score ≤ −1) groups according to WHO definition.

Results: Left femoral neck BMD was significantly correlated with jumping power ($p = 0.04$, $r = 0.452$). The NOR group had significantly greater body weight ($p = 0.030$), total body lean mass ($p = 0.003$), jumping force ($p = 0.016$), jumping power ($p = 0.021$) and Lat Pulldown 1-RM ($p = 0.005$) compared to the LOW group (Table 1).

Conclusion: Our results suggest that postmenopausal women with normal bone density had significantly better muscular fitness than those with low bone density.

Table 1. Comparison of Muscular Fitness based on Bone Mineral Density (Mean ± SD)

Variables	NOR (n=12)	LOW (n=9)	*p*
Grip Strength (kg)	28.7 ± 3.9	25 ± 5.8	0.096
Gait Speed (m/s)	1.3 ± 0.2	1.4 ± 0.2	0.291
Lats Pulldown (kg)	38.1 ± 5.9**	29.7 ± 6.0	0.005
Max Jump Force (N)	1393.1 ± 219.4*	1133.9 ± 225.4	0.016
Max Jump Power (W)	2265.8 ± 323.8*	1916.9 ± 299.2	0.021

48. An Evaluation of Nutrition Knowledge Among NCAA Collegiate Athletes

Quintanilla, Alyssa, MS, Gabrielle Teitelbaum, MS, Rachel E. Blaine, DSc, MPH, RD, Brooke Dekofsky, MPH, RD, and Michelle T. Barrack, PhD, RD, CSSD

California State University, Long Beach

Despite an increase in snack accessibility, due to the 2014 NCAA Deregulation of Feeding, and subsequent increase in university fueling stations, collegiate athletes struggle to meet their nutritional needs, which may be related to a lack of nutrition knowledge.

PURPOSE: To evaluate the nutrition knowledge among NCAA collegiate

athletes and the differences according to gender, sport type, and grade classification.

METHODS: Male and female student athletes, competing in a variety of NCAA sport teams, were invited to complete a 10-item web-based survey, adapted from the validated 49-Sports Nutrition Knowledge Instrument (SKNI). The 49-SKNI consists of 49 true or false questions and statements broken down into six categories. Athletes were classified by gender, sport type, grade classification, and major (health related or non-health related).

RESULTS: A total of 28 athletes (female, n = 26; male, n = 2) completed the nutrition knowledge survey. Results indicated that the mean nutrition knowledge score of all participants was 59% (lowest score being 20% and highest score being 100%). No statistically significant differences in nutrition knowledge scores were observed between athletes based on grade, sport, or major. The two questions with highest frequency of correct responses (89% and 93%, respectively) addressed the athlete's plate and nutrition for training and body composition. Four questions were answered correctly by <50% of athletes and covered the sports nutrition topics of the athlete's plate, role of macronutrients, and nutrition for training and body composition.

CONCLUSION: The results of this study provide support for the potential need of a nutrition education program to support NCAA Division I collegiate athlete’s knowledge regarding the nutrients needed to support optimal fueling for recovery, performance, and health.

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49. Frontal Plane Knee Mechanics During A Loaded and Unloaded Squat in Individuals With and Without Patellofemoral Pain

Quiroz, Kayla, Andani, Maria Stacia, and Roper, Jenevieve Ph.D.

Loyola Marymount University

Individuals with patellofemoral pain (PFP) often display altered lower extremity kinematics during various activities. These alterations can put them at risk for more serious injuries, specifically when performed with additional weight.

Purpose: Our objective was to compare the lower extremity kinematics of individuals with PFP to healthy controls during a loaded (SL) and unloaded (UL) squat.

Methods: Eighteen physically active adults were placed in either the control (n = 10) or symptomatic (n = 8) group. Participants that reported PFP underwent a physical examination by a trained clinician to confirm the presence of PFP prior to experimentation. Participants then performed eight squats with a controlled depth in both SL and UL conditions. An external load of 10% body mass was applied with a weighted vest during the SL. Three-dimensional kinematic data in the frontal plane were measured at the knee during each condition using a 10-camera motion capture system. Results: Knee abduction angles were significantly greater in the PFP group compared to the controls ($P < 0.05$) during both the concentric and eccentric phases of the squat, particularly during the SL condition.

Conclusions: Individuals with PFP demonstrate greater knee abduction during a loaded squat compared to healthy controls.

50. Effectiveness of a 12-Week Multi-Component Training Program on the Fitness Levels of Kinesiology Majors

Resendiz-Perez, Aileen, Schroeder, Jan, Ph.D., Campbell, Candice, M.S., and Rodgers, Jade M.A.

California State University, Long Beach

PURPOSE: A multi-component training program is often studied in improving physical parameters of fitness in college-age students, but there are few studies that evaluate this type of training program in Kinesiology majors. Therefore, the purpose of this study was to evaluate the effectiveness of a 12-week multi-component training program to improve physical parameters of fitness in college-age male and female Kinesiology students.

METHODS: Participants included 841 healthy college-aged students enrolled in a Kinesiology majors' class (age = 21.28+3.57 y; height = 168.94+9.96 cm). Participants completed 12 weeks of multi-component training including cardiorespiratory, muscular strength/endurance, and flexibility exercises following ACSM guidelines. Measurements of body mass, cardiorespiratory fitness (1.5 mile run), muscular strength (bench press and leg press 1-RM), muscular endurance (timed plank and max push-up assessment), and flexibility (modified sit and reach) were assessed at week 0 and week 12. Paired T-Tests were used to determine if there was a difference pre and post training program. Gender differences were determined using a percent change score

RESULTS: There was no improvement in body mass following training (70.28+15.99 vs 70.17+34.06 kg). All physical fitness assessments significantly improved following the 12 week training program; 1-RM leg press (178.10+62.20 vs 215.64+65.23 kg), 1-RM chest press (54.13+28.51vs 60.61+29.14 kg), 1.5 mile run (824.42+167.57 vs 752.60+138.08 sec), pushups (36.40+13.27 vs 51.54+12.99), plank (150.29+69.78 vs 215.29+82.60 sec) and modified sit and reach (42.82+6.83 vs 48.13+5.56 cm). Females had a significantly greater percent change in scores on the 1-RM leg press, 1-RM chest press, push-ups, and plank while males demonstrated a significantly greater percent chance score for the modified sit and reach assessment.

CONCLUSION: This study demonstrated that a 12-week multi-component training program was effective in improving muscular strength and endurance, cardiorespiratory endurance and flexibility but was not effective for decreasing body mass in college-aged Kinesiology majors.

51. Biddle Physical Ability Test (BPAT) Performance in Southern California Structural Firefighter Candidates

Ruvalcaba, Tomas, B.S.[1], Dulla, Joseph, M.S.[2], Meloni, Jennifer, M.S.[2], and Lockie, Robert, Ph.D.[1]

[1]California State University, Fullerton, [2]Santa Ana Community College

INTRODUCTION: The Biddle Physical Ability Test (BPAT) is a strenuous activity for entry level structural firefighters. It was developed and validated by 41 fire departments in southern California to provide one standard for all departments. The BPAT simulates 11 job tasks performed by firefighters that must be completed in ≤ 9:34 min:s. Due to the task specificity, it could be expected that familiarization may better prepare candidates to successfully complete the BPAT.

PURPOSE: To investigate the influence of prior attempts on the proficiency to pass the BPAT.

METHODS: Retrospective analysis was conducted on 1435 male and 72 female structural firefighter candidates. All participants received equivalent instruction on how to complete the BPAT and staff recorded previous attempts. The BPAT was performed in the following gear: turnout coat; helmet; gloves; breathing apparatus; athletic clothes; and tennis shoes. The 11 events were: dry hose drag; charged hose drag; halyard raise; roof walk ascent/descent with chainsaw; attic crawl; roof ventilation; victim removal; ladder removal and carry; stair climb with hose bundle; crawling search; stair climb with air bottles; and hose hoist. Independent samples t-tests, with Bonferroni post hoc, compared candidates who passed the BPAT or failed but still recorded a time. Further, all candidates who failed via a slow time, did not finish, or were disqualified, were detailed.

RESULTS: Candidates with no previous attempts were slower than all other candidates ($p < 0.01$). Candidates with 1 attempt were slower compared to all candidates with 3 or more attempts ($p < 0.01$). Candidates with 2 attempts were slower compared to candidates with 3 or more attempts ($p < 0.01$), while candidates with 3 attempts were slower compared to those with ≥5 attempts ($p < 0.01$). The percentage of candidates that did not pass the BPAT, grouped by previous attempts were: no attempts = 13% (70/547); 1 attempt = 6% (14/238); 2 attempts = 7% (19/276); 3 attempts = 2% (2/128); 4 attempts = 0% (0/94); ≥5 attempts = 0.5% (1/224).

CONCLUSIONS: Familiarization of the BPAT based on previous attempts generally led to a reduction in time and a greater percentage of candidates attaining a passing score. It could be beneficial for structural firefighter candidates to attend practice courses and training sessions to improve BPAT performance and overall time.

52. A single bout of aerobic exercise does not provide a sufficient stimulus for mitochondrial protein synthesis in skeletal muscle of lean subjects or individuals with obesity

Nathan Serrano[1], Lori R Roust[2], Eleanna De Filippis [2], and Christos S Katsanos[1]

[1]Arizona State University; [2]College of Medicine, Mayo Clinic in Arizona

Mitochondrial (mito) dysfunction plays an important role in the pathophysiology of insulin resistance (IR) during obesity. Whole body metabolic health requires sufficient mito protein synthesis (PS), which may be altered in disease states like IR. Strategies that upregulate muscle mito PS are expected to enhance the mito proteome and overall proteostasis in humans with obesity.

Purpose: The purpose of this study was to determine whether a single bout of acute exercise (AE) can differently stimulate mito PS between lean (L) and individuals with obesity (O).

Methods: Following an overnight fast, 13 adults (7 L, 6 O, Age: L=29±9 vs O=31±12y, BMI: L=26.3±2.6 vs O=35.3±3.0) received stable isotope-labeled leucine tracer infusion to determine protein synthesis in muscle. Blood and biopsy samples were collected before and after 45 minutes of AE (70% of VO2max cycle ergometry) for the measurement of mito and whole muscle PS. RT-PCR was performed to identify mRNA expression of PGC-1a and the Myh1, Myh2, and Myh7 genes. 2-way ANOVAs with Tukey's post-hoc were conducted to identify main effects of protein synthesis rates and mRNA expression (PS/mRNA X Group X Time).

Results: Baseline rates of both whole muscle and mito PS were unchanged between L or O (L=1.04±0.16%/hr, O=1.02±0.08%/hr; $p>0.05$). RT-PCR analysis revealed a reduction of Myh7 expression in O at baseline compared to L (O=0.51±0.11 2-ΔΔCT, L=1.0±0.35 2-ΔΔCT; $p<0.05$). Following AE, mRNA levels of markers of PS did not increase in either group in the 4-hour post-cycling period ($p>0.05$). mRNA expression of PGC-1a increased in L (4.79±1.67 fold change; $p<0.05$) but not in O post-AE, while mRNA levels for Myh7 was increased in O (2.14±1.29-fold change; $p<0.05$), opposite of Myh2, which was reduced (0.53±0.10 fold change; $p<0.05$).

Conclusion: Current data illustrate whole muscle or mito PS rates are not stimulated by AE alone. This effect may be secondary to lack of amino acid availability in the fasted state. However, stimulation of gene expression associated with mito and myofibrillar proteomes provides evidence for AE as a potential strategy for maintenance of muscle proteome in humans, including those with obesity. Future research should examine the long-term effects of AE on whole muscle proteostasis in those with obesity and IR.

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53. Rib Pain in Athletes: A Golfing Case Study

Simon, Laura E. BA[1] Lee, Haewon, MD[2], and Vitale, Kenneth, MD FACSM[2]

[1]University of California San Diego School of Medicine, [2]University of California San Diego Department of Orthopedic Surgery

Background: Chest wall and rib pain are common in athletes. However, diagnosis can be challenging.

Case: A 27-year-old male presented with pain in his lead arm at the top of his golf swing. The pain was initially diffuse but localized to rib 4 or 5 along the mid-axillary line after months of continued golfing. There was no pain with lifting, coughing, or breathing. The patient experienced no pain in the latissimus dorsi, lower ribs, scapula, or midline thoracic spine. He had a normal shoulder range of motion, negative Spurling's, and normal neurovascular exam. Chest x-ray was found to be normal. Magnetic resonance imaging (MRI) showed a bright T2 signal indicating bone marrow edema consistent with stress reaction changes in the region of the patient's pain.

Discussion: Most athletic rib injuries occur due to trauma, new sports, changes in technique, or increased training regimens. The differential for chest wall pain in athletes is extensive. Specifically, when athletes present with rib pain, important considerations include rib fractures, slipping rib syndrome, and costal cartilage fractures. Rib fractures are often due to trauma or opposing muscle forces and tend to be slow in onset, unless due to trauma, and pain can be reproduced with specific movements. For rib fractures, rest is often required for the wound to heal. Patients with slipping rib syndrome often experience a slipping or popping sensation and a diagnosis may be determined using a hooking maneuver. Treatment is often the avoidance of aggravating positions. Costal cartilage fractures often result in pain along the costal margin and may be treated with surgery. In golfers specifically, stress injuries and fractures often occur in beginners or athletes with increased training regimens. Injury is usually caused by fatigue of the lead-side serratus anterior due to repetitive activation. Muscle fatigue increases the load on the posterolateral ribs, resulting in injury. Furthermore, beginner golfers may hit the ground with the club during their swing, causing a fracture.

Conclusion: Chest wall pain can be challenging to diagnose in athletes and injuries often result from changes in technique or training requirements. Sport-specific functional rehab is important in returning the athlete to the same level of play.

54. Effects of Previous Gaming Experience on Metabolic Cost during Active Virtual Reality Gaming

Trenton Huynh Stewart[1,2], Kirsten Villanueva[1], Amanda Hahn[1], Julissa Ortiz[1,2], Chandler Wolf[1], Randy Nguyen[1], Nicole D. Bolter[1], Marialice Kern, FACSM[1,2], and James R. Bagley[1,2]

[1]San Francisco State University, and [2]Virtual Reality Institute of Health and Exercise

INTRODUCTION: Recent work by our lab has shown that active virtual reality games (AVRGs) can elicit exercise intensities that meet the recommended American College of Sports Medicine (ACSM) exercise guidelines to promote health and reduce the risk of chronic disease. However, few studies have examined the effect of previous video game experience on energy expenditure while playing AVRGs.

PURPOSE: We investigated potential differences between experienced video gamers (EVG) and novice video gamers (NVG) on energy expenditure (VO2, %VO2max, METs, HR) during AVRG play in different settings (Lab vs. Gym).

METHODS: Thirty-two healthy participants (16 males, 16 females, Age: 22.6 ± 2.6 y; VO2max: 45.01 mL/kg/min; BMI: 23.31) were identified as EVG (n = 20) or NVG (n = 12) and completed two randomized 45-minute AVRG sessions in the lab and gym. They played three games during each session: Fruit Ninja VR, Beat Saber, and Holopoint. The games were novel to all participants, and everyone received the same familiarization training with the equipment.

RESULTS: Significant differences in %VO2max were observed between the EVG group (M = 28.26, SD = 5.35) and NVG group, M = 33.45, SD = 5.74; t (29) = 2.47, p = .02 (two-tailed), when playing Beat Saber in the Lab setting, with EVG having a lower energy expenditure (12.86 ± 2.2 mL/kg/min) than NVG (14.49 ± 2.5 mL/kg/min). However, there were no other differences between EVG and NVG, or between Lab and Gym settings.

CONLCUSIONS: Findings suggest that video game experience may not affect energy expenditure while playing most AVRGs. However, some skill based rhythm games (like Beat Saber) may afford opportunities for different movement patterns between novice and experienced video game players. Future research should investigate the effect of video game experience on participants' selected movement patterns during AVRG gameplay.

55. The Moderating Effect of Reflection: The Impact of Stress on Inhibition

Swanson, Savannah, M.A., Abouezzeddine, Tania, Ph.D., Estacio, Samantha, M.A., Canada, Andrea, Ph.D., and Peterson, Brent, Ph.D.

Biola University

Introduction: The benefits of intellectual self-reflection, an adaptive form of repetitive thought or self-focus, are currently under researched. While negative repetitive thought patters like rumination often featured in depression literature have been shown to contribute to the development and persistence of depression, intellectual self-reflection has been found to be related to decreases in depression over time and associated with various measures of psychological health. Currently, little is known about the protective benefits of intellectual self-reflection on stress. Depression largely diminishes cognitive performance whereas stress has varying influence on executive functions.

Purpose: This study aimed to explore whether intellectual self-reflection, a positive corollary of rumination, buffers stress' influence on inhibition, a form of executive functions.

Methods: A non-clinical sample of U.S. undergraduate students (n = 46) was recruited using a university-wide online research management system. Bio-marker (cortisol) and perceived indicators of stress were used to obtain baseline stress levels. Demographics, perceived stress, and intellectual self-reflection were measured via survey.

Results: Greater perceived stress was associated with greater inhibitory control and those who reported greater perceived stress engaged in reflective practices. Other hypotheses were not supported. Results aided in categorizing measures of momentary/daily stress into more well-researched forms of stress and indicate large differences between the cognitive effects of perceived and biological stress. Reflection's cognitive benefits are still unclear. Future research should continue to substantiate differences in cognitive performance between momentary/daily stress, chronic stress, and long-term stress and recreate this study with an adequate sample size to determine reflection's buffering capacity.

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56. Different Footwear Knee Biomechanics and Loading Rate

Tolas, Alexander, Jones, Makenzie, Juett, Blake, O'Hara, Christiane, M.S., and Hazelwood, Scott, Ph.D.

California Polytechnic State University, San Luis Obispo

Purpose: The greatest loading rate experienced by the body during walking occurs in the heel strike phase of the gait cycle. Previous research has shown that peak ground reaction forces when walking are lower while shod than walking barefoot (Lieberman et al., 2010). The purpose of this study was to examine loading rate at the knee during heel strike using different footwear conditions. Maximum flexion and extension, total range of motion, compressive forces, and muscle activity of the biceps femoris, lateral head of the gastrocnemius, vastus lateralis, and tibialis anterior were analyzed over one gait cycle.

Methods: The conditions examined were barefoot, medium cushion, and high cushion. The medium cushion shoe used was the Nike Epic React and the high cushion shoe was the Nike VaporMax. The compressive loads and knee angles were recorded using a 12-camera motion capture system. EMG data were collected on the dominant leg from the muscles previously listed utilizing sensors from Delsys. 8 female participants (19.75 ± 1.81 yr; 66.23 ± 8.02 kg; 167.22 ± 4.65 cm: mean ± SD) with size 8 to 8.5 shoes were asked to walk across four force plates at a self-selected walking speed four times for each footwear condition. Two trials without marker loss were averaged for analysis. Knee compressive forces and angles were analyzed using Cortex software and normalized to percent gait cycle through MATLAB. EMG data was filtered through a 4th order Butterworth filter with a cutoff frequency of 20 Hz.

Results: A repeated measures ANOVA analysis revealed that the loading rate when walking barefoot is significantly higher than shod conditions ($p<0.001$) and that the range of motion of knee flexion/extension when walking barefoot is significantly lower than when shod ($p<0.01$). No significant differences were found between maximum knee flexion and extension angles and knee compressive forces between conditions. EMG data were not significant between average signal data for all four muscles.

Conclusion: High loading rates occurring while walking barefoot affirms findings that shoe design can greatly influence the forces experienced on the lower extremities while walking. The change in the range of motion from barefoot to shod conditions suggests that knee joint complex angles can be manipulated to increase range of motion and help treat and prevent certain mobility issues or chronic injury.

57. Training Novices to Evaluate the Quality of Physical Activity Promotion Material: Results of a Pilot Study.

Ethan N. Tse,[1] Savannah A. Longoria,[1] Cameron N. Christopher,[2] and Jafrā D. Thomas[1]

[1]California Polytechnic State University, San Luis Obispo, [2]Boston University, Massachusetts

The credibility and usability of lay physical activity promotion material are a persistent problem (Thomas & Cardinal, 2020, TJACM). These quality issues deter materials in promoting health literacy, a major predictor of prevention-oriented health behaviors (e.g. regular exercise, U.S. National Action Plan to Improve Health Literacy). Few studies, however, have evaluated the quality of lay material over time (Thomas et al., 2018, Quest).

Purpose: In order to conduct a repeated-measures study of the quality of physical activity promotion web articles for lay adults, one experienced researcher (JDT) trained undergraduates to use the Suitability Assessment of Materials (SAM) protocol (Doak et al., 1996).

Methods: An adapted version of the SAM protocol was used (Thomas & Cardinal, 2020, Quest). Three undergraduates were part of the pilot project (ENT, SAL, CNC; Feb.-Aug. 2020). Each was introduced to the protocol and practiced its methods using six web articles that were written in English and not used in the longitudinal study. Coding by ENT was compared to JDT for analytic purposes; ENT was pre-assigned to evaluate materials for the longitudinal study. Per Krippendorff's alpha and intraclass coefficient measures, ENT showed acceptable between/within coder agreement during the training phase. Jul.-Aug. 2020, ENT then tested his skills further using a random subset of 16 unique web articles that were part of the longitudinal study.

Results: ENT between-coder agreement ranged between Good/Substantial (both .68) to Excellent/Almost Perfect (both .86) across the SAM's main categories. Overall agreement was Excellent/Substantial (range: .76-.77). Within-coder agreement was Excellent/Almost Perfect across all main categories (both ≥ .85).

Conclusions: This pilot study demonstrates that a novice coder can learn to code material with a high degree of fidelity. This contrasts with speculation that the SAM protocol may be too subjective for good coder agreement. Debriefing revealed key insights: (a) four "rules" that helped the novice coder achieve fidelity (e.g., use print copies) and (b) developer "bad habits" that limit material's educational quality (e.g., jargon-filled advice). We will discuss our results and practical lessons based on post-hoc text profiles of material from our pilot study.

58. Golf Shaft Stiffness Affects Reaction Force Generation

VanKeersbilck, Luke and Peterson, Travis, Ph.D.

California Lutheran University

Introduction: To complete a golf swing, players need to regulate reaction forces to stay balanced (Egret et al. 2003). It has been determined that players did not respond predictably to changes in shaft mass (Haeufle et al., 2012) and could often not tell the difference between shafts of differing stiffness (Milne & Davis, 1992). Most previous studies have focused on the ball or club kinematics with mixed results. This study aims to determine if golf club shaft properties influence player kinetics during a golf swing.

Methods: Highly skilled NCAA Division III men's and women's golf players (3 male, 4 female) volunteered to participate in accordance with the local IRB. Players performed 10 golf shots toward a target downrange with drivers of different shaft overall stiffness (S vs XS). Players stood with each foot supported on a force plate (1200 Hz, Kistler) covered in a thin layer of synthetic turf which allowed players to wear their own spiked golf shoes. The period of interest was defined as the time when the player's target leg reaction force becomes posterior until ball contact. This period coincides with the down swing. Linear impulse was calculated as the area under the force–time curves during the interval of interest and was normalized by body mass. Differences between conditions were determined by a dependent t-test ($\alpha = .05$).

Results: Target leg mediolateral (ML) linear impulse was amplified away from the target with the extra stiff shaft (.357 ± .096 N*s/kg) compared to the stiff shaft (.340 ± .083 N*s/kg, $p = .041$). Conversely, rear leg ML linear impulse was amplified toward the target with the extra stiff shaft (.436 ± .142 N*s/kg) compared to the stiff shaft (.405 ± .132 N*s/kg, $p = .070$). Net ML linear impulse did not change between shaft conditions ($p = 0.46$).

Conclusions: These results may indicate that players unintentionally adjusted force generation strategies to compensate for a shaft of greater stiffness which required coordination of both legs. It is important for the player to understand how their golf shot outcomes are affected by club characteristics since players have so many options to tailor their equipment. It is equally important to balance their equipment with the force generation demands placed on the player. This can help players effectively individualize their set of golf clubs.

59. Muscle Activity During Static Postural Control in Children with Autism Spectrum Disorder: A Case Study

Varre, Mathew S., M.S., Toribio, Julianne, Ison, Christian, M.S., and Janet S. Dufek, Ph.D. FACSM

University of Nevada, Las Vegas

Background: Autism Spectrum Disorder (ASD) is a child-onset and chronic neurodevelopmental disorder that affects one in 45 children in the United States. Increasing evidence has shown that individuals with ASD display gross motor deficits and that children with ASD display greater instability in comparison to children with typical neurodevelopment (TD). However, the contribution of muscular activity in balance deficits is unknown. Therefore, the purpose of this study is to investigate the lower extremity muscle activity during static postural control in a child with ASD compared to a child with TD.

Methodology: This is an exploratory case-controlled study. One nine-year-old male participant diagnosed with ASD and an age matched participant with TD completed three standing trials (20 seconds) of four stance conditions where vision and afferent sensation (hard surface vs foam pad) were manipulated: Hard surface - Eyes open (HEO) vs closed (HEC) and Foam pad: (Eyes open (FEO) vs closed (FEC). Surface electromyography (EMG) electrodes were placed bilaterally on rectus femoris (RF), biceps femoris (BF), tibialis anterior (TA), and gastrocnemius medialis (GM) muscles to record the muscle activity while the participants performed the static postural controls tasks. The EMG data collected were summed over the entire trial to obtain integrated EMG (IEMG) peaks for each condition.

Results: Normalizing the IEMG peaks of other 3 conditions to HEO IEMG peak, results showed that the participant with ASD had greater GM activity compared to the TD participant. IEMG peaks of both children varied similarly on a hard surface in the EC condition. However, with the foam pad, the participant with ASD had greater muscle activity in the lower leg in both visual conditions (FEO & FEC). These differences in IEMG peaks of the lower leg muscles in child with ASD compared to the TD child during the static tasks suggests lower leg muscle weakness to compensate for the greater instability.

Conclusion: Although, the study findings are pilot, further analysis could provide newer insights into the recruitment patterns of lower extremity muscles in maintaining balance in children with ASD.

60. Zinc Intake Comparisons in Female Athletes Presenting or Not With Premenstrual Syndrome

Alexa Vega, Paloma I Pallante, Alexandra Escobar, and Daniela A. Rubin

California State University, Fullerton

INTRODUCTION: Studies have shown that Zinc (Zn) helps regulate the menstrual cycle and prevents premenstrual syndrome (PMS). Females who experience PMS have lower Zn levels than those without PMS, which may be due to females consuming less sources for Zn and more refined sugars and fats. Importantly, females who are involved in sports may be further deficient because of the Zn lost in the sweat during practice or games.

PURPOSE: This study aimed to identify potential differences in Zn intake in female athletes with or without PMS.

METHODS: Participants were thirty NCAA Division 1 eumenorrheic female athletes ages 18-22 years. The exclusion criteria included current or three-month history use of oral contraceptives. Participants were classified as presenting with PMS or not using the Premenstrual Symptoms Screen tool. Participants completed dietary logs (two weekdays and one weekend day) two times within a month separated by three weeks. Mean data was computed to represent monthly dietary intake. Dietary logs were analyzed for total caloric intake, fat and sugar intake and macronutrients sources for Zn (protein, dairy, and fruit), and Zn intake. Independent t-tests were used to determine differences between athletes with and without PMS.

RESULTS: 23 % of the 30 athletes showed PMS. There were no significant ($p>.05$ for all comparisons) differences between athletes with or without PMS for total calories (2239 ± 604 vs. 2401 ± 779 kcals/day), food sources such as protein (88 ± 21 vs. 97 ± 46 g), dairy (0.71 ± 0.31 vs. 1.0 ± 0.57 cups), and fruits (1.3 ± 1.0 vs.1.0 ± 0.63 cups), or Zn intake (11 ± 4 vs. 9 ± 7 mg). There were no significant differences between athletes with PMS and non-PMS when it came to both their sugar (104 ± 40 vs. 91 ± 41g) or fat intake (73 ± 17 vs. 93 ± 40 g).

CONCLUSION: This data shows no differences in Zn intake between athletes with and without PMS likely because of no differences in their caloric intake and the sources of Zn. Limitations include self-report and a small sample size.

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61. Take A Breath: Anthropometric and Physiological Factors Predicting Obstacle Negotiation Ability while Physically Fatigued

Vicente, Joshua, Ponce de Leon, Belle, Krause, Alex, Stoehr, Nicole M., M.S., Rogers, Sean M., DAT, and Hinkel-Lipsker, Jacob W., PhD.

California State University, Northridge

Purpose: When navigating through complex environments, individuals must have the ability to rapidly respond to oncoming obstacles. This response is a process of visual perception driving coordination of the legs to clear such obstacles. In various careers such as construction or firefighting, obstacle negotiation is essential in keeping workers safe in a dynamic, unpredictable workplace. Physical fatigue may impede an individual's ability to coordinate the legs through both delaying visual recognition of obstacles and the motor response, as well as altering the mechanical clearance strategy. Thus, an individual's fitness level may have a direct effect on their ability to negotiate obstacles in a fatigued state. This study explored the relationship between certain demographics collected from participants (such as estimated VO2 and biological sex), and various spatiotemporal parameters of unexpected obstacle negotiation.

Methods: Participants were recorded via three-dimensional motion capture in order to track the motion of the legs during an obstacle negotiation task where they walked through a dark laboratory with an obstacle placed in random locations in their path. When they approached the obstacle, a motion-sensing light suddenly illuminated it. Participants then underwent anaerobic and aerobic exercise protocols to near-maximal exertion and again completed the obstacle negotiation task, this time in a fatigued state. Six linear regression models were used to determine the effects of estimated VO2max, height, sex, and age on six different spatiotemporal obstacle negotiation parameters.

Results: Results demonstrate that estimated VO2max is a significant predictor of horizontal leading and trailing foot placement prior to clearing the obstacle, and height is a significant predictor of horizontal leading foot placement.

Conclusions: These relationships indicate that a lower fitness level and/or shorter stature would make it more challenging for individuals to negotiate obstacles in their everyday environments while fatigued and may inform workplace injury prevention programs as to the importance of worker physical fitness in physically-demanding occupations.

62. The Tiring Truth: A Biomechanical Performance Analysis of Spatiotemporal Strategies during Obstacle Negotiation while Physically Fatigued

Weise, M.A., Cando, N.R., Arzumanyan G.M., Stoehr, N.M., Rogers, S.M., and Hinkel-Lipsker, J.W.

California State University, Northridge

Purpose: In various physically-demanding occupations such as firefighting it is vital to be able to react and respond to oncoming obstacles while navigating dynamic, unpredictable environments The ability to navigate these obstacles is crucial in avoiding slips, trips, and falls.. Physical fatigue may impact individuals' reaction times and visuomotor coordination, thereby putting workers more at risk for occupational injuries. The purpose of this study was to examine the spatiotemporal strategies involved in negotiating unexpected obstacles in a fatigued state. We hypothesized that participants would exhibit a riskier crossing behavior (e.g., lower foot clearance) when fatigued.

Methods: Twenty-one participants within the ages of 18-35 who had an above average level of cardiovascular fitness were recruited for this study. They were first asked to perform 5 rested obstacle negotiation trials that involved them walking through a dark laboratory with an obstacle placed in a random location along their walking path. As they approached, a motion-sensing light illuminated it, requiring participants to quickly recognize it and organize their limbs to effectively clear the obstacle. Next, participants performed a series of anaerobic and aerobic exercises designed to induce physical fatigue. Finally, they again performed 5 obstacle negotiation trials, this time in a fatigued state. Three-dimensional motion capture was used to quantify various spatiotemporal obstacle negotiation parameters during both the rested and fatigued trials.

Results: Following physically fatiguing exercise, participants exhibited statistically lower leading toe and trailing heel clearance. Furthermore, participants stepped closer to the obstacle prior to clearing it when fatigued, placing them at greater risk for foot contact with it. They also walked at a significantly faster gait velocity, which may have reduced the time available to them to coordinate motion over the obstacle.

Conclusion: The results of this study support the hypothesis that participants would exhibit riskier obstacle negotiation behavior when fatigued. With increased fatigue, an increase in work-related injuries could occur in physically-demanding occupations such as these slips, trips, and falls.

AMERICAN COLLEGE of SPORTS MEDICINE
Southwest Chapter

63. Energy Expenditure, Enjoyment, and Simulator Sickness During Virtual Reality Cycle Gaming

Angelina C. Wong[1,2], Leslie Y. Castillo-Ortiz[1,2], Regina Sid[1], Kent A. Lorenz, Ph.D.[1,2], Anthony M. Mayo, Ph.D.[1], C. Matthew Lee, Ph.D., FACSM[1], & James R. Bagley, Ph.D.[1,2]

[1]San Francisco State University, [2]Virtual Reality Institute of Health and Exercise

Introduction: Playing active virtual reality (VR) games can enable people to achieve the American College of Sports Medicine's guidelines for moderate to vigorous physical activity, but few studies have compared the benefits of playing a VR cycling game to riding a stationary bicycle. Despite the benefits of VR exercise, some individuals may experience simulator sickness (SS).

Purpose: The purpose of this exploratory study was to compare: (a) energy expenditure, (b) enjoyment levels, and (c) symptoms of SS in individuals playing a VR cycling game (VRcycle) versus a stationary bicycle control (CONcycle).

Methods: Five volunteers (3 men and 2 women; age 27.6 + 7.3 y) completed both exercise conditions in random order, on separate days. Oxygen consumption (VO2), heart rate (HR), caloric expenditure (kcal/min), physical activity enjoyment (PACES), and simulator sickness (SSQ) were compared between VRcycle and CONcycle. HR, VO2, kcal/min, and PACES were analyzed using MANOVA and SSQ was analyzed using Mann-Whitney U and Wilcoxon Signed Rank Test.

Results: All participants completed the 20-min bout of CONcycle, but two participants did not complete the VRcycle trial due to reported SS (Time: 10:03 min and 14:33 min). HRmax, HRavg, VO2, and kcal/min were not different between VRcycle and CONcycle ($p > 0.05$). There was a trend towards VRcycle (2.40 + 0.63) being reported as more enjoyable than CONcycle (3.98 + 1.25; $p = 0.08$). There were no significant differences between exercise trials for SSQ symptoms ($p > 0.05$), but there were significant differences pre- and post- exercise within each exercise trial for Nausea (3.82 + 8.53 vs 59.15 + 33.32, $Z = 2.023$; 1.91 + 4.27 vs. 36.25 + 18.35, $Z = 2.023$) and Total Severity (5.24 + 7.291 vs. 46.38 + 42.69, $Z = 2.023$; 1.50 + 3.35 vs. 23.94 + 13.64, $Z = 2.023$; $p < 0.05$).

Conclusion: We found that playing a VR cycling game requires similar energy expenditure as riding a stationary bike. Despite the nauseogenic effects of VRcycle and CONcycle, participants reported similar enjoyment for both and would likely play the VR cycling game again. Future research should confirm these findings using more participants and investigate underlying reasons why some individuals experience SS in VR.

64. Relationships Between Strength and Balance in Male Collegiate Athletes

Zorzoli, Kara, Bonilla, Sean, Jackson, Matthew, M.S., and Dabbs, Nicole Ph.D.

California State University, San Bernardino

Introduction: Collegiate athletes are often times assessed with strength and balance measures while recovering from an injury. Strength is often measured using the isokinetic dynamometer and balance performance tests have been associated with ankle sprains and an increased body mass index places athletes at a higher risk.

Purpose: The purpose of this study is to identify a relationship between strength and balance in healthy, non-injured male collegiate athletes.

Methods: Sixty-two male collegiate athletes (n=17, baseball; n=16, basketball; n=29, soccer) (age: 20.00 ± 1.28yr, weight: 80.16 ± 11.70kg, height: 179.64 ± 10.19cm, %body fat: 15.92 ± 5.21) volunteered to be participate in this study. Prior to testing, participants completed an IRB approved informed consent and a Physical Activity Readiness Questionnaire. Participants completed a five -minute warm-up on a stationary bike. Following the warm-up, participants completed the Y-Balance Test protocol involving a maximal reach in three directions for each leg: anterior reach (AR), posterior lateral reach (PLR), and posterior medial reach (PMR). Individuals were barefoot while maintaining single leg balance on stance leg and had to reach as far as possible. During strength testing, participants performed one set of 5 repetitions of knee flexion and knee extension on each leg set at a velocity of 60°/s using the Biodex Isokinetic Dynamometer to measure peak hamstring torque (PHT) and peak quadricep torque (PQT) production. Hamstring and quadricep ratios (HQR) were calculated for both right and left leg by dividing PHT by PQT. Pearson R Correlations were used to analyze relationships between balance and strength measures.

Results: There were positive, moderate, significant correlations between the right leg HQR and the right leg PLR ($p = 0.004$; $r = 0.365$) and right leg PMR ($p = 0.008$; $r = 0.338$). There was a positive, small, significant correlation between right leg PHT and left leg PMR ($p = 0.050$; $r = 0.250$). There is a positive, small, significant correlation between left leg PHT and left leg PMR ($p = 0.040$; $r = 0.262$).

Conclusion: Strength and balance testing are critical in athletic return to play assessment, as well as, rehabilitation. There were significant correlations that proved strength and balance are essential when assessing for injury prevention.